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INVENTOR MEDIA TO OVERCOME COGNITIVE BARRIER ON INTEGRAL MATERIALS

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Abstrak

Ada banyak penyebab munculnya hambatan; hambatan yang disebabkan oleh materi yang dipelajari sulit, faktor kognitif, hereditas dan didaktik. Salah satu usaha dalam menangani masalah tersebut yang dapat dilakukan adalah memfasilitasi siswa dalam belajar matematika melalui media. Tujuan dari penelitian ini adalah untuk mengembangkan media yang praktis dan valid dengan memanfaatkan aplikasi inventor. Tujuan khusus penelitian pengembangan ini untuk mendeskripsikan pengembangan media pembelajaran materi integral berbasis inventor untuk siswa SMA kelas XI. Penelitian ini mengambil populasi seluruh siswa SMA Laboratorium Universitas PGRI Semarang dengan pertimbangan belum pernah ada penelitian terkait kendala dan pengembangan media dengan mengambil siswa satu kelas XI sebagai sampel. Prosedur pengembangan mengadaptasi model yang dikembangkan oleh Borg and Gall yang mengungkap ada sepuluh tahapan. Namun dalam penelitian ini baru mencapai tahap kelima yaitu revisi produk utama. Hasil menunjukkan proses dan hasil pengembangan media pembelajaran berbasis Inventor untuk mengatasi hambatan kognitif pada materi Integral siswa SMA adalah valid dan layak digunakan karena memenuhi syarat kepraktisan serta validasi ahli Siswa dan guru mata pelajaran matematika memberikan respon yang baik. Pembelajaran matematika dengan media Inventor untuk mengatasi hambatan kognitif pada materi Integral untuk siswa SMA menghasilkan pembelajaran yang efektif berdasarkan nilai rata-rata siswa kelas yang menggunakan Inventor melebihi nilai minimal sehingga kelas eksperimen tuntas. Hasil prestasi belajar pada kelas eksperimen lebih baik dari kelas kontrol.

Kata kunci: Hambatan kognitif; integral; pengembangan media

Abstract

There are many causes for hindrances to arise; barriers caused by difficult learning material, cognitive, heredity and didactic factors. To overcome this, efforts that can be made are to facilitate students in learning mathematics through learning media. The purpose of this research is to develop valid and practical media by utilizing inventor applications. The specific objective of this development research was to describe the development of inventor-based integral material learning media for class XI high school students.This study took a population of students of SMA Laboratorium Universitas PGRI Semarang with the consideration that there had never been any research related to media constraints and development by taking students from class XI as a sample. The development procedure adapts the model developed by Borg and Gall which consists of ten stages. However, this research has only reached the fifth stage, namely the revision of the main product. The results showed that the process and results of developing Inventor-based learning media to overcome cognitive barriers in Integral material for high school students were valid and feasible to use because they met the practical requirements and expert validation. Students and math teachers gave a good response. Learning mathematics with Inventor media to overcome cognitive barriers in Integral material for high school students produces effective learning based on the average grade of students using Inventor exceeding the minimum value so that the experimental class is complete. The results of learning achievement in the experimental class is better than the control class.

Keywords*:* Cognitive Barrier, Integral, Media Development

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INTRODUTION

Humans carry out thinking activities every day, and the ability to think comes from within themselves, but these abilities can be trained and developed into different abilities between individuals. Thinking is a mental activity that can help formulate or solve problems, make decisions, or curiosity ((Bahr et al., 2010; Miller & Topple, 2020; Kooloos et al., 2021). Mathematical truths are developed based on logical reasoning, but mathematical work includes observing, guessing, making and testing hypotheses, finding analogies, connecting and communicating, representation, generalizing, proving theorems, and solving problems. In problem solving activities, sometimes people face barriers, as well as in solving problems on Integral material (Paul & Hlanganipai, 2014; Mutodi P 2014; Tague & Richard Baker, 2014; Antonijević, 2016).

Mathematics is a subject that must be taken by students of SMA Laboratorium Universitas PGRI Semarang, both majoring in science and social studies. Integral material is found in class XI even semesters, especially material for Indefinite Integral Algebraic Functions. Because of its mandatory nature, difficulties or barriers that exist during learning take place, it is also mandatory to immediately find a way out and make teachers immediately improve teaching methods in the classroom so that it has an impact on improving student achievement. If the existing barriers are left alone, it will have an impact on the failure of understanding concepts and students' solving abilities, where this has a direct impact on student learning outcomes, especially in Integral Mathematics subjects. (Kartinah et al., 2020; Nanna & Pratiwi, 2020 ; Purnomo et al., 2022). In addition, the use of media can stimulate students to understand a material. The media, could use media that have been circulating so far, but it would be nice if the teacher or educator developed a better and more interesting media in order to overcome the barriers that occur. Research that utilizes learning media in the classroom has been done by many previous researchers and the majority found the benefits of these media (Nuanmeesri & Jamornmongkolpilai, 2018; Lang-Wojtasik et al., 2020; Saputra et al., 2021; Duyen & Loc, 2022). The research background is shown be seen in Figure 1.

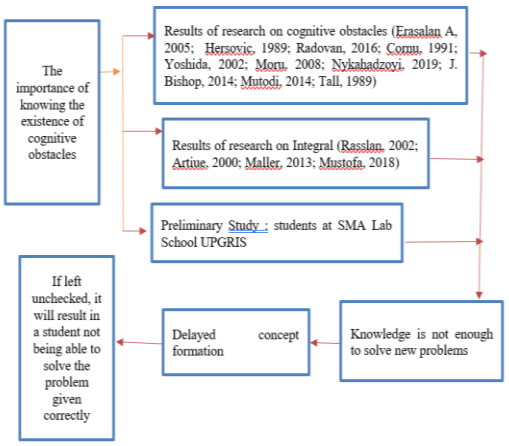

Figure 1. Research background

The aim of this research is to develop valid and practical media by utilizing inventor applications. The specific objective of this development research was explain the development of inventor-based integral material learning media for class XI high school students.

METHODS

This research is a development research or belongs to the type of R and D. By taking the population of all class XI SMA Laboratorium Universitas PGRI Semarang for the academic year

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2020/2021 and by taking one class of class XI SMA Laboratorium Universitas PGRI Semarang as a sample. The development procedure uses the model developed by Borg and Gall (Gustiani, 2019) which includes 10 stages, but in this research, the steps carried out are only up to the fifth stage, there are (1) Research and information collecting, (2) Planning, (3) Develop preliminary form of product, (4) Preliminary field testing, (5) Main product revision. Borg & Gall stated that the research development procedure basically consists of two main objectives, namely: (1) developing the product, and (2) testing the effectiveness of the product in achieving the goal. In this research, the steps carried out The research procedure can be seen in Figure 2.

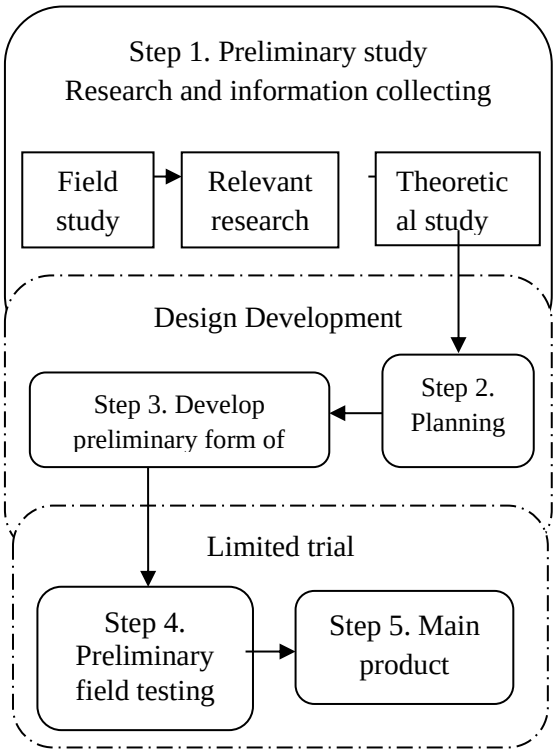

Figure 2. Research procedure

The first stage in development research is the information gathering stage (Research and information collecting) is the initial stage by conducting a literature study that underlies the development of instructional media by reviewing some relevant previous research results, followed by classroom observations, and designing a research framework.

The second stage is the Planning stage. After the preliminary study has been carried out, the next step is to design various activities and procedures to be followed in the development of learning products. As for the second stage of this research, what will be used is the Kodular application which is part of the inventor.

The third stage is developing a preliminary form of product. This stage is the design stage of the initial draft of the media inventor to overcome cognitive barrier in the integral material for students of SMA Laboratorium Universitas PGRI Semarang which has been validated and revised based on input from experts so as to produce revised draft 1.

The fourth stage is preliminary field testing or preliminary trials. The purpose of this stage is to obtain a description of the setting of the application or feasibility of a product, in this case media inventors, to overcome cognitive barriers in integral material for SMA Laboratorium Universitas PGRI Semarang students. This preliminary trial was limited, involving only two classes, namely class XI MIPA 1 and XI MIPA 2.

This fifth stage is the main product revision to fix the weaknesses of Draft 1 based on the results of limited trials resulting in product improvements called Draft 2. Research by (Yopa et al., 2022) who also conducted development research (R and D) with the stages carried out in the research, namely the preparatory stage (preliminary) and the prototyping stage (formative evaluation)

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consisting of one-to-one and expert review , small groups, and field tests.

RESULTS AND DISSCUSION

Results

By taking a population of all students in class XI SMA Laboratorium Universitas PGRI Semarang and with the sample taking one class of class XI students of SMA Laboratorium Universitas PGRI Semarang in the 2020/2021 school year. Based on the development research method carried out on the modification of the stages in the Borg and Gall development model, the authors obtained the results in the field as follows:

The initial stage in development research is the stage of gathering information (research and information collecting) which is the initial stage by conducting a literature study that underlies the development of learning media by reviewing some relevant previous research results, followed by classroom observations, and designing a research framework. The result of this activity is to obtain a profile of the implementation of the learning system, especially those related to the learning object that is to be improved.

The second stage is the planning stage. After the preliminary study is carried out, the next step is to design various activities and procedures that will be taken in the development of learning products. Application Inventor is a platform that makes it easy to build simple applications without learning or using too many programming languages. We can design an Android application as per our requirement using various available layouts and components. As for this research, what will be used is the Kodular application which is part of the inventor. Kodular is a website that provides tools similar to MIT App Inventor to create Android applications using block programming. We don't need to manually enter program codes to create Android applications. Kodular provides advanced functions such as Kodular Store and Kodular Extension IDE, which can facilitate developers to upload Android applications to Kodular Store and create IDE extension blocks according to the needs of developers. This Kodular can customize the theme according to you so that we are comfortable using the site in creating or creating Android applications. The existence file of Kodular is (.aia) and the existence plugin (.aix). Content existence plugin contains some command code in Java programming language which will convert into existence plugin file (.aix), this is useful extension section. Figure 3 Figure 4 are a display of the developed product.

Figure 3. Display of developed products

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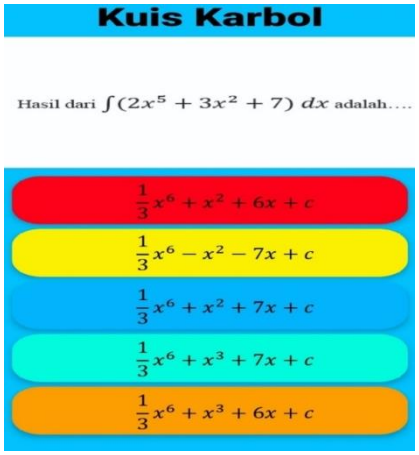

Figure 4. Product quiz display developed

The third stage is Develop Preliminary form of Product. This stage is the design stage for the initial draft of the inventor media to overcome cognitive barriers in the integral material for the students of SMA Laboratorium Universitas PGRI Semarang which has been validated and revised based on expert input so as to produce a revised draft 1. The recapitulation of the validator's assessment of this inventory learning media can be seen in Table 1.

Table 1. Recapitulation of the validator's assessment of the media

No	Assessment aspect	Expected score	Evaluation score	Properness
1.	General View	24	22	91,67%
2.	Custom Views	12	10	83,33%
3.	Media Presentation	16	15	93,75%

The fourth stage is a preliminary form of product or a preliminary test. The purpose of this stage is to obtain a description of the application setting or feasibility of a product in this case the media inventor to overcome cognitive barriers in the integral material of SMA Laboratorium Universitas PGRI Semarang students, This preliminary trial is limited in nature, involving only two classes, namely XI MIPA 1 and XI MIPA 2 class. The results of this limited trial are carried out to find out the weaknesses of draft 1 and are used as material to revise a product to be developed.

Table 2. Recapitulation of the validator's assessment of the material on the media

No.	Assessment aspect	Expected score	Evaluation score	Properness
1.	General View	16	15	93,75%
2.	Custom Views	24	22	91,67%
3.	Media Presentation	36	32	88,89%

This fifth stage is the main product revision to improve the weaknesses of Draft 1 based on the results of a limited trial so as to produce product improvements called Draft 2. Based on the results of the limited trial, the results of the average value of the experimental class have met completeness. What needs to be revised from the results of the limited trial is the time used to test the learning outcomes. Because when they do quizzes on investor-based learning media, they run out of time. The results of a limited trial were carried out to find out the weaknesses of draft 1 and used as material to revise a product to be developed. The last stage is the main product revision stage**.** The activity at this stage is to improve the weaknesses of Draft 1 based on the results of a limited trial so as to produce a product improvement called Draft 2. At this stage we conducted a completeness test

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using the One Sample Test and Comparative Test and obtained the average score of students in the experimental class (XI MIPA1) was completed, while the results of the comparative test (independent sample test) showed that the learning achievement of the experimental class was better than the control class. This shows that the developed media to overcome cognitive barriers in the integral material of SMA Laboratorium Universitas PGRI Semarang, can improve student achievement.

Discussion

Activity results in this outcome. obtaining a profile of Inventor-based learning media and implementing it into the learning system in the Mathematics class at SMA Laboratorium Universitas PGRI Semarang which the quality is to be improved. Since the founding of this high school, there has never been improvisational media that supports learning specifically for Integral material. With the results of developing media that show results that are feasible to use based on the opinions of the validators involved in this study. This is in line with research (Aulia & Prahmana, 2022) who developed the e-module at this stage (Aulia called it the preliminary stage) conducted curriculum analysis, analysis of student characteristics, and analysis of learning materials.

After the preliminary study is carried out, the next step is to design various activities and procedures that will be taken in the development of learning products. The activities carried out in this stage are to formulate specific goals to be achieved by developing a product; estimate the funds, energy, and time required to develop a product; formulate research capabilities, work procedures, and forms of participation required during research and development of a product. The next stage is the develop preliminary form of product which is the initial draft design stage of the media inventor which has been validated and revised based on expert input so as to produce a revised draft 1. From Table 1 above it can be seen that the developed media is suitable for use in class of XI learning. While the results of the validation to material experts, based on Table 2, it appears that in general, the substance of the material in this media inventor is feasible to be given to students at SMA Laboratorium Universitas PGRI Semarang.

Similar to what (Istiqlal, 2020) had done, after conducting a needs analysis in the field, starting with the collection of books and references, the researcher chose the right design according to the characteristics of the junior high school students who were the target of his research.

Based on the results of limited trials, the results of the average value of the experimental class have fulfilled completeness. What needs to be revised from the limited trial results is the time used to test learning outcomes. Because when working on quizzes on investor-based learning media, they ran out of time. Slightly different from what was done by (Nuanmeesri & Jamornmongkolpilai, 2018) specifically in the third step, while (Nuanmeesri & Jamornmongkolpilai, 2018) carried out six stages in its development research; analyze and collect information, design learning media, develop learning media (in this step the researcher does not do expert validation), evaluate the effectiveness, disseminate learning media, evaluate the effectiveness again.

The development of mathematics from year to year continues to increase

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according to the challenges of the times. One of the challenges faced this year is the Corona Virus Desese-2019 outbreak. The outbreak of Covid19 is driving simultaneous changes in the form of online or distance learning in every element of education. This form of learning is one way to overcome difficulties in implementing learning activities. This is a new challenge for every element of education, especially teachers in providing distance learning. It is conceivable that with this distance learning system, the delivery of material, especially in mathematics lessons, which was originally face-to-face using the help of a blackboard, has changed through the help of applications or software.

There are several ways that are used by teachers, namely by using electronic mail facilities, virtual class applications such as Google Classroom, zoom meetings to using messaging applications on mobile phones such as WhatsApp, Line, Telegram. All of these methods are used by the teacher to be able to convey mathematics learning material to students. In order for the process of teaching and learning activities to be more efficient, learning media is needed as a teacher's support tool. Technological developments are able to provide convenience to every human being in obtaining various information. At present, technology is a basic human need, so that updates in technology are increasingly developing over time. One of the software that can be utilized for mobile phone systems is the MIT App Inventor. App Inventor is used in this study because it is practical and simple and it is easy to design learning media applications that do not require complex coding languages (Septiawan, 2020).

(Pulungan et al., 2022) research examines academic resilience felt by students, as well as observed by teachers during online mathematics learning during the Covid19 pandemic in mathematics. Teachers found it difficult to convey knowledge to their pupils. Students also have difficulty getting support in learning mathematics online from parents or family. Students find it difficult to adapt, low interest and motivation during online mathematics learning, even teachers are limited in controlling students' online learning strategies and they need interesting learning media so that innovative learning media is urgently needed as a solution to increasing students' academic resilience because as we know the ability individuals to persist in completing their education even in difficult conditions or unpleasant situations and can solve an academic problem (Rosdiana et al., 2022)

CONCLUSSION

Based on the process of developing Inventor-based learning media to overcome cognitive barriers in the integral material of high school students that has been carried out, it can be concluded as follows.

The process and results of developing Inventor-based learning media to overcome cognitive barriers in the Integral material of high school students are valid. Because the Invetor-based learning media that has been developed has gone through a validation process determined by experts or experts in their fields. The percentage of feasibility of Inventor-based learning media to overcome cognitive barriers in the Integral material of high school students is 90.38% by media experts. The percentage of the feasibility of students' Integral material on Inventor-based learning media to overcome the

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high school cognitive barrier is 90.78% by material experts.

Inventor-based learning media to overcome cognitive barriers in Integral material for high school students has been implemented well or practically. The implementation of learning at the SMA Laboratorium Universitas PGRI Semarang, turned out to be a good response for students and teachers of mathematics subjects.

Learning mathematics with Inventor-based learning media to overcome cognitive barriers in the Integral material of high school students produces effective learning based on (1) The average value of the experimental class students reaches more than the minimum mastery standard of 86.00 so that the experimental class is classically completed. (2) the results of the experimental class students' learning achievement is better than the control class. The value obtained is 86.00 for the experimental class and 76.73 for the control class.

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