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Selecta Capita of Mathematics E-Book for SHS on Contextual Teaching and Learning (CTL) Approach

Dina Octaria[1], Nila Kesumawati[2], Allen Marga Retta[3]

[1,2,3]Universitas PGRI Palembang, Palembang, Indonesia
Corresponding Author: nilakesumawati@univpgri-palembang.ac.id[2]

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Abstract

Selecta capita of mathematics is a subject that discusses algebra, geometry, and high school calculus material. Students face obstacles during the learning process: misconceptions about studying selecta capita of mathematics and the lack of electronic textbooks. Therefore, it is necessary to have electronic textbooks that can help students to solve problems by prioritizing independence in the learning process. This study aims to produce a selecta capita of mathematics e-books for SHS on a reasonable and practical contextual teaching and learning (CTL) approach and to see the effectiveness of the e-book that has been developed. The development of selecta capita of mathematics e-book for SHS on CTL approach refers to ADDIE development model. The instruments used to determine the quality of a developed e-book are (1) questionnaires to measure the validity, (2) student response questionnaires to measure practicality, and (3) learning outcomes test questions. The results showed that selecta capita of mathematics e-books for SHS based on the CTL approach developed was good quality and could be used in learning.

Abstrak

Kapita selekta matematika merupakan mata kuliah yang membahas materi aljabar, geometri dan kalkulus sekolah menengah atas. Salah satu kendala yang dihadapi peserta didik selama proses pembelajaran yaitu terdapat miskonsepsi dalam mempelajari kapita selekta matematika serta masih minimnya buku ajar elektronik. Oleh karena itu, diperlukan adanya bahan ajar elektronik yang dapat membantu peserta didik memecahkan permasalahan dengan mengutamakan kemandirian dalam proses pembelajaran. Penelitian ini bertujuan untuk menghasilkan e-book kapita selekta matematika SMA berbasis pendekatan contextual teaching and learning (CTL) yang valid dan praktis, serta melihat keefektifan e-book yang telah dikembangkan. Pengembangan e-book kapita selekta matematika SMA berbasis pendekatan CTL mengacu pada model pengembangan ADDIE. Instrumen yang digunakan untuk mengetahui kualitas e-book yang dikembangkan, yakni: (1) angket untuk mengukur kevalidan; (2) angket respon peserta didik untuk mengukur kepraktisan; (3) soal tes hasil belajar. Hasil penelitian menunjukkan e-book kapita selekta matematika SMA berbasis pendekatan CTL yang telah dikembangkan berkualitas baik dan dapat digunakan dalam pembelajaran.

***Keywords**: E-Book, Selecta Capita of Mathematics, Contextual Teaching and Learning.*

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INTRODUCTION

Selecta capita of mathematics in high school is one of the compulsory subjects that students of the Mathematics Education Study Program must take. This is because this course discusses in-depth algebra and geometry in high school. The material in this course consists of sequence, series, sigma notation, trigonometry, polynomials, composition functions and inverse functions, three dimensions, logarithms, equations and inequalities, absolute values, financial mathematics, vectors, cones and conic sections, transformations and matrices, and high school calculus.

Based on the researcher's experience while teaching Selecta Capita of Mathematics subject in high school, there are several obstacles during the learning process, namely: 1) the number of material that students must master; 2) the lack of electronic textbooks high school selecta capita of mathematics (because this course is a combination of algebra, geometry and calculus materials) (Huda, 2017); 3) student learning outcomes in Selecta Capita of Mathematics subject for high school are still low, this is due to a lack of student concepts understanding in learning. The typical student concept understanding is because students have difficulties, especially in learning geometry and calculus material. This is in line with the opinion of Wardani et al., who stated that there was a misconception (misunderstanding) in learning selecta capita of mathematics. (Wardani, Mudzalipah, & Hidayat, 2013). Gunawan and Retraningrum's research state that the difficulties experienced by students lie in factual knowledge, conceptual knowledge, procedural knowledge, and metacognitive knowledge (Gunawan & Retnaningrum, 2016). Kumalasari and Sugiman, in their research, stated that the most considerable difficulty faced by students lies in metacognitive knowledge (Kumalasari & Sugiman, 2015). Jiang stated that geometry is one of the fields in mathematics that is very weakly absorbed (Nur'aini, Harahap, Badruzzaman, & Darmawan, 2017). In comparison, Leithold said that in studying calculus, one must know trigonometry, algebra, and geometry concepts (Wahyuni, 2017).

Studying material such as algebra, geometry, or calculus emphasizes understanding concepts and can also hone systematic, logical, critical, and analytical reasoning (Andriani, 2015). This is in line with Wahyuni, who stated that learning mathematics aims to produce humans who can reason logically, critically, systematically, rationally, and carefully, and can be honest, objective, creative, and open (Wahyuni, 2017).

To achieve these learning objectives, it is necessary to have textbooks in the learning process. According to Tarigan, a textbook is a type of book used in specific fields of study and a standard book compiled by experts for instructional purposes equipped with appropriate teaching facilities and easily understood by users in schools and universities so that they can support a teaching program (Kurbaita, Zulkardi, & Siroj, 2013). With the textbook, it is hoped that students can construct their knowledge independently. Knowledge construction can be built if textbooks are made or developed using an approach or theory that is appropriate to learning. Research conducted by Mulyana and Gunadi states that the appropriate approach for the Selecta Capita of Mathematics subject is contextual teaching and learning; this is because the characteristics of Selecta Capita of Mathematics subject require an authentic context to solve a problem (Mulyana & Gunadi, 2018). This is supported by three CTL components applied

in the learning process: modelling, constructing knowledge, and understanding learning materials (Asrizal, Desnita, & Darvina, 2020). This is in line with the research of Apriani, Buyung and Relawati, who stated that the appropriate approach for algebraic material is contextual teaching and learning. (Apriani, Buyung, & Relawati, 2017).

The development of science and technology that is in line with the era development in Era 4.0 is needed, especially in the current condition that the world is facing a COVID-19 pandemic, which causes face-to-face interaction to be minimal. All sectors of life must adapt to the current situation. Likewise, online learning is needed in education in today's conditions. Efforts made to overcome these problems required the existence of electronic books (e-books) in the learning process.

E-Book is a textbook that contains a multimedia database with various data sources converted into digital form (Restiyowati & Sanjaya, 2012). E-Book has advantages: more practical and easier to carry everywhere, environmentally friendly, durable, easy to copy and easy to distribute. (Makdis, 2020).

Research conducted by Bayani states that e-books can be used as exciting teaching material (Bayani, 2019). This is confirmed by several studies that Mindayula has carried out; Supriadi; Wibowo and Pratiwi; Rosyidah and Rahayu; Maynastiti et al. They stated that the developed e-book was valid because students gave a very positive response to the learning process and could practice creative thinking skills and problem-solving abilities (Muhaimin, Bakar, &Mindayula, 2016); (Supriadi, 2015); (Wibowo & Pratiwi, 2018); (Rosyidah & Rahayu, 2022); (Maynastiti, Serevina, & Sugihartono, 2020).

Based on relevant previous research, there are differences and updates from each research conducted. The differences and updates in this research lie in the approach and materials. This research aims to produce an e-book of high school selecta capita of mathematics on contextual teaching and learning approaches that are valid and practical and to see the effectiveness of a developed e-book.

METHOD

The method used in this research is research and development. The development used adapts the ADDIE model developed by Dick and Carry (Sugiyono, 2016), consisting of 5 stages Analysis, Design, Development, Implementation, and Evaluation.

Analysis. At this stage, needs analysis, curriculum analysis and characteristics analysis are carried out. Needs analysis in the form of syllabus, materials, applications, and approaches used analysis. Curriculum analysis was conducted to determine Basic Competencies, Indicators of Competency Achievement, and learning objectives. Meanwhile, student characteristics analysis was carried out to develop e-books.

Design. At this stage, the researcher designed/made an e-book design that would be developed. The researcher made a storyboard that outlines e-book contents in general, including e-book design and materials based on a contextual teaching and learning approach, as well as compiling an assessment instrument.

Development. This stage was the process of making/developing an e-book based on the storyboard and design that had been made. Then e-book was reviewed by the validator. The validation carried out was material validation and product validation to measure the feasibility of the developed product by filling

out the validation assessment sheet. This assessment is used as a guideline for improving e-books to produce feasible e-books for testing.

Implementation. At this stage, the researchers conducted product trials in the classroom and gave questionnaires to determine student responses about the feasibility of e-books used in learning. At this stage, the test is also given to determine the effectiveness of the e-book.

Evaluation. At this stage, an evaluation was carried out based on the response questionnaire analysis and student test results to determine the quality of the e-book.

This study's data collection techniques used validation assessment sheets, response questionnaires, and learning outcomes tests. The validation assessment sheet is addressed to experts to measure the validity of the resulting e-book. The assessment sheet is addressed to media experts and material experts. The response questionnaire was used to determine student responses and reactions related to e-book practicality. The e-book practicality was viewed from the convenience and assistance for students in the learning process. The learning outcomes test was used to measure the level of student learning completeness. Completeness of student learning outcomes would be used to indicate the effectiveness of the e-book.

The data analysis technique used in this study is a qualitative descriptive analysis technique that describes product development results in the form of the e-book for high school selecta capita of mathematics based on contextual teaching and learning. The data obtained from the assessment sheets and questionnaires provided were analyzed using qualitative descriptive statistics. The assessment scores from each validator and respondent were then searched for the average and converted to determine the validity and feasibility of e-books for high school selecta capita of mathematics based on contextual teaching and learning. Criteria of validity and practicality can be seen in Table 1 and Table 2.

Table 1. Criteria of E-Book Validity

Score Interval	Criteria
$3{,}4 < \bar{x} \leq 4{,}0$	Very Valid
$2{,}8 < \bar{x} \leq 3{,}4$	Valid
$2{,}2 < \bar{x} \leq 2{,}8$	Quite Valid
$1{,}6 < \bar{x} \leq 2{,}2$	Less Valid
$0 \leq \bar{x} \leq 1{,}6$	Very Invalid

Source: (Widoyoko, 2012)

Table 2. Criteria of E-Book Practicality

Score Interval	Criteria
$3{,}4 < \bar{x} \leq 4{,}0$	Very Practical
$2{,}8 < \bar{x} \leq 3{,}4$	Practical
$2{,}2 < \bar{x} \leq 2{,}8$	Quite Practical
$1{,}6 < \bar{x} \leq 2{,}2$	Less Practical
$0 \leq \bar{x} \leq 1{,}6$	Very Less Practical

Source: (Widoyoko, 2012)

The data obtained were used to determine the effectiveness of the e-book, determined by counting the number of students who had completed, then the completeness percentage was categorized according to the criteria, which can be seen in Table 3. Learning outcomes are said to be effective if at least they reach good criteria.

Table 3. Criteria of Academic Proficiency Assessment

Completeness Percentage (%)	Criteria
$\boldsymbol{p > 80}$	Very Good
$60 < p \leq 80$	Good
$40 < p \leq 60$	Enough
$\boldsymbol{20 < p \leq 40}$	Less
$\boldsymbol{p \leq 20}$	Very Less

Sources: (Widoyoko, 2012)

RESULTS AND DISCUSSIONS

Research Results

This study used the ADDIE development model, which consists of 5 stages that

must be carried out, including analysis, design, development, implementation, and evaluation.

Analysis

The stages of analysis carried out in the development of Selecta Capita of Mathematics e-book based on contextual teaching and learning are as follows.

Needs analysis. The needs analysis was carried out based on the researcher's experience while teaching the Selecta Capita of Mathematics subject in high school and based on discussion results with other lecturers who taught Selecta Capita of Mathematics subject to find out problems related to the learning process. Information obtained that: 1) the number of materials that students must master; 2) there was still a lack of selecta capita of mathematics textbooks for high school; 3) student learning outcomes were still low; 4) the occurrence of the covid-19 pandemic which requires learning to switch from face-to-face to online learning systems. So it needs a textbook which is more exciting and can be accessed anywhere and anytime, so it can make students actively involved in the learning process.

Curriculum analysis. Curriculum analysis was carried out based on the KKNI curriculum. The analysis was about CPL Study Programs, CP Subjects, and Learning Indicators Selecta Capita of Mathematics subject for High School.

Media analysis. In developing e-books, the primary material used is Microsoft word 2007. Microsoft word has various menus that make it easier for researchers to make e-books. After entering all the e-book material in Microsoft Word, the file will be converted into a pdf form to be inserted into the following application: Flip PDF Builder. Flip PDF Builder is used as one software in developing e-books because this application has good capabilities in displaying products, multimedia, and animation. The various menus that flip pdf builder must make it easy for users to use this application. The development of this e-book is published in the form of a link.

Design

The next stage after the analysis stage is the e-book design stage described in detail.

Reference Collection. In developing e-books, the researchers look for and collect references first. Learning resources that are considered relevant and following the material developed in the e-book are used as references by researchers. Researchers also collect pictures and videos sourced from the internet; videos serve to attract students' interest in e-books and clarify the material contained in e-books.

Create Storyboards. A storyboard is made as a plan for making an e-book. Storyboard in the development of this e-book consists of front and back covers, instructions for using the e-book, concept maps, indicators and materials, stages of contextual teaching and learning, evaluation, answer keys, and bibliography.

Development

At the development stage, researchers developed e-books according to the design stage. The media used to create the e-book is Microsoft Word 2007, then it is converted into a pdf form then, followed by the flip pdf builder application. The steps at the e-book development stage are as follows.

Making an e-book was done by collecting the necessary materials such as materials, images, videos, and backgrounds. The researcher then composed the e-book with Microsoft Word 2007,

which followed the design stage design. The display of the developed e-book can be seen in Table 4 (*see appendix A*).

Product validation. The Selecta Capita of Mathematics E-book was validated by 3 validators, 2 validators are from Universitas PGRI Palembang, while 1 validator is from Universitas Muhammadiyah Palembang.

Product revision. After validation process, there were several revisions to the e-book. The selecta capita of mathematics e-books for high school based on contextual teaching and learning was revised according to suggestions and input from the validators. Validator comments and revisions can be seen in Table 5.

Implementation

In the implementation stage, the selecta capita of mathematics e-books for high school based on contextual teaching and learning validated and revised was then tested. The e-book trial was carried out online through the Google Suite application and campus e-learning with 26 third semester students as research subjects. The trial was carried out by giving a response questionnaire to determine the attractiveness of e-books developed and a test to see the effectiveness of e-books.

Evaluation

The last stage in e-book development was evaluation.

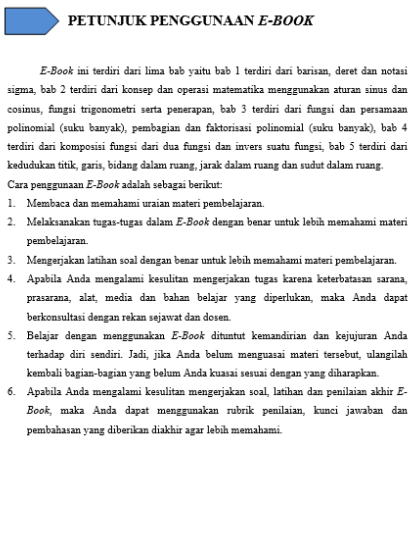
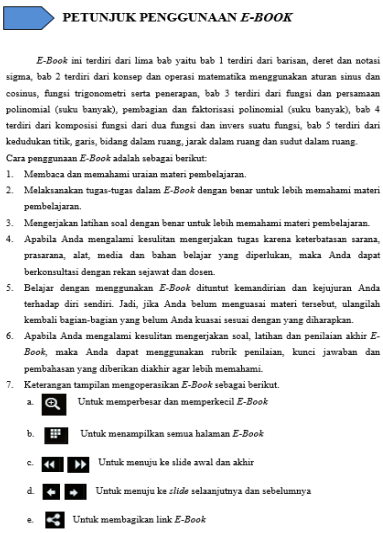
Validity analysis. Validity analysis was conducted to determine the quality of the developed e-book based on the assessment results by the validator. The results of the e-book assessment of each validator can be seen in Table 6.

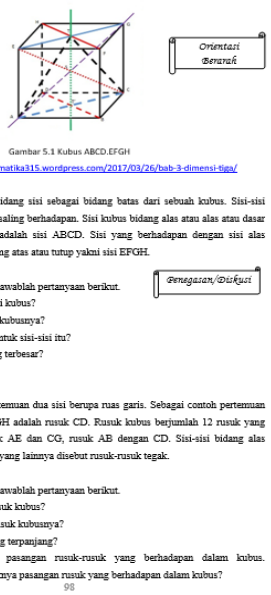
Table 6. The result from 3 Validator

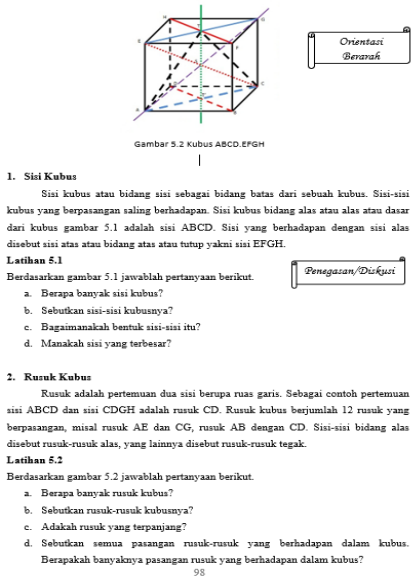
Validator	Average score	Criteria
Validator 1	3,10	Valid
Validator 2	3,09	Valid
Validator 3	3,86	Very Valid
The Average	3,35	Valid

Based on Table 6, the average score of validators 1 is 3.10 with valid criteria. For validator 2 the average score is 3.09 with valid criteria. From validator 3, the average score is 3.86, with very valid criteria. Thus, the average score for the three validators is 3.35 with "valid" criteria.

Table 5. Validator Comments and Revisions

Before Revisions	After Revisions
	
Instructions for using e-book add the existing button/menu functions and add operating instructions	





The Image number fixed

Practical Analysis. The practicality assessment is based on a questionnaire response of 26 students to assess a selecta capita of mathematics e-books for high school based on contextual teaching and learning. The assessment results showed that the average score of the student response questionnaire was 3.25 with the "practical" criteria.

Effectiveness Analysis. The effectiveness analysis is seen from the student learning outcomes test. The test results show that 24 of the 26 students who achieve the minimum completeness criteria (KKM) are greater than 70. The percentage of student completeness obtained is 92.31%, and the effectiveness is obtained with very high criteria. So that it can be said that the selecta capita of mathematics based on contextual teaching and learning e-books for high school is said to be "very effective".

Discussions

Based on the development results, it was found that selecta capita of mathematics based on contextual teaching and learning e-books for high school, which was developed with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) was declared valid, practical, and effective.

Data from the validation results of the e-book provided by three validators showed an average score of 3.35 with "valid" criteria. The data from the practicality test of e-book conducted by providing student response questionnaires obtained an average score of 3.25 with "practical" criteria. Furthermore, from the student learning outcomes test data, the percentage of completeness is 92.31%, with very high criteria. This shows that the developed e-book is "very effective" used in the learning process. The results of this study are in line with the research results of Nurkayanti et al., which stated that the learning resources developed were declared good if they satisfied the aspects such as validity, practicality, and effectiveness. (Nurkayanti, Muhiddin, & Arifin, 2021).

Selecta Capita of Mathematics E-book for High School based on contextual teaching and learning developed got a positive response from students. This is

supported by the research of Cheng et al., which suggested that multimedia-assisted learning can improve students' learning styles and increase motivation and learning outcomes (Cheng, Cheng, & Chen, 2012). Ratnaningsih and Patmawati, in their research, also stated that using interactive learning media in Selecta Capita of Mathematics subject can provide enthusiasm and motivation for students in the learning process (Ratnaningsih & Patmawati, 2016).

The e-books also have advantages as contextual learning. It can be a source of learning so that students can develop their knowledge and motivate them to build the integration of knowledge applied in everyday life (Suwarno, Prasetyo, Priambodo, Huda, & Nai'mah, 2020). The stages of contextual learning in e-books can help students in the thinking process (Maynastiti, Serevina, & Sugihartono, 2020). Another advantage of using e-books in learning is that they can improve students' literacy skills (Moody, 2010), foster learning independence, and improve student learning outcomes (Pramana & Dewi, 2014). This is reinforced by Samit, who stated that learning using multimedia-based books helped students learn actively and independently compared to traditional learning (Shah, 2013).

CONCLUSIONS

The resulting Selecta Capita of Mathematics E-book based on contextual teaching and learning for high school had been developed with the ADDIE model satisfied the criteria of being valid, practical, and very effective. So, e-books were said to be of good quality and can be used in learning.

Based on the research results that had been done, the researchers provide the following suggestions: 1) educators should be able to use e-books produced in this research as learning resources so that they can train students to be independent and actively involved in learning; 2) for students, they can use e-books that had been developed so they can learn anywhere and anytime; 3) for other researchers, in order to be able to develop e-books with an approach for different subjects so that they can enrich students' learning resources.

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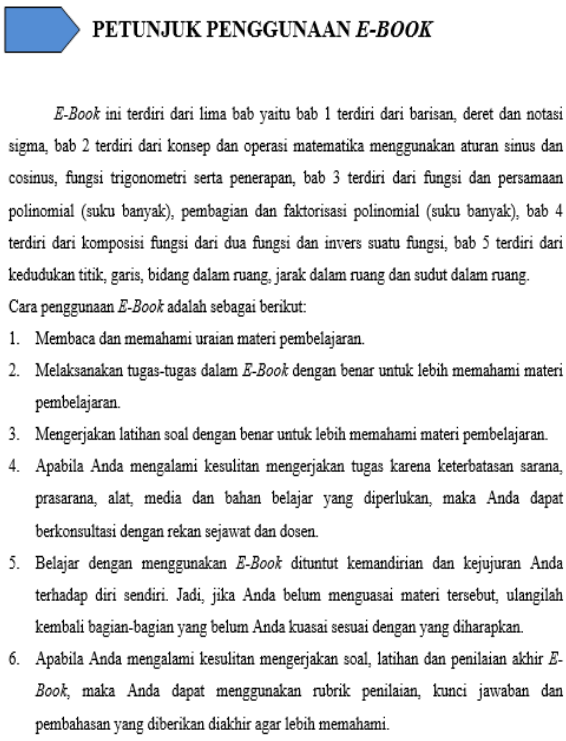
Appendix A

Table 4. E-Book Display

E-Book Display and its Information
 The front cover is the front of the e-book, consisting of Universitas PGRI Palembang logo and FKIP logo, the author's name, the title of the e-book, pictures, and the faculty name.
 The back cover is the back of the e-book, made in harmony with the front cover, which contains the quality of Universitas PGRI Palembang and the quality of FKIP.



PETUNJUK PENGGUNAAN *E-BOOK*

E-Book ini terdiri dari lima bab yaitu bab 1 terdiri dari barisan, deret dan notasi sigma, bab 2 terdiri dari konsep dan operasi matematika menggunakan aturan sinus dan cosinus, fungsi trigonometri serta penerapan, bab 3 terdiri dari fungsi dan persamaan polinomial (suku banyak), pembagian dan faktorisasi polinomial (suku banyak), bab 4 terdiri dari komposisi fungsi dari dua fungsi dan invers suatu fungsi, bab 5 terdiri dari kedudukan titik, garis, bidang dalam ruang, jarak dalam ruang dan sudut dalam ruang.

Cara penggunaan *E-Book* adalah sebagai berikut:

1. Membaca dan memahami uraian materi pembelajaran.
2. Melaksanakan tugas-tugas dalam *E-Book* dengan benar untuk lebih memahami materi pembelajaran.
3. Mengerjakan latihan soal dengan benar untuk lebih memahami materi pembelajaran.
4. Apabila Anda mengalami kesulitan mengerjakan tugas karena keterbatasan sarana, prasarana, alat, media dan bahan belajar yang diperlukan, maka Anda dapat berkonsultasi dengan rekan sejawat dan dosen.
5. Belajar dengan menggunakan *E-Book* dituntut kemandirian dan kejujuran Anda terhadap diri sendiri. Jadi, jika Anda belum menguasai materi tersebut, ulangilah kembali bagian-bagian yang belum Anda kuasai sesuai dengan yang diharapkan.
6. Apabila Anda mengalami kesulitan mengerjakan soal, latihan dan penilaian akhir *E-Book*, maka Anda dapat menggunakan rubrik penilaian, kunci jawaban dan pembahasan yang diberikan diakhir agar lebih memahami.

Instructions for using e-books were made to understand the flow and stages of learning to use e-books.

The concept map contains the outline of the material to be studied in the chapter to be discussed.

BAB 1
BARISAN, DERET DAN NOTASI SIGMA

Dalam Bab 1, Anda akan mempelajari tentang barisan, deret dan notasi sigma yang diberikan dalam tiga kegiatan belajar, yaitu Kegiatan Belajar 1, Kegiatan Belajar 2, dan Kegiatan Belajar 3. Dalam Kegiatan Belajar 1, Anda akan mempelajari barisan bilangan yang mencakup pola barisan, barisan aritmatika dan barisan geometri. Dalam Kegiatan Belajar 2, Anda akan mempelajari deret bilangan yang mencakup deret aritmatika, deret geometri, dan deret geometri tak hingga. Sedangkan pada Kegiatan Belajar 3, Anda akan mempelajari notasi sigma yang mencakup menyatakan deret dalam bentuk notasi sigma, sifat-sifat notasi sigma, dan penggunaannya dalam menyelesaikan soal yang terkait dengan notasi sigma.

Setelah mempelajari materi ini, diharapkan Anda dapat:

1. menentukan barisan bilangan yang terbentuk dari masalah nyata yang diberikan;
2. menentukan pola barisan bilangan yang terbentuk dari masalah nyata yang diberikan;
3. menyebutkan contoh konteks barisan aritmatika dan geometri;
4. menentukan suku ke-n dari barisan bilangan yang diberikan;
5. menentukan jumlah n buah suku pertama barisan bilangan yang diberikan;
6. menyelesaikan soal-soal yang menggunakan konsep barisan aritmatika dan geometri;
7. menyelesaikan soal-soal yang menggunakan konsep deret aritmatika dan geometri;
8. mengubah bentuk deret bilangan kedalam bentuk notasi sigma dan sebaliknya;
9. menggunakan sifat-sifat notasi sigma dalam menyelesaikan soal-soal yang terkait dengan notasi sigma;

The introduction section contains the description of the material to be studied and indicators of achievement.

Stages of CTL

KEGIATAN BELAJAR 1
BARISAN BILANGAN

A. Pola Bilangan

Pernahkah Anda bermain ular tangga? Untuk dapat memainkan permainan ular tangga Anda memerlukan sebuah dadu. Jika Anda perhatikan, di setiap dadu tersebut memiliki bilangan-bilangan yang digambarkan dalam bentuk bulatan-bulatan kecil (disebut noktah atau titik).

Konstruktivisme

Gambar 1. Dadu (Sumber: https://pixabay.com/id/vectors/search/dadu/)

Bulatan-bulatan kecil tersebut mewakili bilangan-bilangan yang ditentukan. Satu bulatan pada dadu mewakili bagian 1, dua bulatan pada dadu mewakili bilangan 2, tiga bulatan pada dadu mewakili bilangan 3, dan seterusnya hingga enam bulatan pada dadu yang mewakili bilangan 6. Jika bilangan tersebut diurutkan dengan suatu aturan tertentu, maka akan membentuk suatu barisan. Berdasarkan uraian tersebut, kita dapat mengetahui pengertian pola bilangan.

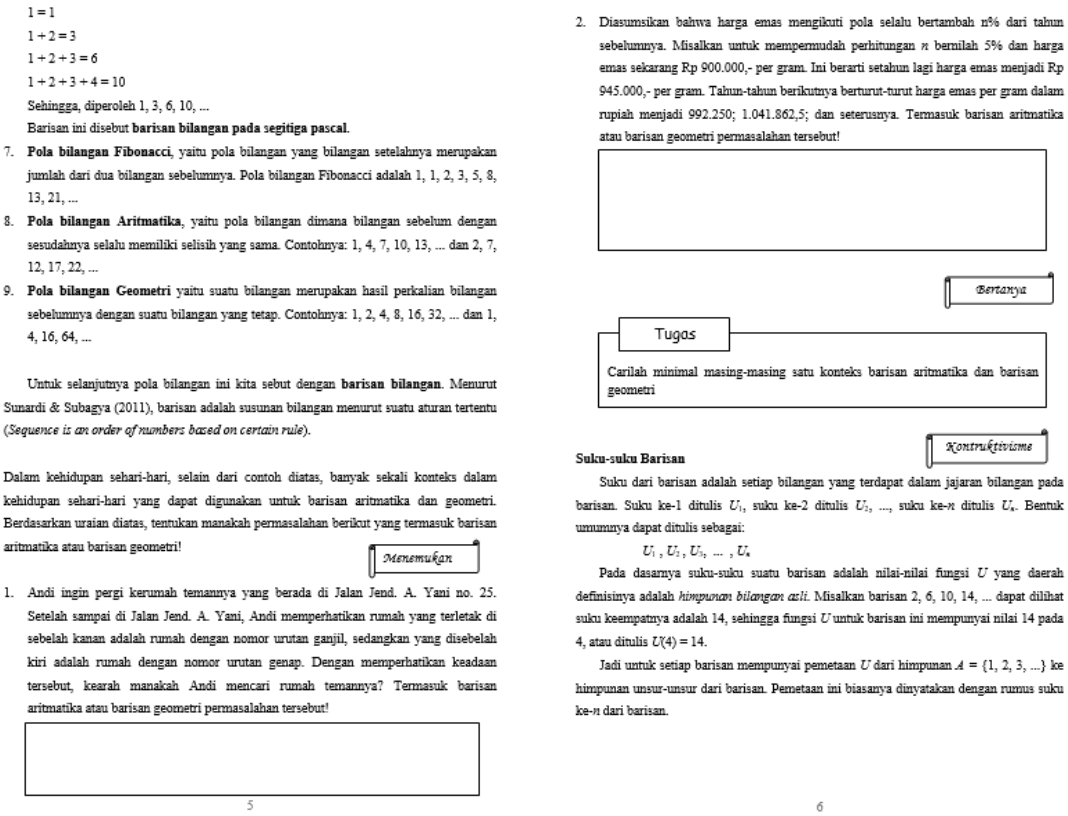
Pola Bilangan merupakan suatu bilangan dengan aturan tertentu yang akan membentuk suatu barisan bilangan yang teratur

Suatu barisan bilangan dapat ditunjukkan dengan pola-pola. Pelajari pola bilangan-pola bilangan dibawah ini:

1. Perhatikan gambar berikut

3

Constructivism stages of constructing students' thinking in understanding number pattern material



1 = 1
1 + 2 = 3
1 + 2 + 3 = 6
1 + 2 + 3 + 4 = 10
Sehingga, diperoleh 1, 3, 6, 10, ...
Barisan ini disebut **barisan bilangan pada segitiga pascal**.

7. **Pola bilangan Fibonacci**, yaitu pola bilangan yang bilangan setelahnya merupakan jumlah dari dua bilangan sebelumnya. Pola bilangan Fibonacci adalah 1, 1, 2, 3, 5, 8, 13, 21, ...
8. **Pola bilangan Aritmatika**, yaitu pola bilangan dimana bilangan sebelum dengan sesudahnya selalu memiliki selisih yang sama. Contohnya: 1, 4, 7, 10, 13, ... dan 2, 7, 12, 17, 22, ...
9. **Pola bilangan Geometri** yaitu suatu bilangan merupakan hasil perkalian bilangan sebelumnya dengan suatu bilangan yang tetap. Contohnya: 1, 2, 4, 8, 16, 32, ... dan 1, 4, 16, 64, ...

Untuk selanjutnya pola bilangan ini kita sebut dengan **barisan bilangan**. Menurut Sunardi & Subagya (2011), barisan adalah susunan bilangan menurut suatu aturan tertentu (*Sequence is an order of numbers based on certain rule*).

Dalam kehidupan sehari-hari, selain dari contoh diatas, banyak sekali konteks dalam kehidupan sehari-hari yang dapat digunakan untuk barisan aritmatika dan geometri. Berdasarkan uraian diatas, tentukan manakah permasalahan berikut yang termasuk barisan aritmatika atau barisan geometri!

Menemukan

1. Andi ingin pergi kerumah temannya yang berada di Jalan Jend. A. Yani no. 25. Setelah sampai di Jalan Jend. A. Yani, Andi memperhatikan rumah yang terletak di sebelah kanan adalah rumah dengan nomor urutan ganjil, sedangkan yang disebelah kiri adalah rumah dengan nomor urutan genap. Dengan memperhatikan keadaan tersebut, kearah manakah Andi mencari rumah temannya? Termasuk barisan aritmatika atau barisan geometri permasalahan tersebut!

5

2. Diasumsikan bahwa harga emas mengikuti pola selalu bertambah n% dari tahun sebelumnya. Misalkan untuk mempermudah perhitungan n bernilah 5% dan harga emas sekarang Rp 900.000,- per gram. Ini berarti setahun lagi harga emas menjadi Rp 945.000,- per gram. Tahun-tahun berikutnya berturut-turut harga emas per gram dalam rupiah menjadi 992.250; 1.041.862,5; dan seterusnya. Termasuk barisan aritmatika atau barisan geometri permasalahan tersebut!

Bertanya

Tugas

Carilah minimal masing-masing satu konteks barisan aritmatika dan barisan geometri

Konstruktivisme

Suku-suku Barisan

Suku dari barisan adalah setiap bilangan yang terdapat dalam jajaran bilangan pada barisan. Suku ke-1 ditulis U_1, suku ke-2 ditulis U_2, ..., suku ke-n ditulis U_n. Bentuk umumnya dapat ditulis sebagai:

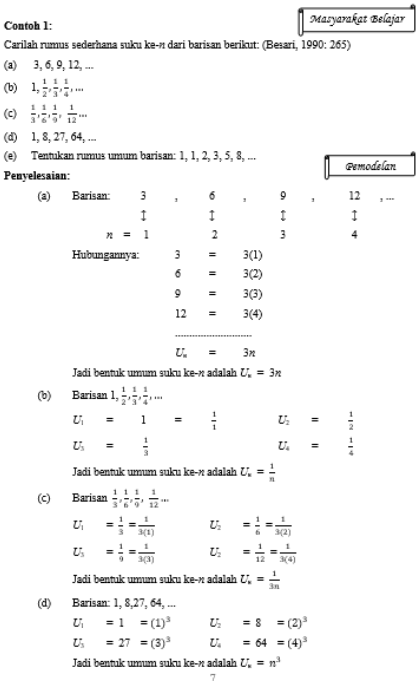
$U_1, U_2, U_3, \ldots, U_n$

Pada dasarnya suku-suku suatu barisan adalah nilai-nilai fungsi U yang daerah definisinya adalah *himpunan bilangan asli*. Misalkan barisan 2, 6, 10, 14, ... dapat dilihat suku keempatnya adalah 14, sehingga fungsi U untuk barisan ini mempunyai nilai 14 pada 4, atau ditulis $U(4) = 14$.

Jadi untuk setiap barisan mempunyai pemetaan U dari himpunan $A = \{1, 2, 3, ...\}$ ke himpunan unsur-unsur dari barisan. Pemetaan ini biasanya dinyatakan dengan rumus suku ke-n dari barisan.

6

Finding stages, given problems to students, students can determine the material being discussed by answering the problems. (Left side)
At the questioning stage, students are given questions to explore students' knowledge. (Right side)



Masyarakat Belajar

Contoh 1:
Carilah rumus sederhana suku ke-n dari barisan berikut: (Besari, 1990: 265)
(a) 3, 6, 9, 12, ...
(b) $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \ldots$
(c) $\frac{1}{3}, \frac{1}{6}, \frac{1}{9}, \frac{1}{12} \ldots$
(d) 1, 8, 27, 64, ...
(e) Tentukan rumus umum barisan: 1, 1, 2, 3, 5, 8, ...

Pemodelan

Penyelesaian:

(a) Barisan: 3 , 6 , 9 , 12 , ...
n = 1 2 3 4
Hubungannya: $3 = 3(1)$, $6 = 3(2)$, $9 = 3(3)$, $12 = 3(4)$, ..., $U_n = 3n$
Jadi bentuk umum suku ke-n adalah $U_n = 3n$

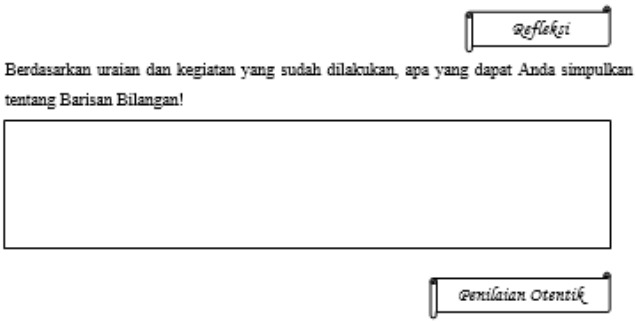
(b) Barisan $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \ldots$
$U_1 = 1 = \frac{1}{1}$, $U_2 = \frac{1}{2}$, $U_3 = \frac{1}{3}$, $U_4 = \frac{1}{4}$
Jadi bentuk umum suku ke-n adalah $U_n = \frac{1}{n}$

(c) Barisan $\frac{1}{3}, \frac{1}{6}, \frac{1}{9}, \frac{1}{12} \ldots$
$U_1 = \frac{1}{3} = \frac{1}{3(1)}$, $U_2 = \frac{1}{6} = \frac{1}{3(2)}$
$U_3 = \frac{1}{9} = \frac{1}{3(3)}$, $U_2 = \frac{1}{12} = \frac{1}{3(4)}$
Jadi bentuk umum suku ke-n adalah $U_n = \frac{1}{3n}$

(d) Barisan: 1, 8,27, 64, ...
$U_1 = 1 = (1)^3$, $U_2 = 8 = (2)^3$
$U_3 = 27 = (3)^3$, $U_4 = 64 = (4)^3$
Jadi bentuk umum suku ke-n adalah $U_n = n^3$

7

In a community learning and modelling stage, students understand the form of the material being discussed by using examples of questions.



Refleksi

Berdasarkan uraian dan kegiatan yang sudah dilakukan, apa yang dapat Anda simpulkan tentang Barisan Bilangan!

Penilaian Otentik

Latihan 1.1

1. Tentukan rumus suku ke-n dan tentukan nilai suku ke 12 dari barisan berikut:
   (a) 1, -2, 4, -8, ...
   (b) -1, 1, -1, 1, ...
   (c) $\frac{1}{3}, \frac{1}{9}, \frac{1}{27}, \frac{1}{81}, \ldots$
   (d) $\frac{1}{1\times2}, \frac{1}{2\times3}, \frac{1}{3\times4}, \ldots$
2. Tentukan suku ke-7 dari barisan *Fibonacci* yang ditentukan oleh:
   $U_1 = U_2 = 1 \quad , \; U_{n+1} = 2\,U_n + 3\,U_{n-1}$ untuk $n \geq 2$
3. Tentukan lima suku pertama dari barisan yang suku ke-n nya ditentukan oleh: $U_n = 4(-2)^{n-2}$.
4. Diketahui rumus jumlah n suku pertama deret aritmetika adalah $S_n = 2n^2 + 3n$. Tentukan beda dan barisan aritmatikanya?
5. Suku kedua dari suatu deret aritmetika adalah 5. Jumlah suku ke – 4 dan ke – 6 sama dengan 28. Pertanyaannya tentukan suku ke-9 dan jumlah kesembilan suku pertama dari deret tersebut.
6. Seutas pita dibagi menjadi 10 bagian dengan panjang yang membentuk deret aritmatika. Panjang pita yang terpendek 20 cm dan yang terpanjang 155 cm. Tentukan panjang pita semula!
7. Seorang petani mencatat hasil panennya selama 11 hari. Hasil panen hari pertama 15 kg dan selalu mengalami kenaikan tetap sebesar 2 kg setiap hari. Tentukan jumlah hasil panen yang diperoleh!
8. Diketahui $U_2 + U_4 = 12$ dan $U_3 + U_5 = 16$, tentukan suku ke-7 barisan itu!

17

At the reflection stage, students are allowed to conclude the learning followed.

Cocokkanlah jawaban Anda dengan Kunci Jawaban Latihan yang terdapat di bagian akhir *E-Book* ini. Hitunglah jawaban yang benar, kemudian gunakan rumus berikut untuk mengetahui tingkat penguasaan Anda terhadap materi Kegiatan Belajar 1.

$$Tingkat\ Penguasaan = \frac{Jumlah\ Jawaban\ yang\ Benar}{Jumlah\ Soal} \times 100\%$$

Arti tingkat penguasaan:
90 – 100% = baik sekali
80 – 89% = baik
70 – 79% = cukup
< 70% = kurang

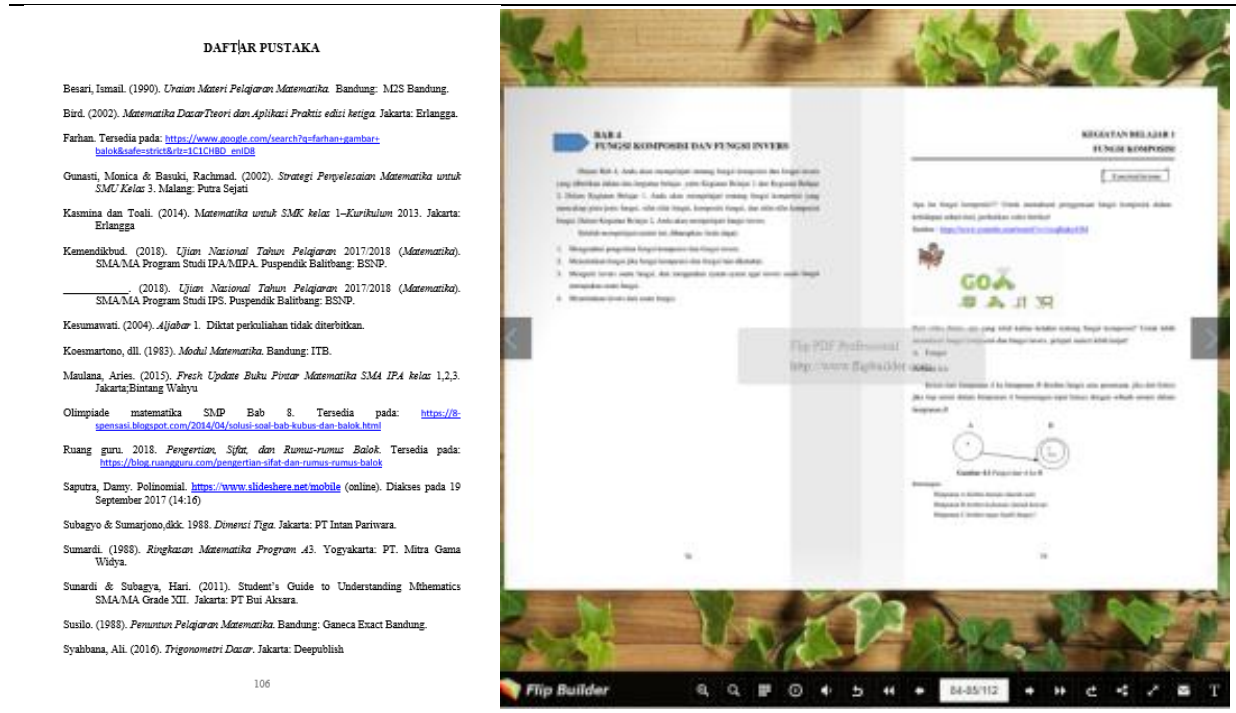
Apabila mencapai tingkat penguasaan minimal **Baik**, Anda dapat meneruskan dengan materi selanjutnya. Jika masih di bawah minimal **Baik**, Anda harus mengulangi materi Kegiatan Belajar 1, terutama bagian yang belum dikuasai.

At the authentic assessment stage, students are allowed to measure the extent of the student's abilities.

EVALUASI

1. Dua kapal yakni Baruna I dan Baruna II berangkat dari pelabuhan Bakahuni pada waktu yang bersamaan. Kedua kapal berlayar pada jalur yang lurus dan membentuk sudut 60° satu sama lain. Jika kecepatan kapal Baruna I 25 km/jam dan kecepatan kapal Baruna II 15 km/jam, berapakah jarak antara kapal Baruna I dan kapal Baruna II setelah berlayar 1 jam?
2. Seorang pilot angkatan udara menerbangkan pesawat jet. Pesawat jetnya tinggal landas dengan kecepatan rata-rata 75 m/detik dan sudut elevasinya 10°. Pilot tersebut merencanakan untuk mencapai ketinggian 4575 m. Pertanyaannya berapakah waktu yang diperlukan untuk mencapai ketinggian tersebut?
3. Dalam ruang olahraga terdapat sebuah balok dengan ukuran perbandingan yakni P : L : T = 6 : 3 : 2. Diketahui panjang diagonal ruangnya adalah 28 cm. Pertanyaannya tentukan volum balok tersebut?
4. Seorang tukang kayu memiliki sebuah balok luas alasnya 96 cm^2, luas sisi depannya adalah 72 cm^2, dan luas sisi sampingnya adalah 48 cm^2. Tentukan volum balok tersebut?
5. Tentukan jumlah deret berikut:
$$\frac{1}{\sqrt{1}+\sqrt{2}}+\frac{1}{\sqrt{2}+\sqrt{3}}+\frac{1}{\sqrt{3}+\sqrt{4}}+\frac{1}{\sqrt{4}+\sqrt{5}}+\cdots+\frac{1}{\sqrt{99}+\sqrt{100}}=\cdots.$$
6. Tiga buah bilangan berurutan yang merupakan suku-suku barisan aritmatika jumlahnya adalah 12. Jika bilangan ketiga ditambah 2, maka diperoleh deret geomatri. Tuliskan ketiga bilangan tersebut!
7. Suku banyak $x^4 - ax^3 - (a-b)x^2 + (3a+b+2)x - 3a - b$ mempunyai sisa $x - 3$ jika dibagi $x^2 + x - 2$. Tentukan nilai a dan b!
8. Diketahui $f(x) = ax + 3$ dengan gradien positif. Jika $f[f(2)] - 3a = 4$. Tentukan nilai a.
9. Diketahui salah satu akar dari persamaan $x^3 - 7x + 6 = 0$ adalah $x = 1$. Tentukan jumlah kedua akar tersebut!
10. Polinomial dari $x^3 + ax^2 + bx + c = 0$ dengan $a = b + c$ akar-akarnya adalah x_1, x_2, dan x_3. Tentukan nilai dari $x_1^2 + x_2^2 + x_3^2$

The evaluation aims to measure the ability of students to learning.



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106

Bibliography (left side) and E-book display containing learning materials and videos (right side)