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Development Needs Aspects of the Android Learning Media Eksponia in Learning Exponent Material

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Abstract

Understanding the concept of exponents remains a challenge for students due to the less-than-interactive delivery of material and the limited learning media used. This study was conducted to identify the development needs for an Android-based learning medium called Eksponia as a solution to improve students' conceptual understanding of exponent material. The method used is a case study with a qualitative approach through interviews with students, teachers, and the vice principal of SMA Negeri 1 Sindang. The results show that students need media that is contextual, visual, and independently accessible. Teachers are also aware of the need for interactive media, while the school has supported the use of technology in learning. The implication of this research is the importance of developing the Eksponia media, which can bridge the needs of students and teachers in learning exponents and support the implementation of the Merdeka Curriculum, which emphasizes learning independence and flexibility.

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1. Introduction

Mathematical conceptual understanding is the ability to comprehend, integrate, and effectively apply various mathematical ideas in diverse contexts. According to Fries et al. (2021), mathematical conceptual understanding encompasses the ability to connect various ideas well, resulting in deep comprehension. In line with this, Kolar & Hodnik (2021) state that mathematical conceptual understanding includes the ability to grasp fundamental mathematical principles, not merely perform calculation procedures mechanically. Rather, this understanding involves mastery of the relationships between concepts, the ability to identify patterns, and the application of concepts in real-world situations.

A deep understanding of mathematical concepts enables students to solve more complex problems. Nurjanah et al. (2020) state that conceptual understanding is a very important part of mathematics learning. Conceptual understanding serves as the foundation for critical thinking, solving mathematical problems, and supporting other abilities. Wardani et al. (2024) explain that mathematical conceptual understanding has significant benefits in education and the development of knowledge. Deep understanding is an important foundation for students in building logical thinking skills, thus supporting the mastery of skills across various fields of science that are beneficial to students.

Although mathematical conceptual understanding is very important, many students have difficulty understanding the concept of exponent material. Gardenia et al. (2021) reveal that students with low academic ability tend to experience difficulties across all indicators of mathematical conceptual understanding. This condition shows that mastery of concepts in learning material is not yet evenly distributed, especially among students with lower ability levels. Additionally, Bilousova et al. (2024) add that many students experience obstacles in connecting mathematical concepts with real-life situations. Weak conceptual understanding of exponents can have a negative impact on students' motivation and engagement in the mathematics learning process. As a result, students who experience difficulties tend to lose interest in mathematics, which ultimately affects their overall learning achievement.

The weak understanding of the concept of exponents can be caused by several factors. Damayanti et al. (2024) identify several causes of low mathematical conceptual understanding, including: 1) students' lack of concentration in learning, 2) irregular study habits, and 3) the use of unattractive learning methods. Meanwhile, Kastira & Irwan (2023) explain that the conventional teacher-centered learning process is one of the barriers to building conceptual understanding. In conventional learning, students become less active in constructing their own knowledge. One solution that can be applied is the use of Android-based learning media, which is capable of attracting students and facilitating an independent and meaningful learning process.

Android learning media enables students to learn independently and flexibly according to their own pace and needs. Ajidiana et al. (2023) explain that the use of engaging technology can increase students' enthusiasm in learning, so that students become more active in understanding and applying mathematical concepts. With innovative learning media, students can develop an understanding of the abstract concept of exponents more easily. Mahuda et al. (2022) also reveal that Android learning media provides flexibility of access to learning material without being limited by time and place. This gives students the freedom to learn at their own rhythm and according to their needs, which has a positive impact on learning independence.

Hidayat et al. (2023) define Android learning media as interactive technology-based media designed to support the ongoing learning process. In line with this, Kumullah & Tayibu (2021) state that Android learning media is interactive multimedia designed to support mathematics learning effectively and engagingly for students. The use of the Eksponia Android-based learning medium can optimize the utilization of technology in education, helping students to better understand mathematical concepts.

Yuniarti et al. (2022) reveal that Android-based learning media serves as a solution for supporting mathematics learning. Learning media designed innovatively can help students understand mathematics material. Pohan & Siregar (2023) show that the use of Android learning media also contributes to helping students understand mathematical concepts. This media also helps students understand mathematical terms and symbols better, supporting a more effective and meaningful learning process.

Eksponia is an Android-based learning medium designed to present exponent material in an engaging manner. The Eksponia learning medium aims to help students' understanding of exponent concepts through features that are easily accessible and can be used anytime and anywhere. The development of the Eksponia learning medium is based on the problems students face in understanding exponent concepts deeply. Therefore, this research was conducted to identify the development needs for the Eksponia learning medium in exponent material.

2. Method

This research was conducted using a qualitative approach through the case study method to understand the weakness of students' conceptual understanding in exponent learning. A case study is an approach that aims to understand in depth a problem in the context of real life (Poltak & Widjaja, 2024), thereby providing further insight into effective learning strategies.

This research was conducted at SMA Negeri 1 Sindang with three Grade XI students who had studied exponent material and its properties as participants. The selection of participants was based on the level of students' understanding, namely high, medium, and low, in order to provide a broader picture of the differences in students' ability to understand the concept of exponents.

Data collection was carried out through interviews and observations of students and teachers. Interviews aimed to determine the obstacles faced by students when solving exponent problems, including difficulties in understanding and applying the properties of exponents in test questions. Meanwhile, observations were conducted to directly observe the process of students in solving exponent problems, so that it can be determined to what extent students understand and apply the concepts taught.

Table 1
Student Interview Indicators

No.	Dimension	Question Indicator	Number of Questions
1.	Understanding of material	Students understand the basic concepts and properties of exponent operations	5

No.	Dimension	Question Indicator	Number of Questions
2.	Techniques used	Students explain how to solve the given exponent test problems	4
3.	Students' responses to learning exponent material	Students provide responses to learning exponent material	4
Total			13

Adapted from Wijayanti et al. (2023)

Table 2

Teacher Interview Indicators

No.	Dimension	Question Indicator	Number of Questions
1.	Delivering exponent material	The teacher explains the strategy for delivering exponent material	4
2.	Difficulties in delivering exponent material	The teacher explains the obstacles in the teaching process	4
3.	Use of media	The teacher conveys the types of media used in exponent learning	5
Total			13

Adapted from Hidayat et al. (2023)

In addition, exponent conceptual understanding test questions were used to evaluate the extent to which students master the material and to identify aspects that need to be improved in the learning method. The results of this evaluation will serve as the basis for identifying the development needs for the Eksponia learning medium in exponent material, so that the learning features and strategies designed can better suit the needs and characteristics of students.

Table 3

Exponent Test Indicators

No.	Basic Competency	Achievement Indicator	Cognitive Level	Test Form
1	Analyzing the properties of exponent number operations	Students are able to analyze and simplify the form of exponential numbers using the properties of exponents	C4	Essay
2	Solving problems related to exponents	Students are able to analyze and solve contextual problems using the exponential model accurately	C4	Essay

Adapted from Ratnavati et al. (2022)

Data analysis used a qualitative approach by collecting and examining interview results in depth. The data obtained were analyzed using *Atlas.ti* to assist in the process of coding, categorization, and searching for main themes. This approach enables an in-depth exploration of students' needs related to learning exponent material.

3. Results and Discussion

Results

1) Interview with the Vice Principal for Curriculum

Figure 1 documents the interview process conducted on June 3, 2025, at SMA Negeri 1 Sindang. The subject of this interview was the Vice Principal for Curriculum. The interview was conducted to gather in-depth information about curriculum implementation, learning preparation, teacher resources, and the use of facilities and infrastructure at the school.

Figure 1
Interview with the Vice Principal for Curriculum



The interview with the Vice Principal for Curriculum provided an overview of identifying the need aspects for the Eksponia Android media for learning exponent material, particularly to make it more relevant to teacher characteristics, the readiness of facilities, and the approach that has been implemented at the school.

Figure 2
Interview Results with Vice Principal for Curriculum

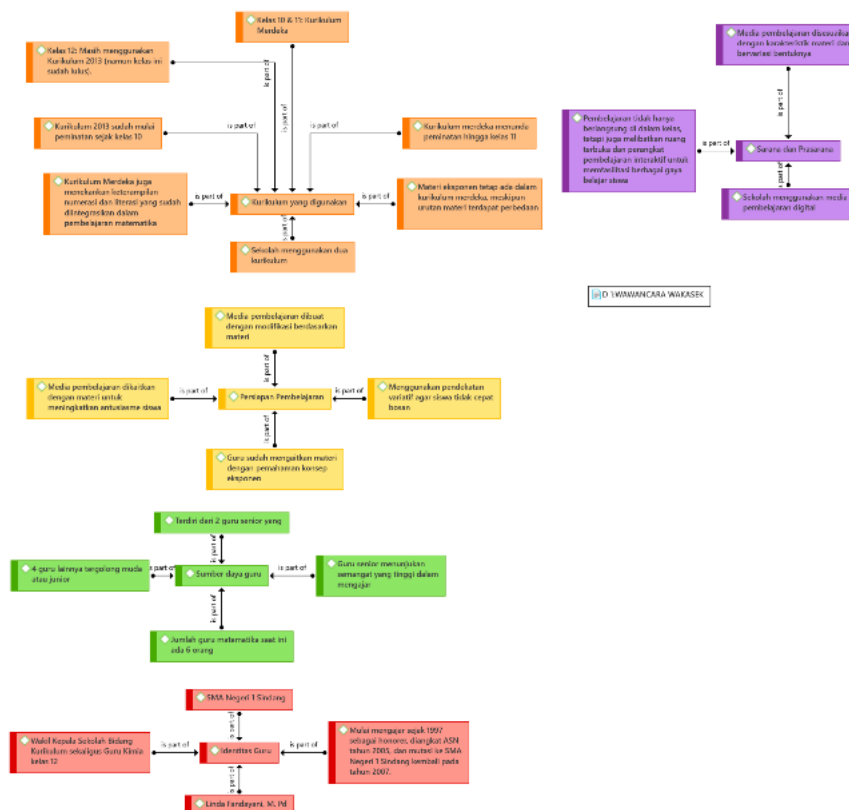


Figure 2 presents the interview results with the Vice Principal for Curriculum using *Atlas.ti*. SMA Negeri 1 Sindang uses two curricula simultaneously: the 2013 Curriculum for Grade XII and the Merdeka Curriculum for Grades X and XI. Learning preparation is carried out by modifying media according to the material's needs, connecting the material to real-life situations to increase student enthusiasm, and using varied approaches to prevent monotony.

The school has also utilized digital learning media designed flexibly to accommodate the learning style characteristics of each student. The facilities used include open spaces and interactive devices that enable a more flexible and contextual learning approach. In terms of teaching staff, there are six mathematics teachers, two of whom are senior teachers who demonstrate high enthusiasm, while the rest are classified as junior teachers. Based on the interview, it can be concluded that exponent learning at this school requires interactive and varied Android-based learning media to adapt to the needs of the material and student characteristics, as well as to support the implementation of the Merdeka Curriculum, which prioritizes learning independence.

b) Interview with the Mathematics Teacher

Figure 3 is documentation of an interview conducted directly on May 28, 2025, in the school environment of SMA Negeri 1 Sindang. The subject of this interview was a mathematics teacher who teaches in Grade X and directly teaches exponent material. The teacher was selected because of their direct involvement in the learning process of the exponent topic, thus deemed capable of providing a real picture of classroom teaching practices.

Figure 3
Teacher Interview



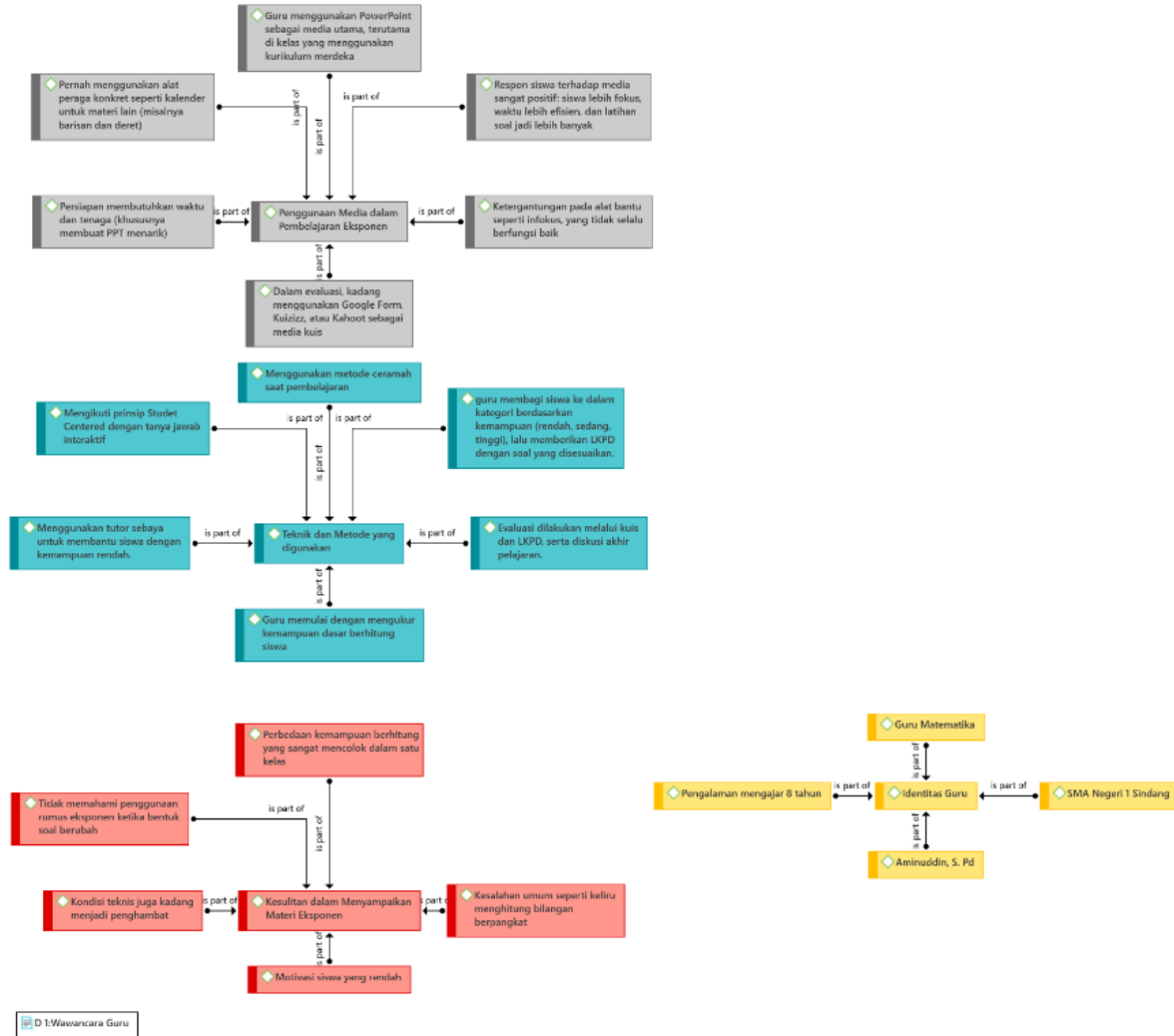
This interview aimed to gather in-depth information related to the implementation of exponent material learning, including the use of learning media, methods applied, obstacles faced by both teachers and students, and students' responses to the material taught. The information obtained is very important for identifying real needs in the field, so that the development of the Eksponia Android-based learning medium can be designed contextually, in accordance with the characteristics of learners and classroom conditions.

Based on the teacher interview results analyzed through *ATLAS.ti* software, various important information was obtained regarding the learning process of exponent material in Grade X at SMA Negeri 1 Sindang. The teacher uses learning media such as PowerPoint, video, and Google Form for evaluation. However, the media used is still one-directional and not yet fully interactive. The teacher recognizes the importance of using digital media, but limitations in design and teaching time are obstacles to creating more engaging media.

In the implementation of learning, the teacher applies a lecture method combined with a contextual approach. Although efforts have been made to engage students, learning is still not fully active. The teacher also faces challenges such as low student learning motivation, difficulties in understanding exponential numbers, and quite noticeable differences in learning abilities within the classroom. Learning evaluation is

carried out through multiple-choice and essay questions, but has not yet been maximally effective in measuring students' conceptual understanding.

Figure 4
Teacher Interview Results



These findings reveal a gap between student needs and the available learning media. Therefore, media is needed that can present exponent learning in a contextual, engaging, and easily accessible manner. With reference to these interview results, this research was conducted to develop an Android-based learning medium named Eksponia, designed to more effectively and interactively meet the needs of students and teachers in the learning process of exponent material.

c) Student Interview

Figure 5 is documentation of an interview conducted directly on May 28, 2025, in the school environment of SMA Negeri 1 Sindang. The subjects of this interview were Grade XI students who had received and studied exponent material. This interview was conducted to obtain a direct picture from students regarding their experience in following the learning of exponent material in class.

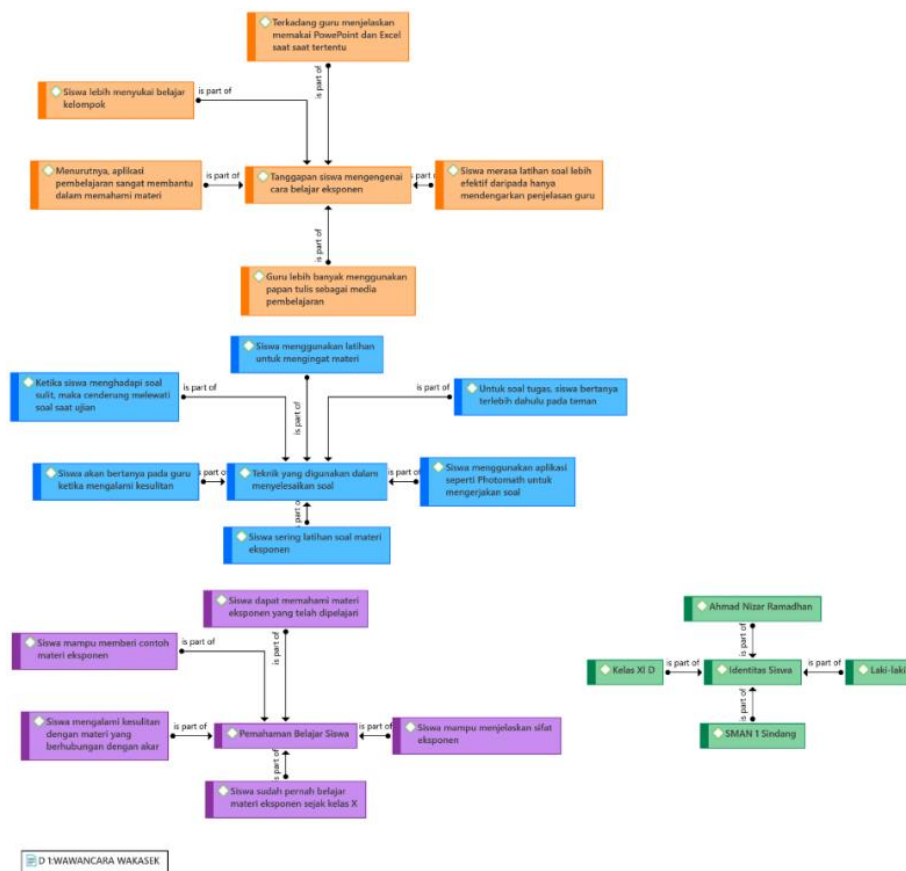
This interview aimed to determine how students understand the material, the techniques used in solving problems, the use of learning media, and responses to the teaching methods applied by the teacher in class. The data obtained from this interview serves as an important part in identifying student needs during the learning process. This information is used as the basis for developing the Android-based learning medium "Eksponia," which is expected to address students' learning challenges, provide ease in understanding exponent concepts, and support a more engaging, independent learning process that is appropriate to the characteristics of learners.

Figure 5
Student Interview



Based on the student interview results analyzed through *ATLAS.ti*, information was obtained regarding students' experiences and views on exponent material learning in Grade X at SMA Negeri 1 Sindang. Students stated that learning still predominantly uses conventional media such as blackboards, although the teacher occasionally uses PowerPoint or Excel. Students feel it is easier to understand exponent material through practice problems rather than just listening to the teacher's explanation, and they prefer group learning and using digital applications to help solve problems.

Figure 6
Student Interview Results



In terms of students' techniques when solving problems, students tend to rely on repetitive practice and the help of friends when encountering difficulties. Some students also utilize applications such as Photomath to understand problem solutions. Nevertheless, students' understanding of exponent material varies. Some are able to re-explain the properties of exponents and give examples, but there are also those who experience difficulties, especially when problems involve roots and algebraic forms. This shows that students' learning strategies are not yet fully systematic and depend on individual practice habits.

These findings indicate that students need learning media that not only presents material visually and interactively, but is also capable of facilitating practice problems in a gradual and contextual manner. Therefore, this research was conducted to develop the Eksponia Android media, which is capable of meeting students' needs in understanding exponent material in an enjoyable, easily accessible way that is appropriate to their learning styles.

Discussion

a) Vice Principal for Curriculum Interview Results

The interview conducted with the Vice Principal for Curriculum provided information about curriculum implementation, teacher readiness, and the use of facilities and infrastructure. Learning preparation is carried out by adapting media to the needs of the material, and linking it to the context of real life to make it more meaningful for students. The school also utilizes digital media and provides learning tools that support a more contextual learning process.

These findings are consistent with Nurbani & Puspitasari (2022), who show that the use of Android-based learning media can make a positive contribution to the student learning process. In addition, Rezeki et al. (2023) also state that Android-based media has the potential to increase student engagement in learning mathematics. The use of a curriculum that emphasizes learning independence, such as the Merdeka Curriculum, also requires the support of learning media that can be independently accessed by students.

Based on the interview results, it can be concluded that the school needs learning media that can support the implementation of the Merdeka Curriculum and contextual learning. Therefore, the development of the Eksponia Android media becomes important to provide a flexible, independent learning alternative that is appropriate to the characteristics of students and the curriculum policy implemented at the school.

b) Mathematics Teacher Interview Results

The interview with the mathematics teacher showed that the process of learning exponent material in Grade X is still conventional, with a tendency toward lecture methods and the use of media such as *PowerPoint*, video, and *Google Form* for evaluation. The teacher stated that although digital media is already being used, limitations in time and media design ability are obstacles to developing more interactive media. In addition, students still experience difficulties in understanding exponent material, particularly regarding exponential numbers and roots, and show low learning motivation.

This is reinforced by the findings of Nainggolan et al. (2024), who reveal that conventional teacher-centered learning methods tend to hinder conceptual understanding because students become passive. Mahuda et al. (2022) also state that Android-based learning media can improve independent learning and understanding of mathematical concepts due to their flexibility and interactivity. The limitations of learning media that is informative but not interactive can make it difficult for learners to integrate and connect various concepts as a whole.

Thus, it can be concluded that there is a need to develop interactive Android-based learning media that supports active student engagement. The development of Eksponia media is expected to be able to address the challenges of teachers and students in exponent learning, and to strengthen conceptual understanding through a visual, contextual, and systematically practice-based approach.

c) Student Interview Results

The interview results show that students prefer learning that involves practice problems rather than just listening to the teacher's explanation. The learning media used by the teacher, such as blackboards, *PowerPoint*, or *Excel*, are considered not yet fully effective because they are less interactive. In addition, students also often use applications such as *Photomath* in working on problems as an additional aid. When encountering difficulties, students tend to ask their friends first before asking the teacher, indicating a dependence on the social learning environment.

These findings are supported by previous research from Aminullah & Irwansya (2024), who state that students tend to find it easier to understand mathematics material when learning is accompanied by structured practice problems and supporting digital media for independent exploration. In addition, the research results of Utami et al. (2024) also show that the use of interactive Android-based learning applications is able to improve conceptual understanding and student activeness, especially in abstract material such as exponents.

Therefore, based on the interview results and support from previous research, it can be concluded that the development of the Eksponia Android media is highly necessary to support exponent learning in Grade X. This media is expected to serve as an alternative solution that suits students' needs, provides space for independent practice, and presents material visually and interactively to more effectively improve the understanding of exponent concepts.

4. Conclusion

This research was conducted to identify the need aspects in the development of the Eksponia Android-based learning medium for exponent material. Based on the interview results with students, teachers, and the vice principal, it was found that exponent learning is still dominated by conventional methods, and the learning media used has not yet fully supported deep conceptual understanding. Students need media that can facilitate independent, contextual, and visual learning. Therefore, the development of Eksponia media is the right solution to address the need for more engaging, flexible exponent learning that is appropriate to students' characteristics and the implementation of the Merdeka Curriculum. The implication of this research is that the development of the Eksponia Android media can have a positive impact on the mathematics learning process, particularly in improving students' understanding of exponent concepts. This media has the potential to encourage learning independence, active student engagement, and a more contextual and accessible presentation of material. In addition, the results of this research can serve as a reference for teachers, schools, and media developers in designing more innovative and effective digital learning strategies to support learning achievement in the technology era.

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