

Development of Android-Based Learning Media to Improve Cognitive Ability of Grade XII Students at MAN 2 Bojonegoro on the Topic of Fiqih Sources of Islamic Law

M. Nizar Chariri^{1✉}, Yeri Sutopo², Samsudin Anis²

¹MAN 2 Bojonegoro, Indonesia

²Universitas Negeri Semarang, Indonesia

Article Info

Article History :

Received

April 2026

Accepted

June 2026

Published

December 2026

Keywords:

Android-Based Learning Media; ADDIE Model; Computer Based Test (CBT); Fiqih; Mawaris

Abstract

This study aims to design Android-based learning media combined with a Computer Based Test (CBT), and to examine its level of feasibility, practicality, and effectiveness in raising student learning outcomes. The content focus is concentrated on the subject of Fiqih, particularly the various sources of Islamic law relating to inheritance studies (mawaris). The research method applied is Research and Development (R&D), adopting the ADDIE framework (Analysis, Design, Development, Implementation, Evaluation). The research subjects involved grade XII students of MAN 2 Bojonegoro as the experimental group and MA A1-Rosyid as the control group. Data were collected through expert validation sheets, teacher practicality response questionnaires, and cognitive learning outcome tests, then analyzed using feasibility tests, normality tests, homogeneity tests, N-Gain, and an independent sample t-test. The media was rated very feasible, based on an average score of 4.59 from media experts and 4.70 from content experts. The practical feasibility assessment carried out by ten Fiqih subject teachers across several MA schools in Bojonegoro Regency produced a cumulative score of 95.45%, placing it in the very practical category. Implementation of the media was shown to significantly improve the cognitive ability of students in the experimental class, reaching an average N-Gain index of 70.08%, categorized as fairly effective, which exceeded the control class result of only 50.63%. The results of the independent t-test further confirmed a significant difference in effectiveness between the experimental class that used this integrated learning media and the control class.

✉ Correspondence:

Jl. Monginsidi No.158, Sukorejo Kidul, Sukorejo, Kec. Bojonegoro,
Kabupaten Bojonegoro, Jawa Timur 62115, Indonesia
E-mail: nizarchariri8@gmail.com

p-ISSN 2339-0344

e-ISSN 2503-2305

INTRODUCTION

Android-based learning media is one of several efforts made by teachers to draw greater interest in learning, so that students can develop cognitive ability and creative thinking skills through a learning atmosphere that engages and directs them toward further exploration of a particular field of knowledge, while also giving them a genuine learning experience.

The learning model is one of the most important variables within the overall concept of education in the student learning process. Learning models can be examined through several categories. According to (Mokalu et al., 2022), there are three classifications of instructional models that have developed within the digital education ecosystem. The first model relies on digital teaching materials provided by lecturers or teachers, which students then access and study independently after downloading them. The second model focuses on learning activities that take place entirely online, where the transfer and deepening of material occurs within cyberspace. The third model is realized through a collaborative scheme that combines the advantages of virtual and face-to-face learning mechanisms.

Regarding learning media, (Nurrita, 2018) argues explicitly that there needs to be interaction in which learners and teachers communicate interactively by making use of information and communication technology, such as computers or laptops connected to the internet, smartphones with their applications, and other similar tools.

Android is one of several operating systems widely used on smartphone devices. According to (Pratama et al., 2022), Android is a Linux-based mobile operating system that combines elements of an operating system, middleware, and application modules.

Android is a software stack for mobile devices that includes an operating system, middleware, and key applications. According to Setyaputra and Aritonang, as cited in (Kuswanto & Radiansah, 2018), Android functions as the system software on smartphones and tablets, representing an essential component that bridges the interaction between a device and its user.

Even so, the availability of learning facilities at Madrasah Aliyah schools has not yet fully kept pace with the demands of technological development. Initial observations at MAN 2 Bojonegoro show that learning related to the use of technology and to basic knowledge of inheritance studies (mawaris) still relies on separate components that have not been integrated into one complete learning system. This condition makes it difficult for students to understand the relationships among these systems and the underlying principles of modern electrical technology.

Based on these problems, there is a need to develop learning media capable of integrating Android-based learning media technology, in which the media already includes complete content, explanatory videos, and a CBT component. This media is expected to provide a more contextual and applicable learning experience. Therefore, this study aims to develop Android-based learning media and CBT, and to examine its feasibility, practicality, and effectiveness in improving student learning outcomes.

METHODOLOGY

This study uses the R&D research method. According to (Fransisca et al., 2019), development research using the Research and Development (R&D) method is a research method used to produce a particular product and to test the effectiveness of that product.

The relevance between earlier studies and this research lies in their shared focus on instrument development, namely designing Android-based learning media whose feasibility is tested before wide-scale implementation. Even so, a methodological distinction can be seen in the research procedure model adopted: previous research relied on the Four-D model, involving three content and media expert validators, whereas this study applies a Research and Development (R&D) approach involving two content experts and two media experts respectively.

The research written by (Alya Azzahra, 2023) is also considered useful theoretical support for the present study. This can be seen in its

abstract summary, which explains that the study was oriented toward identifying the level of feasibility and the cognitive performance of students following the implementation of Android-based learning media. Adopting the ADDIE development framework, the results of that study show that an Android application designed using Smart Apps Creator (SAC) received a very feasible rating based on assessments from content experts, language experts, media experts, and student responses.

Research and Development (R&D) is a research methodology oriented toward constructing a specific product as a solution to an actual problem found in the field, while also testing the level of effectiveness of the product being developed (Apriansyah & Kusno Adi Sambowo, 2020).

As the approach used in developing Android-based learning media to improve the cognitive ability of grade XII students of MAN 2 Bojonegoro on the topic of Fiqih sources of Islamic law, this study adopts the ADDIE model, which consists of five stages that must be carried out during development: Analysis, Design, Development, Implementation, and Evaluation (Widihastrini et al., 2020).

Each stage of ADDIE research and development has its own objective. The first stage is the analysis stage, whose main purpose is to analyze the results of the survey that has been conducted. Within this stage there are two steps that need attention: first, problem analysis through preliminary observation, followed by needs analysis, in which, based on the results of the observation and the questionnaire that had been administered, it was found that students would be more interested in learning, and would enjoy it more, if the learning media used were more varied.

The design stage begins with the researcher planning and creating the design of the learning media to be developed. There are four progressive steps involved, including building the framework of the Android-based learning media, collecting data that is later selected as reference material, creating the actual design of the Android-based learning media, and preparing the instruments for the Android-based learning media.

The development stage in this study involved building the Android-based learning media itself. This stage aims to assess how well the media that had been designed meets the requirements and feasibility criteria needed for implementation. The developed media was then submitted to validators for a formal assessment of its suitability for use.

The implementation stage covers the activity of applying the Android-based learning media. Respondents at this stage included grade XII students of MAN 2 Bojonegoro as the experimental group and grade XII students of Madrasah Aliyah (MA) Al-Rosyid as the control group.

At the evaluation stage, a distinction in type is drawn between two forms of evaluation, namely formative evaluation and summative evaluation. The main difference between the two is that formative evaluation is focused on supporting learning, while summative evaluation is focused on measuring learning (Sari et al., 2019). This stage also aims to analyze the research results in order to determine the feasibility, practicality, and effectiveness of the learning media, as well as to assess the improvement in learning outcomes using N-Gain.

RESULTS

The feasibility test validators in this study consisted of three media experts, including academics (a lecturer who also served as Vice Rector I of IKIP PGRI Bojonegoro, and a lecturer who also served as Head of the Information Technology Education study program) along with a teacher who is also the head of the Informatics subject-teacher working group (MGMP) at the MA level in East Java.

Feasibility Analysis of the Media by Media and Content Experts

The feasibility test data on the Android-based learning media reviewed by the media and content expert validators were scored by three media experts, namely academics (a lecturer who also served as Vice Rector I of IKIP PGRI Bojonegoro, and a lecturer who also served as Head of the Information Technology Education study program at Universitas Negeri Surabaya)

and a teacher who also serves as head of the Informatics MGMP at the MA level in East Java, together with three content experts: an academic lecturer, a Fiqih teacher who also serves as head of the Fiqih MGMP in Bojonegoro Regency, and a community figure who also serves as a

pesantren supervisor and Head of the Pontren Section at the Ministry of Religious Affairs of Bojonegoro Regency. The overall scoring for each aspect assessed by all validators is presented below.

Table 1. Summary of the Feasibility Test by Media and Content Experts

No.	Expert Type	Expert 1	Expert 2	Expert 3	Average	Criterion
1	Media Expert	4.67	4.61	4.71	4.59	Very Feasible
2	Content Expert	4.6	4.8	4.7	4.7	Very Feasible
Overall Average Across Experts					4.64	Very Feasible

Based on the data above, the overall average score across all aspects is 4.64, which falls into the very feasible category (Sukardjo, 2014). Accordingly, this Android-based learning media is considered valid and very feasible for use as a learning medium in grade 12 Fiqih classes.

Practicality Test of the Media

Practicality data were collected during the product development phase by distributing a

questionnaire to ten Fiqih subject teachers at MAN and MA schools in Bojonegoro. The instrument included 11 assessment items. The testing procedure began with a demonstration of the product using the developed media before respondents completed the questionnaire provided. The results obtained are presented below.

Table 2. Practicality Test Data from Teachers

Item	Responses of Fiqih Subject Teachers from MAN and MA Schools in Bojonegoro									
	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1
2	1	1	0	1	1	1	1	1	1	1
3	1	1	0	1	1	1	0	1	1	1
4	1	1	1	1	0	1	1	1	0	1
5	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1
E	0	0	2	0	1	0	1	0	1	0
Tn	11	11	9	11	10	11	10	11	10	11

Calculation of the Reproducibility Coefficient (Kr)

$$K_r = 1 - e/n$$

$$\begin{aligned}
 K_r (\text{Teachers}) &= 1 - \frac{\text{the number of error scores}}{\text{(number of statements x number of respondents)}} \\
 &= 1 - \frac{5}{(11 \times 10)} \\
 &= 1 - 0.045 \\
 &= 0.954
 \end{aligned}$$

According to the criteria proposed by (Ghozali, 2020), a research instrument is considered to meet the requirement if the Reproducibility Coefficient (Kr) exceeds 0.90. The results of this study show that the Kr score from teacher respondents reached 0.95, indicating

that the developed Android-based learning media meets the established practicality requirement and falls into the very practical category for use in learning.

Calculation of the Scalability Coefficient (Ks)

$$K_s = 1 - e/k$$

where :

$$\begin{aligned} K_s (\text{Teachers}) &= 1 - \frac{\text{the number of errors}}{0.5 (\text{number of items} \times \text{number of respondents}) - \text{total S score}} \\ &= 1 - \frac{5}{0.5 (11 \times 10) - 110} \\ &= 1 - 0.091 \\ &= 0.909 \end{aligned}$$

In this study, the results of the practicality test of the Android media are further supported by the Scalability Test (Ks Test). The resulting Ks score for teachers was 0.909, meeting the criterion of Ks greater than 0.60 (Noviyanita, 2018).

Based on the assessment of the ten validators, all of them expert teachers, an average practicality test score of 95.45% was obtained. This result places the product in the very practical category. Accordingly, this learning media is considered feasible and practical for implementation in the Fiqih subject, specifically on the topic of Inheritance Studies (Ilmu Mawaris) for grade XII.

Effectiveness Test of the Media (N-Gain)

The normalized gain calculation (N-Gain) is used to assess the improvement in student learning outcomes. The N-Gain value is obtained from the difference between pretest and posttest scores, with an ideal maximum score of 100 (Khumaedi, 2019), and is expressed as a percentage. The complete calculation results are presented in the appendix table of N-Gain score output, while a more concise summary is presented in the table below.

Table 3. N-Gain Score Test

Indicator	Experimental Class	Indicator	Control Class
	N-Gain (%)		N-Gain (%)
Average	70.08	Average	50.63
Minimum	46.00	Minimum	18.00
Maximum	94.00	Maximum	85.00

Based on the N-Gain calculation results, the average N-Gain score in the experimental

class is 70.08, with a minimum value of 46.00 and a maximum of 94.00. The control class, meanwhile, has an average of 50.63, with the lowest score at 18.00 and the highest at 85.00. These scores were then interpreted using the N-Gain effectiveness interpretation table below.

Table 4. N-Gain Score Interpretation Table

Percentage	Interpretation	Group
< 40	Not Effective	1
40 – 55	Less Effective	2
56 – 75	Fairly Effective	3
> 76	Effective	4

Source: (Hake, 1999)

Based on the N-Gain effectiveness interpretation above, the average N-Gain score of the experimental class, at 70.08%, indicates that the application of the Android learning media is fairly effective in improving the cognitive scores of grade XII students. The conventional method, represented by the control class, shows an average N-Gain score of 50.63%, which is considered less effective in improving student cognitive scores.

T-Test

The use of the Independent Sample t-test in experimental educational research is based on its ability to test the difference between the means of two independent, normally distributed groups (Khumaedi et al., 2021). This parametric test provides greater statistical power than non-parametric tests, as long as its underlying assumptions are met. In line with this, (Lukman & Ulfa, 2020) emphasize that before conducting a

comparative hypothesis test, data validity must be confirmed through prerequisite testing, namely normality and homogeneity. Normality testing serves to ensure that the data used represent a normally distributed population, so that the results of the t-test are unbiased and can be generalized (Ghozali, 2020). This approach therefore ensures that the comparison between conventional learning and learning using the Android-based media rests on a solid empirical foundation. The analysis was carried out using the Kolmogorov-Smirnov and Shapiro-Wilk methods in IBM SPSS software. The full results of the normality test for the experimental and control class N-Gain values are presented in the table below.

Table 5. Normality Test Results for N-Gain Data

		Data	
	Class	Sig. Kolmogorof- Smirnov	Sig. Shapiro- Wilk
N-Gain (Percent)	Experiment	0.200	0.750
	Control	0.200	0.671

Based on the data in Table 5, the normality test results for the N-Gain values related to the effectiveness of the Android-based learning media show that all data are normally distributed. This is confirmed by the Kolmogorov-Smirnov significance values for both the experimental and control classes, which reach 0.200 ($p > 0.05$). Consistent results are also seen in the Shapiro-Wilk test, with significance values of 0.750 for the experimental class and 0.671 for the control class. Because all significance values exceed the 0.05 threshold, the assumption of normality is met, and the analysis can proceed to the next stage.

The next step is a test of variance homogeneity using the Levene Test (Test of Homogeneity of Variances) at a significance level of 0.05. This test aims to confirm that the variances between data groups are equal, so that the comparison of means through a parametric test remains valid (Ghozali, 2020). Referring to the criteria set out by (Surya, 2022), data are considered to have homogeneous variance if the resulting significance value is greater than 0.05. Meeting both the normality and homogeneity assumptions is an essential prerequisite for using

parametric statistics, so that the conclusions of the research carry high reliability (Lukman & Ulfa, 2020).

Table 6. T-Test Results for the Control and Experimental Classes

Independent Samples Test	Lavene Statistic Sig.	t test	-	Taraf Signifikansi
N-Gain (Persen)	Equal variances assumed	0.467	5.656	0.000

Referring to the data presented in Table 6, the results of the Levene Test for Equality of Variances show a significance value of 0.467. Since this value is greater than the significance level of 0.05 ($p > 0.05$), it can be concluded that the variance of the N-Gain (%) data between the experimental and control classes is homogeneous. Based on this fulfillment of the homogeneity assumption, hypothesis testing was carried out using the Equal Variances Assumed row.

The results of the independent sample t-test show a significance value (2-tailed) of 0.000, which is far below the 0.05 threshold ($p < 0.05$). This finding indicates a statistically significant difference in effectiveness between the use of Android-based learning media and the conventional method in improving student learning outcomes. The advantage of this interactive, Android-based media is consistent with findings showing that the integration of technology into learning media can stimulate student cognition more deeply through dynamic visualization. Accordingly, the use of technology-based media is shown to be superior in optimizing conceptual understanding compared with the conventional approach.

Discussion

Conceptually, this product serves as a pedagogical innovation that transforms the conventional learning paradigm through the integration of dynamic visual stimulation and interactive content narration. Its main added value lies in the synergy between the instructional media and the CBT system. The CBT functions not only as a tool for measuring cognitive ability at the pretest and posttest stages, but also as a conditioning instrument that helps build a sense

of integrity and academic honesty among students. Supported by an attractive interface and a high level of usability, this media has proven effective in stimulating intrinsic motivation and learning interest among students.

1. Analysis of Product Feasibility and Practicality

Validity testing of the design and technical aspects by three media experts produced average scores of 4.67, 4.61, and 4.71, with an overall combined average of 4.59, rated very feasible. This result demonstrates that the product has strong visual quality, navigation, and interactivity. The validation test for scientific content by three content experts produced average scores of 4.6, 4.8, and 4.7, with a combined average of 4.7, also rated very feasible. This confirms the accuracy of the content, the depth of the subject matter, and its alignment with the curriculum being developed.

The next phase was the practical feasibility test involving ten Fiqih subject teachers. The tabulated results show a practicality score of 95.45%, rated very practical. This result confirms that the Android-based learning media and CBT have high flexibility, ease of use, and efficiency when applied in the classroom.

2. Analysis of Statistical Prerequisite Testing

Before testing the effectiveness hypothesis, classical assumption tests for normality and homogeneity were carried out as prerequisites for the data analysis. The normality test for the distribution of the pretest and posttest data, using the Kolmogorov-Smirnov and Shapiro-Wilk methods, shows a significance value of $p > 0.05$. Specifically, the normality test on the Normalized Gain (N-Gain) data produced a Kolmogorov-Smirnov significance value of 0.200 ($p > 0.05$), further supported by Shapiro-Wilk values of 0.750 for the experimental class and 0.671 for the control class. The data are therefore confirmed to be normally distributed.

The homogeneity test using the Levene Statistic on the posttest scores, based on the mean, produced a significance value of 0.568 ($p > 0.05$). In line with this, the homogeneity test on the N-Gain (%) data shows a significance value of 0.467 ($p > 0.05$). Because both significance values exceed the critical threshold of 0.05, the data

variance is considered homogeneous, providing methodological justification for proceeding to the Independent Samples T-Test stage.

3. Analysis of Product Effectiveness

The effectiveness test was conducted by comparing the N-Gain Score results between the experimental and control classes. The empirical analysis reveals a clear contrast in academic performance: the experimental class recorded an average N-Gain score of 70.08%, rated fairly effective, while the control class reached only 50.63%.

CONCLUSION

Based on the results of the development process, statistical testing, and discussion, this study concludes the following:

1. **Product Feasibility.** The Android-based learning media and CBT developed in this study are rated very feasible, both from a theoretical-substantive and a technical standpoint, with an average validation score of 4.59 from media experts and 4.70 from content experts.
2. **Product Practicality.** This learning tool meets the very practical criterion, with a score of 95.45% obtained from practitioner teachers, confirming the high usability, flexibility, and efficiency of the product when implemented in classroom teaching and learning activities.
3. **Product Effectiveness.** The integration of Android media and CBT is shown to be significantly effective in improving the cognitive learning outcomes of students. This is reflected in the average N-Gain score of the experimental class (70.08%), which exceeds that of the control class (50.63%), and is further supported by the results of the Independent Samples T-Test, which confirm a significant difference in effectiveness between the two groups.

REFERENCES

- Alya Azzahra. (2023). *Pengembangan media pembelajaran berbasis.*

- Apriansyah, M. R., & Kusno Adi Sambowo, A. M. (2020). *Pengembangan Media Pembelajaran Video Berbasis Animasi Mata Kuliah Ilmu Bahan Bangunan Di Program Studi Pendidikan Teknik Bangunan Fakultas Teknik Universitas Negeri Jakarta*. 9(1).
- Fransisca, S., Putri, R. N., Kom, M., & Artikel, S. (2019). *PEMANFAATAN TEKNOLOGI RFID UNTUK PENGELOLAAN INVENTARIS SEKOLAH DENGAN METODE (R & D) (Studi Kasus: SMK Global Pekanbaru)*. 1(1).
- Ghozali, I. (2020). Aplikasi Analisis Multiverse dengan program SPSS 25. In *Sustainability (Switzerland)* (Vol. 11, Number 1, pp. 1–14).
<http://scioteca.caf.com/bitstream/handle/123456789/1091/RED2017-Eng-8ene.pdf?sequence=12&isAllowed=y%0A>
http://dx.doi.org/10.1016/j.regsciurbeco.2008.06.005%0Ahttps://www.researchgate.net/publication/305320484_SISTEM_PEMBETUNGAN_TERPUSAT_STRATEGI_MELESTARI
- Khumaedi, M. (2019). Assessment Of Teaching Material In Mechanical Engineering Drawings. *Journal of Mechanical Engineering Education*, 4(2), 115–124.
- Khumaedi, M., Widjanarko, D., Setiadi, R., & Setiyawan, A. (2021). Evaluating the impact of audio-visual media on learning outcomes of drawing orthographic projections. *International Journal of Education and Practice*, 9(3), 613–624.
<https://doi.org/10.18488/journal.61.2021.93.613.624>
- Kuswanto, J., & Radiansah, F. (2018). *Media Pembelajaran Berbasis Android Pada Mata Pelajaran Sistem Operasi Jaringan Kelas XI*. 14(1).
- Lukman, I., & Ulfa, A. (2020). Meningkatkan Kemampuan Kognitif Kimia Siswa SMA Melalui Pengembangan Media Pembelajaran Berbasis Android. *JINOTEP (Jurnal Inovasi Dan Teknologi Pembelajaran): Kajian Dan Riset Dalam Teknologi Pembelajaran*, 7(2), 157–164.
<https://doi.org/10.17977/um031v7i22020p157>
- Mokalu, V. R., Panjaitan, J. K., Boiliu, N. I., & Rantung, D. A. (2022). *EDUKATIF: JURNAL ILMU PENDIDIKAN Hubungan Teori Belajar dengan Teknologi Pendidikan*. 4(1), 1475–1486.
- Noviyanita, W. (2018). *PENGEMBANGAN BAHAN AJAR ELEKTRONIK BERBASIS FLIPBOOK Abstrak*. 6(2), 41–49.
- Nurrita, T. (2018). *Kata Kunci: Media Pembelajaran dan Hasil Belajar Siswa*. 03, 171–187.
- Pratama, N. A., Hermawan, C., Kom, S., Darwan, U., Sampit, A., Universitas, D., Ali, D., Informasi, J. S., Komputer, F. I., Darwan, U., & Sampit, A. (2022). *APLIKASI PEMBELAJARAN TES POTENSI AKADEMIK BERBASIS ANDROID komputer yang dibuat untuk menolong manusia Dalvik Virtual Machine (DVM) adalah Android SDK adalah tools API (Application Examination) yang sudah menjadi standar Pengertian Android Android ad*. 1–6.
- Sari, A. C., Fadillah, A. M., Jonathan, J., & Prabowo, M. R. D. (2019). Interactive gamification learning media application for blind children using android smartphone in Indonesia. *Procedia Computer Science*, 157, 589–595.
<https://doi.org/10.1016/j.procs.2019.09.018>
- Surya, A. D. (2022). *Pentingnya Implementasi Pembelajaran Berbasis Android dalam Mengembangkan Kemampuan Kognitif Siswa Kelas Tinggi Sekolah Dasar*. 4(2), 80–87.
- Widihastrini, F., Susilaningih, S., Bektiningsih, K., & Samadhy, U. (2020). *Jurnal PAJAR (Pendidikan dan Pengajaran) Volume 4 Nomor 1 Januari 2020 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337 DOI: http://dx.doi.org/10.33578/pjr.v4i1.7907 Jurnal PAJAR (Pendidikan dan Pengajaran) Volume 4 Nomor 1 Januari 2020 | ISSN . 4, 41–47*.