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Developing android-based interactive media in integrated science subjects for madrasah tsanawiyah students

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Abstract: This study aims to develop an Android-based interactive media for valid, practical, and effective science learning. This study focuses on the development of interactive media among students of Madrasah Tsanawiyah (MTs) in Sidenreng Rappang Regency. The development process follows the AADC model, which is divided into four main stages: Analyze, Align, Design, and Construct. This research used two validators (experts in material and media), one science instructor, and 30 seventh-grade students for the trial. Data were gathered using validation sheets, questionnaires, and assessments of learning outcomes. The outcomes of the interactive media validity study during the validation phase include two dimensions: material validation and medium validation. The material validation achieved a very valid category (average 93%), whereas validation by media specialists attained a very valid category (average 90%). The evaluation findings of the individual trial response questionnaire revealed an average of 92%, while the small-group test yielded 93%, suggesting that the medium is effective for use. The teacher response questionnaire on interactive media was deemed very effective, with an average 99%. The pretest and posttest data indicated an enhancement in student learning outcomes, with an average pretest score of 51.67 and a posttest score of 86.00. The n-gain value was 0.71, indicating a substantial improvement in student learning outcomes. It may be concluded that Android-based interactive media satisfies students' demands and fulfills the criteria of validity, practicality, and effectiveness for educational purposes.

Keywords: Achievement, android media, interactive technology, science learning

Abstrak: Penelitian ini bertujuan untuk mengembangkan media interaktif berbasis Android untuk pembelajaran sains yang valid, praktis, dan efektif. Penelitian ini berfokus pada pengembangan media interaktif di kalangan siswa Madrasah Tsanawiyah (MTs) di Kabupaten Sidenreng Rappang. Proses pengembangan mengikuti model AADC, yang dibagi menjadi empat tahap utama: *Analyze, Align, Design,* dan *Construct*. Penelitian ini menggunakan dua validator (pakar materi dan media), satu instruktur sains, dan 30 siswa kelas tujuh untuk uji coba. Data dikumpulkan menggunakan lembar validasi, kuesioner, dan penilaian hasil belajar. Hasil studi validitas media interaktif selama fase validasi mencakup dua dimensi: validasi materi dan validasi media. Validasi materi mencapai kategori sangat valid (rata-rata 93%), sedangkan validasi oleh spesialis media mencapai kategori sangat valid (rata-rata 90%). Temuan evaluasi kuesioner respons uji coba individu menunjukkan rata-rata 92%, sedangkan uji kelompok kecil menghasilkan 93%, menunjukkan bahwa media tersebut efektif untuk digunakan. Kuesioner respons guru tentang media interaktif dianggap sangat efektif, dengan rata-rata 99%. Data pra-uji dan pasca-uji menunjukkan peningkatan hasil belajar siswa, dengan skor pra-uji rata-rata 51,67 dan skor pasca-uji 86,00. Nilai n-gain adalah 0,71, menunjukkan peningkatan substansial dalam hasil belajar siswa. Dapat disimpulkan bahwa media interaktif berbasis Android memenuhi tuntutan siswa dan memenuhi kriteria validitas, kepraktisan, dan efektivitas untuk tujuan pendidikan.

Kata kunci: Prestasi, media Android, teknologi interaktif, pembelajaran sains

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INTRODUCTION

The pace of technological advancement is constantly increasing, particularly in information and communication technology. This creates the illusion that humans are

inseparable by time, space, and distance (Pratama & Ervianti, 2024). The advancement of science and technology introduces innovations that revolutionize society's culture and daily routines. The digital revolution enhances education by facilitating the remote monitoring of students and the more effective management of learning activities through information and communication technology (ICT) (Criollo-C et al., 2021). Numerous studies have demonstrated that integrating technology into science education has a beneficial impact on student attitudes and academic performance (Hillmayr et al., 2020; Isnaeni et al., 2021; Sahin & Yilmaz, 2020; Usman et al., 2021).

Science learning is not merely textual, lecture-based, and note-taking. Two-way interaction and hands-on learning experience are essential when conducting science learning. The transformation of educational technology is related to the many forms of media that teachers use to facilitate learning (Ananda et al., 2023). Unsupportive media can lead to a lack of student response, motivation, and interest in a subject. Conversely, the presence of engaging media can help students become more enthusiastic about a subject. The development of educational technology pertains to the resources utilised by educators during the learning process. Moreover, studies have been undertaken on the use of educational media to facilitate the learning process and ensure the attainment of learning objectives. Learning media refers to both tangible and intangible technologies employed by educators to convey information to students in a more effective and efficient manner (Puspitarini & Hanif, 2019). Effective student absorption of difficult and complex learning materials can occur with the help of aids. The use of appropriate media is an alternative to address low student learning outcomes, especially in sciences (Bahtiar et al., 2018).

Based on the results of the analysis and initial data collection conducted in October 2024 at MTs Negeri 1 Sidenreng Rappang, Android has been used quite frequently. One example is in assignment submission activities through Android-based e-learning. Consequently, students are well-acquainted with using Android for educational purposes and want to use Android-based interactive learning material in the classroom. This viewpoint is among the reasons academics want to create Android-based interactive learning material. The constructivism idea posits that learning transpires when students actively build their own knowledge via experiential engagement and interaction with their surroundings, rather than through rote memorisation (Criollo-C et al., 2021). In the context of using Android-based interactive media, this theory can be applied by providing a platform that allows students to explore, collaborate, and solve problems independently.

Android-based interactive media, such as learning applications, interactive videos, and simulations, provide opportunities for students to learn in a more personalized and contextual way, tailored to their needs and level of understanding (Astra et al., 2015; Darwin et al., 2023; Daryanes et al., 2023; Fajar et al., 2021). Interactive media is a tool that is used to elucidate the presentation of educational materials. The objective of interactive media is to enhance the learning experience of students. Interactive media is a learning programme that utilises computers or similar devices to integrate and synergize a variety of media, including text, images, graphics, videos, animations, and simulations, in order to achieve specific learning objectives. Users are able to actively engage with the programme (Zega et al., 2022). The application of interactive media is a way to facilitate the delivery of material so that students more easily understand the material provided (Tabrani et al., 2021). Interactive media can be developed using the Android platform (Sari et al., 2026).

Android presents a compelling prospect for educational usage as a medium that accommodates dynamic lives, enabling access to learning information via smartphones at any time and location, often referred to as mobile learning (Criollo-C et al., 2021; Crompton et al., 2016). Android-based media are applications or software designed to run on the Android operating system (Munir et al., 2023). This media is used to support various activities, including learning, conveying information, and entertainment in an interactive and flexible manner. According to Yusuf and Afandi (2020), Android-based media are applications that utilize Android devices to convey information or content, whether in the form of text, images, audio, or video. This media can be used for various purposes, such as learning, entertainment, or communication. This study aims to develop interactive Android-based media for science learning that is valid, practical, and effective.

METHOD

This study examines the advancement of interactive media among students at Madrasah Tsanawiyah (MTs) in Sidenreng Rappang Regency. This study employs Research and Development (R&D). This study was to develop an interactive media product to facilitate students' comprehension of scientific classes, specifically the sub-chapter on the solar system. In this context, the product developed is a learning medium containing educational messages about the solar system, designed visually and narratively for easy comprehension by students.

The development process follows the AADC model, which is divided into four main stages: Analyze, Align, Design, and Construct. The AADC model is a synthesis model that integrates the strengths of three widely tested learning development models: ADDIE, ASSURE, and Dick and Carey. This model is designed to provide systematic guidance in developing effective learning media that meets student needs and learning objectives. Each stage is interconnected and forms a development cycle oriented towards learning needs and effectiveness.

Analyze (needs and characteristics analysis)

The initial stage in this model is needs analysis. At this stage, media developers identify learning needs, student characteristics, and the learning environment. The information gathered includes students' initial abilities, learning styles, technology readiness, and the desired curriculum objectives. This analysis serves as the primary basis for determining the strategy and format of the media to be developed.

Align (formulating learning objectives and strategies)

After the analysis is completed, the next step is to align the learning objectives with the media and methods to be used. Learning objectives are formulated in a specific, measurable, and relevant manner. This stage also includes selecting the learning approach and delivery strategy that best suits the student characteristics and the results of the initial analysis.

Design (media and learning material design)

In the design stage, developers begin designing the learning media to be used. This includes content planning, script writing, visual and audio design, and the creation of

evaluation tools. This design process follows instructional design principles that emphasize message clarity, interactivity, and active student engagement in the learning process.

Construct (development, implementation, and evaluation)

The final stage in the AADC model is media construction, implementation, and evaluation. Developers begin producing the media based on the design and then conduct trials on small or large groups. Evaluation is conducted both formatively and summatively to measure the media's effectiveness in achieving learning objectives. Evaluation results are used as the basis for revisions to improve the media.

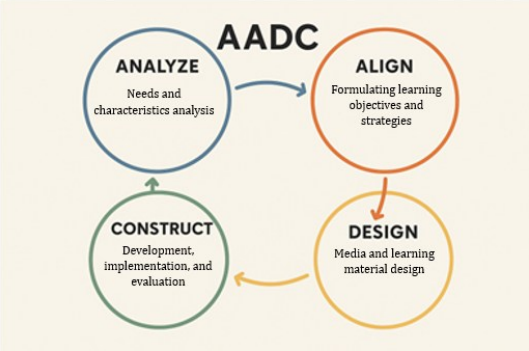


Fig. 1. Synthesis results

The study aimed to provide Android-based media for teaching the solar system subtopic to seventh-grade students at MTs Negeri 1 Sidenreng Rappang during the odd semester of the 2025/2026 academic year. Participants, including two validators-a material expert and a media expert, a science educator, and thirty seventh-grade students- played crucial roles in validating and piloting the media, highlighting their vital contribution to the project's success.

The data collection technique used was a non-test instrument. A research instrument is an assessment tool used to gather information, or a tool that can be used to collect data in the form of questions or explanations. Non-test instruments are needed to obtain student feedback on the interactive learning media used in the learning process. This questionnaire contained data processing results consisting of 11 questions from 30 students. The following statements emerged from the data processing: 1) The majority of students are accustomed to using additional learning resources. This could be an indicator that learning materials or methods must utilize learning media to better understand the learning. 2) Most students have received learning media in the form of PowerPoint, although a small number have not yet experienced this. 3) Interactive learning media has been proven to be very effective according to all students. 4) The majority of students still experience obstacles in understanding the solar system material with the current PowerPoint learning methods and media. 5) Student interest in using digital technology in the form of Android-based interactive media in science learning is very high. 6) Teachers are quite consistent in using PowerPoint learning media, although not optimally. 7) Interactive media powered by Android piques students' curiosity and inspires them to study more. 8) The challenges associated with employing interactive media on Android are not that big. Most students find that interactive material based on Android is straightforward to access and utilise. 9)

Interactive media built on Android is great for enhancing comprehension. 10) It is critical to quickly advance interactive media. 11) The difficulty level of the solar system material is in the medium-half category, students still need additional assistance.

The effectiveness of learning media is shown via the examination of student learning outcome assessments. The data used for this research comes from the average discrepancy between all students' learning outcome exams and the percentage level of student learning. The assessment of learning outcomes occurs in two phases: a pretest and a posttest. The pretest is administered before to the learning sessions using the generated interactive media product. The posttest is administered at the conclusion of the learning session.

Validity analysis is performed to assess the legitimacy of the interactive media created. Validity data are acquired from subject matter experts, media, and design experts. The practicality assessment of the Android-based educational media is derived from observations of teacher and student activities, together with the completion of response questionnaires from both teachers and students. Observations of teacher and student actions begin with the small-group trial and continue through the end of the learning process. Questionnaires for both teacher and student responses are distributed at the final meeting. The research utilizes data from teacher and student response surveys to demonstrate the effectiveness of the Android-based learning media in education.

Table 1. Criteria for the validity and practicality of interactive media (Muttaqin et al., 2021)

%	Valid	Practical
81-100	Media is Highly Valid	Media is Highly Practical
61-80	Media is Valid	Media is Practical
41-60	Media is Quite Valid	Media is Quite Practical
21-40	Media is Less Valid	Media is Less Practical
0-20	Media is Not Valid	Media is Not Practical

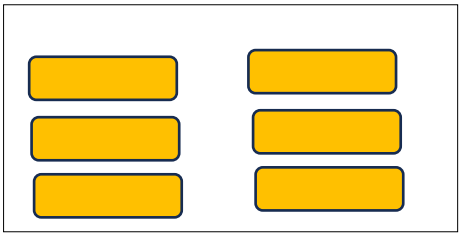
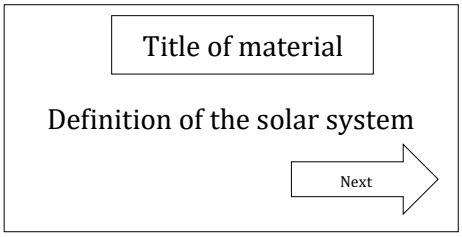
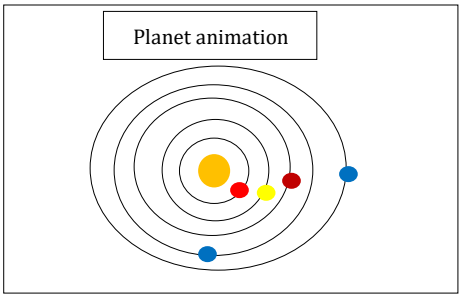
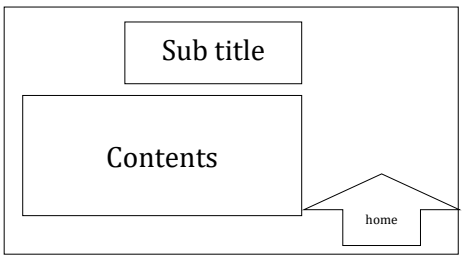
RESULTS AND DISCUSSION

This interactive media study aims to develop products that enhance student learning outcomes. Based on the results of initial observations conducted through interviews with a science teacher, it was found that the learning resources currently used are printed books/packages for the VII A science subject, but these printed books are limited to presenting material in the form of text and images. Enhancing the quality of education necessitates the development of more engaging and comprehensive learning tools, such as Android-based interactive media containing videos, images, sounds, animations to attract student learning. Learning resources that are less interesting will make students unmotivated to learn (Dita et al., 2023; Yomaki et al., 2023).

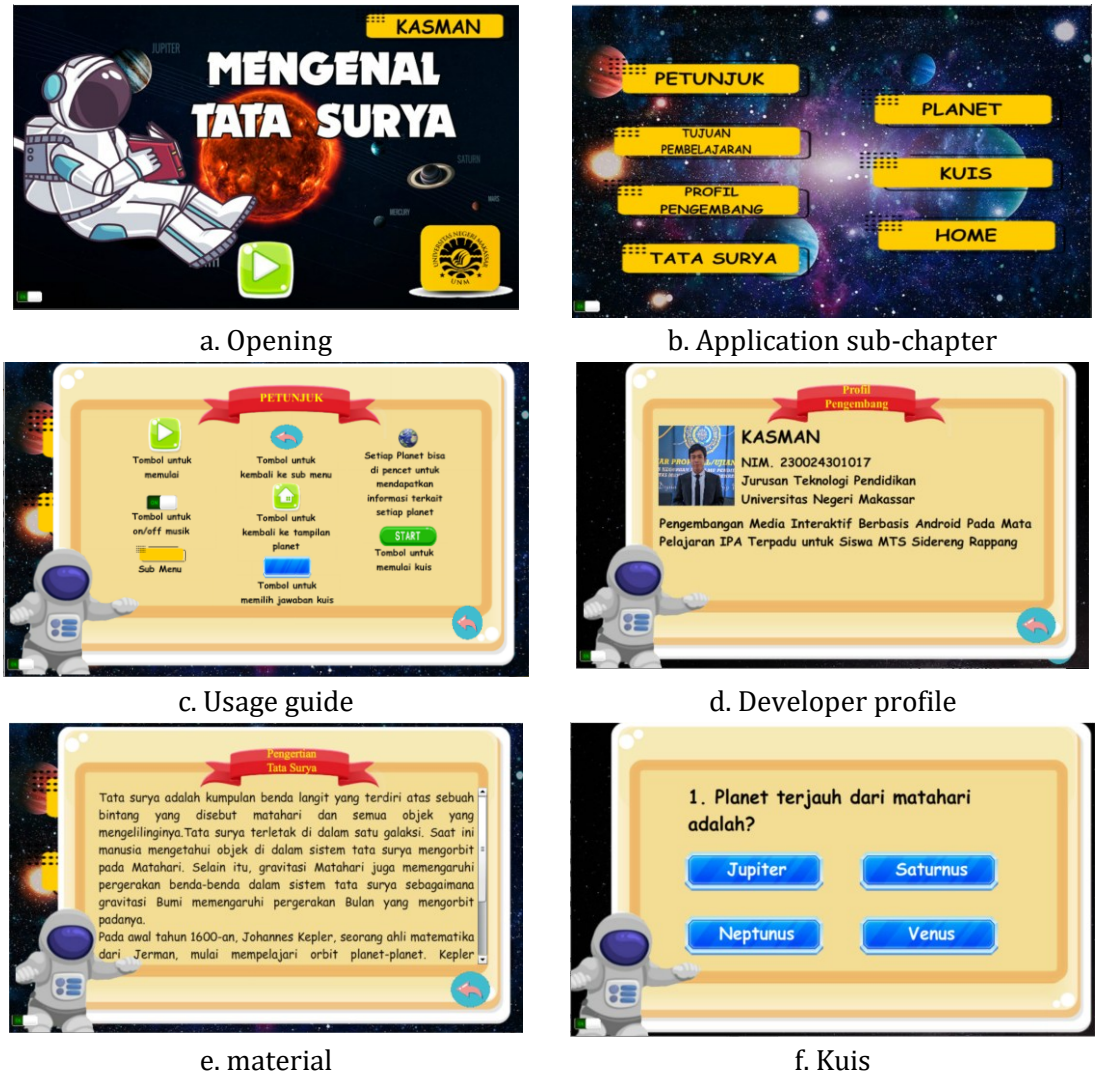
The needs identification questionnaire for the Android-based interactive media product yielded a total score of 268, representing 81%, indicating affirmative responses across 11 criteria. A cumulative score of 61, corresponding to 18%, indicated a negative response. It can be concluded based on the results of the questionnaire given to 30 students, that the majority of students have used additional interactive media and obtained learning media from teachers, and all students stated that learning media helps understanding the material and they enjoy using it. However, most students still have difficulty understanding the material with interactive media and conventional methods, and half of them consider

the Solar System material still difficult. All students support the development of Android-based interactive media and need more interesting alternative interactive media, while obstacles in using the media are relatively small. Needs analysis as a basis for developing products (Dita et al., 2024). Overall, the data shows that the development of Android-based interactive media is very necessary to increase student understanding and interest, especially in the Solar System material. It is necessary to do a requirements analysis before moving on to the design phase. An interactive media storyboard built on Android is the end result of the current design phase. Table 2 displays the science-related interactive media storyboard design that is based on Android..

Table 2. Android-based interactive media storyboard

Information	Visual	Audio
Opening - Title of the material to be presented		Background Sound (Music)
Sub Menu Display - Provided subtitles		Background Sound (Music)
Introductory Material - Understanding the Solar System		Background Sound (Music)
Sun and planet animation - Sun image - Planet image		Background Sound (Music)
Explanation of the material		Background Sound (Music)

The subsequent phase is to design the interactive media for Android using the Adobe Animate application after the storyboard has been generated. Based on the previously created storyboard, the design is then executed. Using available design tools and creative options, the product is created, taking into account the layout, images, and other visual elements that align with the storyboard. Additionally, the design will be customised to accommodate the implemented requirements and preferences, while also considering design principles that enhance the aesthetic appeal of Android-based interactive media and facilitate comprehension.. Storyboards serve as the foundation for the creation of educational media (Damopolii & Kurniadi, 2019). By referring to the storyboard as a guide, the Android-based interactive media design serves as the foundation for subsequent implementation, ensuring that the final result is in line with the stated expectations and objectives. Figure 2 presents the developed product.



a. Opening b. Application sub-chapter

c. Usage guide d. Developer profile

e. material f. Kuis

Fig. 2. Interactive media developed

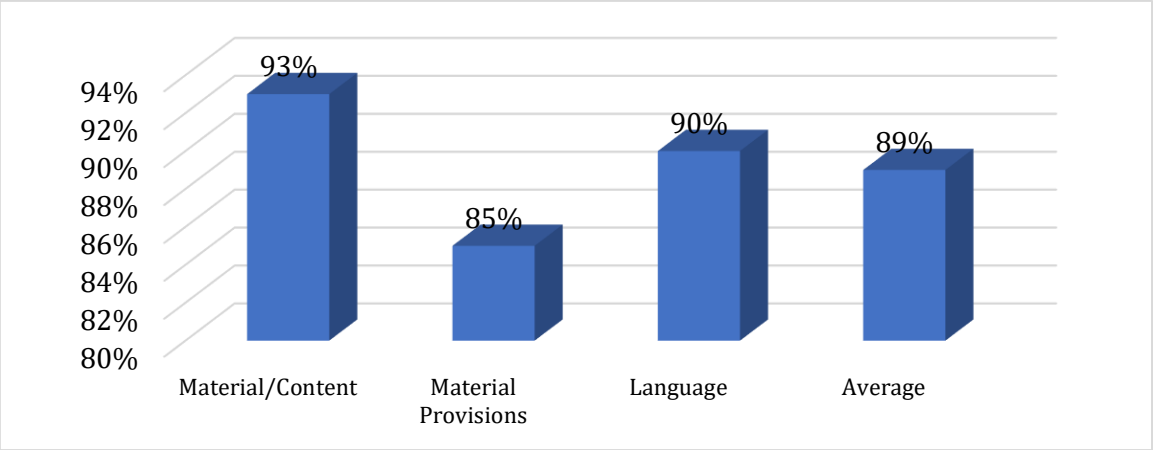


Fig. 3. Results of validation by material experts

The suggestions given by the material expert to the researcher regarding the developed android-based interactive media are improvements only in the technical arrangement of the writing of the material, images, and bibliography. The results of the assessment of the material expert validator in Figure 3 indicate that the results are very valid in the material/content aspect, with a percentage of 93%. In the material accuracy aspect, the results are very valid, with a percentage of 85%. In the language aspect, the results are very valid, with a percentage of 90%. It is evident that the android-based interactive media developed by the researcher is worthy of being tested in research, as a total percentage of 89% was obtained from these three aspects, indicating that it is in the very valid category. The validation results of the material expert serve as the foundation for the assertion that a product has satisfied the criteria for the veracity of the information (Ahliana et al., 2025; Amir et al., 2025).

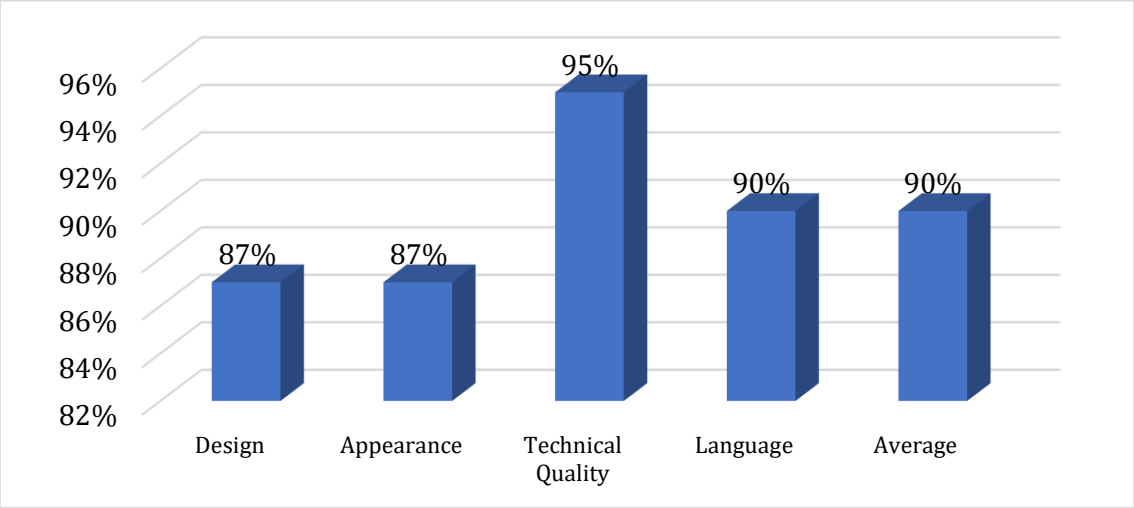


Fig. 4. Media expert validation results

The design aspect received a percentage result of 87%, indicating that it is highly valid. The appearance aspect also received a percentage result of 87%, indicating that it is highly valid. The technical quality aspect received a 95%, indicating it is highly valid. These

findings are supported by the results of the media expert validator's assessment in Figure 4. The linguistic aspect achieved a percentage result of 90%, which is considered to be highly valid. It is evident that the Android-based interactive media developed by researchers is worthy of further research, as a total of 90% was achieved across the four aspects. The results of the media expert validation indicate that the design and appearance of the media attract students' attention and can be tested in the next stage (Runniarsiti et al., 2025; Yani et al., 2024).

a. Cover before revision b. Cover after revision

c. Sub menu before revision d. Sub menu setelah revisi

Fig. 5. Product revision results

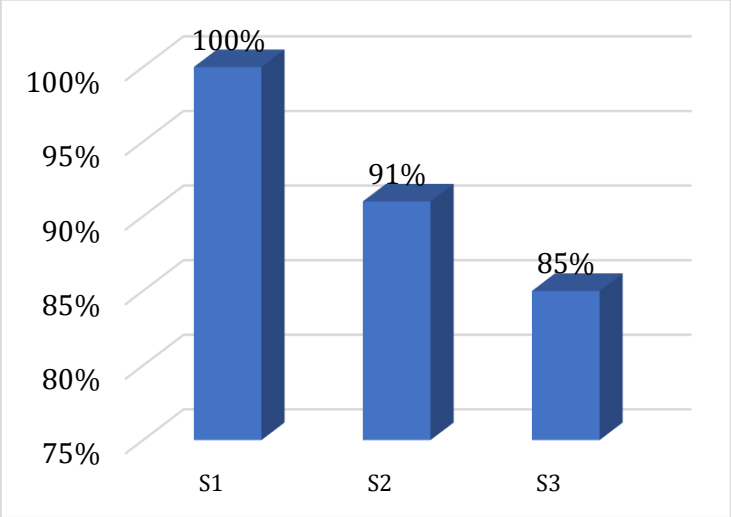


Fig. 6. Individual trial results

The Android-based interactive media product was piloted with three students, who then provided feedback or assessments. The average percentage of responses to the individual trial questionnaires, as illustrated in Figure 6, was 92%. This outcome suggests

that the practicality level is in the "very practical" category, implying that the learning process can be facilitated by the use of interactive media based on Android. The practicality category obtained indicates that the media can be used by teachers to teach solar system material.

For the purposes of small group testing, nine seventh-grade students from MTs Negeri 1 Sidenreng Rappang were first divided into three groups. The first group is students with low learning ability (the brand consists of three students), the second group is the medium learning ability category, consisting of three students, and the third group includes the high learning ability category with three students. These three groups are assigned to give a value to the Android-based learning media product that has been developed by researchers. The basis for determining students placed in groups is by considering specific objectives.

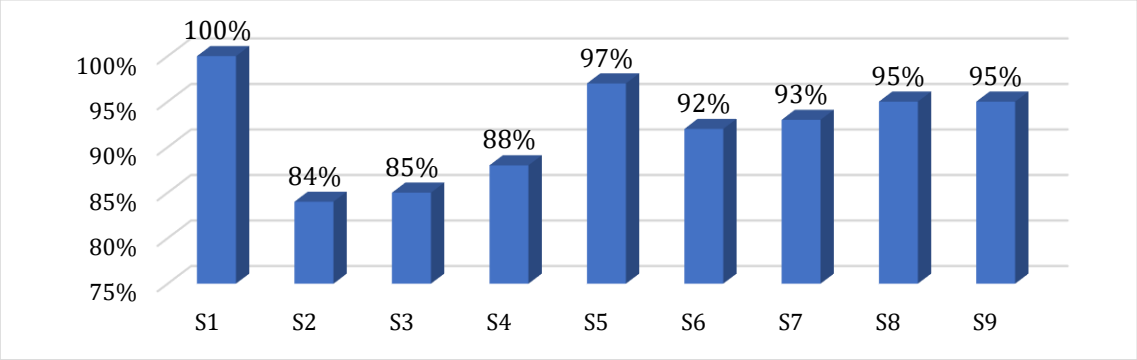


Fig. 7. Small group trial results

In order to ascertain the effectiveness and responses of the Android-based interactive media when operated by students, a small group trial was implemented. The average percentage of the small group trials, as illustrated in Figure 7, was 93%, as indicated by the questionnaire assessment results. These findings suggest that the practicality level is in the "very practical" category, indicating that the learning process can be facilitated by the use of interactive media based on Android. Media that has received a positive response and achieved practicality indicates that its effectiveness can be tested (Nasrul et al., 2024). The teacher response questionnaire regarding interactive media obtained a very practical category with an average percentage of 99% (presented in Figure 8).

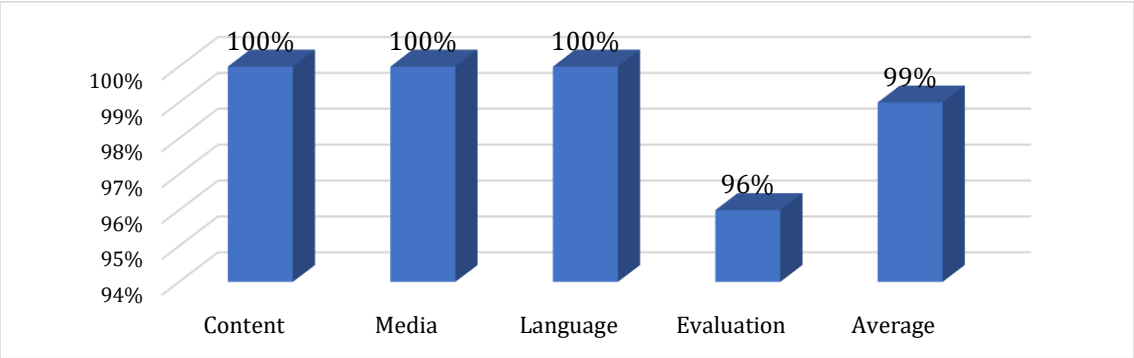


Fig. 8. Teachers' responses to the implementation of interactive media

Tabel 3. Effectiveness test results

Data	N	Minimum	Maximum	Mean	SD	Gain	n-gain
Pretest	30	20.00	60.00	51.67	10.20	34.33	0.71
Posttest	30	70.00	100.00	86.00	8.55		

The data gained from student learning outcomes via pretest and posttest activities. Before using interactive media, the average pretest score was 51.67; after using it, the average posttest score was 86.00. This information is based on Table 3. According to the n-gain value of 0.71, there has been a high improvement in the learning outcomes of the students. The high increase in students' learning outcomes is evidence that interactive media based on Android is extremely successful.

The validity, practicality, and effectiveness assessments of the interactive media for the Science curriculum in class VII A at MTs Negeri 1 Sidenreng Rappang demonstrated compliance with the established criteria. This interactive media can be used as an important resource in learning, because the material presented in it has been adapted to clear learning objectives. Interactive media helps students understand the material (Mustofa et al., 2024), is motivated to learn (Maulidya & Astuti, 2025), involvement and cooperation (Maulidya & Astuti, 2025). Consequently, this interactive media enables students to learn independently. Students are provided access to resources aligned with learning goals, including diverse exercises, worksheets, assessments, and supplementary materials such as text, photos, and videos that enhance the educational experience.

Interactive media developed based on current student needs. Interactive media went through validation stages and was tested on students, resulting in it being declared highly practical for use. Interactive media is effective in the learning process and enhances student learning outcomes by facilitating simpler and more engaging access to interactive learning materials. Interactive media helps improve students' understanding of abstract concepts, captures their attention, and increases engagement during learning (Hasanah & Sudira, 2021; Kusumawati & Prastiwi, 2025). The interactive media developed has a visual appearance and presents engaging material for students to learn. Through the use of this media, students receive immediate feedback, complete with usage instructions, and quizzes or practice questions. Various elements, including interactivity, media integration (images, text, audio, video), and simplicity of navigation, are considered in the development of the media to guarantee that the content is not only informative but also engaging and readily accessible. Elements such as images, layout, and navigation must be considered to attract and facilitate student access to the media (Astuti et al., 2020; Damopolii et al., 2021; Setyantoko et al., 2023).

This interactive media product offers several advantages that support effective learning, including flexibility in accessing materials anywhere and anytime via electronic devices. Further, interactive media can enhance students' learning experiences by incorporating a variety of multimedia elements, including text, images, audio, and video, to present more engaging and interactive materials. Additionally, the capacity to directly update materials is a significant advantage, as it enables the information to remain pertinent and current. Interactive media is also tailored to individual student needs, providing opportunities for independent learning at their own pace.

CONCLUSION

Based on the findings of the research and discussion, it is evident that android-based interactive media has satisfied the requirements of students and has met the criteria of being valid, practical, and effective for educational purposes. Students require interactive media that is designed to be visually appealing and includes audio, images, and educational videos to facilitate an engaging learning experience. The analytical results of the validation stage of interactive media consist of two components: media validation and material validation. The material validation was classified as highly valid, and the media expert validation was classified as highly valid. The teacher response questionnaire to interactive media was classified as highly practical, while the student response questionnaire to interactive media was classified as highly practical. The pretest and posttest results indicated that student learning outcomes had improved. An alternative method for science instructors to instruct their students is the utilisation of interactive media that is based on Android.

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