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Article

**Textbook of *Energi Dalam Sistem Kehidupan* (EDSK) with Contextual Approach Based on 7 Components of Effective Learning**Faninda Novika Pertiwi<sup>1\*</sup>, Nurzatulshima Kamarudin<sup>2</sup><sup>1</sup>IAIN Ponorogo, Indonesia<sup>2</sup>Universiti Putra Malaysia, Selangor, Malaysia\*Corresponding Address: [faninda@iainponorogo.ac.id](mailto:faninda@iainponorogo.ac.id)**Article Info**

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**ABSTRACT**

The Department of Tadris IPA IAIN Ponorogo in the 2020/2021 school year redesigned the curriculum to become the KKNI. The KKNI is applied to students starting in semester 1 of the 2020/2021 academic year. Where the types of courses and learning carried out are of course different from the previous curriculum. Implementation of learning with KKNI is certainly not as easy as expected. One of the obstacles to implementing KKNI is the unavailability of learning media or textbooks based on KKNI that can be used. Based on interviews with science lecturers who teach in semester 1, the textbooks used are still textbooks used in the old curriculum. For example, when teaching the *Energi Dalam Sistem Kehidupan* course, the textbook used is the basic physics textbook used in the previous semester. This is what causes the accumulation of material and is not optimal in linking material physics with other fields and is not yet contextualized even though material energy is very important and close to life. This problem underlies the researchers to develop a textbook on *Energi Dalam Sistem Kehidupan* with a contextual approach based on the 7 components of effective learning.

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**INTRODUCTION**

At the end of 2009 the Ministry of Manpower and Transmigration and the Directorate General of Higher Education jointly took steps to develop a qualifications framework at the national level called the Indonesian National Qualifications Framework (KKNI). The KKNI is a form of self-quality related to the national education system, the national job training system as well as the national equality assessment system, which is owned by Indonesia to produce human resources through learning outcomes, which is owned by every Indonesian worker to make quality contributions in their respective fields of work (Direktorat Jendral Pembelajaran dan Kemahasiswaan Kementerian Riset, Teknologi, dan Pendidikan Tinggi Republik Indonesia, 2015). KKNI appears and is considered capable of overcoming existing competition (Beslina, 2021).

The KKNI is one of the national references in order to advance and improve the quality of human resources and increase competitiveness, namely through increasing the qualifications of human resources. The qualifications of human resources referred to here are created through

education, national job training, and learning achievement assessment systems (Jono, 2016). Based on Ministerial and Culture Regulation (Permendikbud) RI No. 73 of 2013 requires universities to rearrange the curriculum simultaneously no later than the 2016/2017 academic year. The application of the Indonesian National Qualifications Framework in tertiary institutions is also marked by the RI Presidential Decree no. 8 of 2012 (Peraturan Presiden, 2012). The rearrangement of the curriculum has reasons including the logic of globalization. The logic of globalization means that higher education outside and within the country is equalized in quality.

KKNI (Indonesian National Qualifications Framework) can be said to be a reference level of competency qualifications for job recognition (Beslina, 2021). The KKNI was designed and initiated by the government through the ministry of education in 2010 which can be used as a reference in curriculum development. The presence of the KKNI is a general reference regarding a person's qualifications to gain recognition in the world of work (Solikhah, 2015). According to Nurdin (2018) the main objective of the KKNI is to equalize human resources in Indonesia with those in other countries, both in education and job training (Nurdin, 2017). That is why, the application of KKNI in the curriculum needs to formulate learning outcomes that clearly and in detail describe the profile of graduates that will be produced.

Based on this, the Tadris IPA IAIN Ponorogo department in the 2020/2021 school year redesigned the curriculum to become the KKNI. The KKNI is applied to students starting in semester 1 of the 2020/2021 school year. The vision of Tadris IPA IAIN Ponorogo is to become a superior study program in the field of integrated natural science tadris with an environmental perspective, scientific character, and spiritual integrity in 2021. In order to realize this vision, curriculum and course designs need updating and refinement. Where the types of courses and learning carried out are of course different from the previous curriculum. Learning in KKNI encourages educators to be able to integrate and connect material with other fields and is more contextual.

Implementation of learning with KKNI is certainly not as easy as expected. The obstacles to implementing KKNI include the unavailability of course books based on KKNI. Based on interviews with science lecturers who teach in semester 1 where their learning already uses KKNI, they say that they have not used books in which special material is set for KKNI. The textbooks used are still the textbooks used in the old curriculum. For example, when teaching energy courses in living systems, the books used are basic physics or basic mechanics. Then when teaching basic physics courses the handbook used is the basic physics textbook used to teach students in the previous semester, namely when basic physics was still broken down into basic physics 1 and basic physics 2. The difference is that all the material is on basic physics 1 and basic physics 2 combined into one so that it can be completed in 1 semester. This causes a buildup of material. The full learning process is also not as expected by the KKNI. So far, based on observations, it appears that the learning process is still centered on the lecturer, students cannot be actively invited to create interesting learning because lecture ideas usually come from lecturers. The learning that is carried out also does not use media or teaching materials that can be used by students who have various learning styles. This makes it difficult for students to understand the material because they only follow instructions and do not have a book that can be used as a study guide. According to previous research, the adjustment of learning media with the preferences of students' learning styles is a process in increasing the effectiveness of learning (Kurniawan, 2017). The use of learning media that is not adapted to the learning styles of students will lead to less optimal learning effectiveness. The selection of learning media to be used in the learning process must be able to cover various learning styles of students (Rosalina and Suhardi, 2020).

Based on observations, when learning energy courses in living systems, in semester 3 students it appears that the material presented is still general and does not specifically discuss

energy. Then students were asked to present according to the theme that each group got. The material presented by students is still generally the result of searching the internet or books, but the books used are high school books or basic physics books, this is because there is no specific textbook that discusses energy. Including the energy connection with many daily events as well as its relation to religion. Even though according to their vision, students of *Tadris IPA* must have an environmental perspective (in this case their learning must be more contextual), have a scientific character, and spiritual integrity (in this case being able to explain the relationship between the material being studied and religion). Apart from that, energy material is very important to understand, this is because it is defined by some students as being difficult and incomprehensible, energy as a topic is said to be difficult to comprehend because it includes especially abstract concepts (Bezen et al, 2016). Therefore this textbook on energy is very important to develop.

In response to the above, the researcher is interested in developing an KKNi textbook which in discussing the material is integrated with other fields and relates it to real problems that exist in everyday life. The textbook developed is related to physics for the EDSK (*Energi Dalam Sistem Kehidupan*) course. Before the KKNi, energy material was included in basic physics and basic mechanics courses. Along with the curriculum changes made, energy is presented in depth in a separate subject, namely the *Energi Dalam Sistem Kehidupan* course. The hope is that by changing the course name, existing Energy-related material will be more contextual by presenting applications or daily problems related to energy and then analyzing its integration with religion, technology or health. So that the material studied by students will be more usable in everyday life. This *Energi Dalam Sistem Kehidupan* course will discuss business energy and the relationship between the two, energy in the body, renewable energy, non-renewable energy, metabolism in humans, cell metabolism, bioenergy, natural energy and its utilization, the application of energy through the manufacture of simple tools, and energy in Islamic studies. This textbook can be used when the *Energi Dalam Sistem Kehidupan* (EDSK) course appears in semester 3. So that the material studied by students will be more usable in everyday life. This *Energi Dalam Sistem Kehidupan* course will discuss business energy and the relationship between the two, energy in the body, renewable energy, non-renewable energy, metabolism in humans, cell metabolism, bioenergy, natural energy and its utilization, the application of energy through the manufacture of simple tools, and energy in Islamic studies. This textbook can be used when the *Energi Dalam Sistem Kehidupan* (EDSK) course appears in semester 3 So that the material studied by students will be more usable in everyday life. This *Energi Dalam Sistem Kehidupan* course will discuss business energy and the relationship between the two, energy in the body, renewable energy, non-renewable energy, metabolism in humans, cell metabolism, bioenergy, natural energy and its utilization, the application of energy through the manufacture of simple tools, and energy in Islamic studies. This textbook can be used when the *Energi Dalam Sistem Kehidupan* (EDSK) course appears in semester 3 cell metabolism, bioenergy, natural energy and its utilization, the application of energy through the manufacture of simple tools, and energy in Islamic studies. This textbook can be used when the *Energi Dalam Sistem Kehidupan* (EDSK) course appears in semester 3 cell metabolism, bioenergy, natural energy and its utilization, the application of energy through the manufacture of simple tools, and energy in Islamic studies. This textbook can be used when the *Energi Dalam Sistem Kehidupan* (EDSK) course appears in semester 3.

This textbook certainly has the advantage that besides offering material in which there is integration and interconnection with other knowledge, the hallmark of this textbook is that in each chapter it is discussed using a contextual approach and based on effective learning. In this textbook, every discussion of the material includes real problems in everyday life and is based on effective learning. Each material contains as much as possible the 7 components of effective learning, namely constructivism, inquiry, questioning, learning communities, modeling,

reflection, real assessment. This effective learning was chosen besides containing 7 important components as well because with effective learning the learning objectives will be easy to achieve (Setyawan et al, n.d).

Effective learning here is chosen to be applied to textbooks that are compiled because in the current curriculum learning is required to emphasize the modern dimensions of knowledge in learning and is required to improve cognitive, affective, psychomotor abilities and students' interests so that learning objectives can be achieved. These seven components of effective learning fall into the contextual teaching and learning (CTL) approach. The CTL approach was chosen because according to CTL theory it is a holistic learning process that aims to educate learners in comprehending learning materials meaningfully related to real life contexts, whether related to personal, religious, social, economic, and cultural environment. So that learners acquire knowledge and skills that can be applied and transferred from one context to one problem to another (Lotulung et al, 2018). The first component of CTL, namely constructivism, requires students to construct meaning from a new experience based on previous knowledge. The constructivism component trains students' thinking levels based on experience. According to constructivism, a knowledge that comes from outside is then constructed from within a person, therefore knowledge is created from two important things, namely something that is observed and the ability to interpret what has been observed. So in this component students not only receive knowledge but must go through the process of constructing it. The second component is Inquiry or finding, this is a process for building concepts that starts with the process of observing, formulating problems, submitting hypotheses, collecting data, then analyze the data obtained so as to be able to conclude and find the concept. The concept is the result of the thoughts of a person or group of people expressed by definitions, laws and theories (Taqwa and Priyadi, 2019). Inquiry is a process of searching or discovering a concept through a systematic thinking process. In this case the inquiry component serves to train students' thinking skills. The third component is asking, this is important as a form of interaction between educators and students. Asking is a form of curiosity for everyone and this is what arouses students' learning motivation. In every learning process, asking is one thing that is always used. Therefore an educator must know good questioning techniques. In this component, there is a question and answer process between educators and students. The fourth component is the learning community, namely by applying learning in groups whose members are heterogeneous to help students learn from each other to exchange information and exchange experiences. In addition to group learning, it will train students to work together to solve a problem. The learning community is a forum or place for exchanging opinions or ideas. The fifth component is modeling, where in this component there is an activity of doing something or demonstrating something whose purpose is for students to be able to observe, imitate and do something according to the model or example given. Modeling is an action taken to be imitated by students. Modeling is not only limited to educators, but teachers can also take advantage of students who have the ability to do modeling. At this stage it is expected that students can think, work, and study, of course. The sixth component is reflection. This is done to look back at an event, or an activity to identify things that are already known, understood or not. Reflection is carried out so that a stage of improvement can be carried out if there are still deficiencies. The last or seventh component is the actual assessment, in this component the emphasis is on an assessment that shows the real ability of students including knowledge, skills and attitudes. So it's more of a process assessment. Usually this is done by giving practice questions that are appropriate to the material and of course contextual.

This textbook uses a contextual approach, namely by linking problems that occur and can be observed in everyday life with the reason that students are aware of the importance of the material they are learning. Besides that, another goal of the contextual approach is by presenting problems and real life in class, students are expected to be more motivated in

learning. In this way, it is hoped that students will more easily link between theory and existing real practice. The contextual approach embodied in this book is that in each discussion of the material, examples are given related to events that are usually observed in everyday life.

The material discussed in this textbook is 8 chapters but includes points that can later be conveyed in 14 meetings or in one semester. Each material discussed will use a contextual approach which also includes the seven components of effective learning, namely constructivism, inquiry, asking, learning communities, modeling, reflection, real assessment. This is an added value of the developed textbook. In accordance with the statement in the article Systemics, Cybernetics and Informatics namely In particular, developing students' conceptual understanding and analytical abilities through doing authentic science-based guided-inquiry hands-on activities enhances students' self-worth and confidence, and accordingly improves their school-wide academic achievement (Balasubramanian et al., n.d). Based on this statement, it really supports student understanding if it includes several stages, one of which is inquiry. This textbook based on effective learning with a contextual approach is later expected to be able to help lecturers when conveying energy material in the life system in class. In this energy material there are many concepts that students must understand. The concept referred to here is an abstraction that represents an event, object, or several things that have something in common. In this energy material there are many concepts that students must understand. The concept referred to here is an abstraction that represents an event, object, or several things that have something in common. In this energy material there are many concepts that students must understand. The concept referred to here is an abstraction that represents an event, object, or several things that have something in common (Santoso and Mutmainna, 2018).

Based on several previous studies regarding the development of textbooks, it was found that classroom learning would be better and more meaningful if the appropriate textbooks were used. For example, research conducted by Yusmanila, by making textbooks that are contextual, learning in class is also more life and very interesting because students are able to relate material to situations that are often encountered in everyday life. The research conducted by Susilawati was a textbook based on life skills, the results also showed that there was an improvement and an increase in students' understanding of the expected life skills. Therefore, researchers feel it is necessary to develop a textbook on *Energi Dalam Sistem Kehidupan* with the hope that learning in this course will be more contextually meaningful and effective because it uses 7 components of effective learning. Apart from that, of course, the hope is that students are able to integrate every material they study with religion

## **METHODS**

### **Types of research**

This type of research is development research. Development research is usually known as the type of R&D (Research and Development). The development research method is a research method that aims to produce certain products and test the effectiveness of these products (Sugiyono, 2015). This development research was carried out to produce a product, namely a textbook product. The product developed is an EDSK textbook (*Energi Dalam Sistem Kehidupan*) with a contextual approach based on 7 components of effective learning. The development model chosen is the ADDIE model which has five stages of development, namely the analysis, design, development, implementation and evaluation stages (Budoya et al, 2019).

### **Research Subjects and Objects**

The population in this study were 3 semester students majoring in Science Tadris at IAIN Ponorogo for the 2022/2023 academic year with a total of 89 students divided into 3 classes. The sample used to determine students' understanding of concepts is the IPA.A class as the experimental class and the IPA.B class as the control class. The sample selection was carried out by purposive sampling.

## Research procedure

This research is a development research using the ADDIE model which has five stages that must be passed, namely Analysis, Design, Development, Implementation, and Evaluation.

## Research Instruments

The research instrument used in this research is the expert validation sheet which functions to determine the validity of the product which will be assessed by material, learning, language and media experts with the aim of knowing the level of validity of a product. Then a questionnaire aimed at students to find out student responses to the textbook products developed. The response questionnaire aims to determine the level of feasibility and attractiveness of textbooks from the student's point of view. To find out the effectiveness of textbooks on students' understanding of concepts by using tests that contain indicators of students' understanding of concepts.

## Data Collection Technique

The data collection technique used was validation on expert validators, textbook feasibility surveys for students, as well as tests used to collect data on students' conceptual understanding.

## Data Analysis

The data analysis technique performed by the researcher is the expert validity test. This validity test aims to analyze and assess content validation sheets, content suitability, learning model suitability and design. Validation was carried out by four expert validators, who then analyzed the validation data using qualitative and quantitative descriptive methods. Then for the questionnaire assessment, based on the results of the survey conducted, namely from the results of filling out the questionnaire, it can be seen to what extent the attractiveness and suitability of the textbooks that have been developed. The review of the survey results was carried out using the following formula.

$$RP (\%) = (\text{number of responses}) / (\text{maximum number}) \times 100 \%$$

The next step is the effectiveness test. The effectiveness test is used to determine the effectiveness of the developed EDSK textbook on students' understanding of concepts. Before testing the effectiveness, the previous steps were tested for validity, reliability, normality, homogeneity, and finally the independent sample t-test.

## RESULTS AND DISCUSSION

### Development Process of EDSK Textbook (*Energi Dalam Sistem Kehidupan*) with a Contextual Approach Based on 7 Components of Effective Learning

This development research went through 5 stages, namely using the ADDIE model. This was chosen because According to Aldoobie (2015), the ADDIE model is one of the most common models used in the instructional design field. It helps instructional designers and teachers to create an efficient, and effective teaching design by the processes of applying the ADDIE model on any instructional product (Budoya et al, 2019). ADDIE is an acronym for (1) analyze (2) design (3) develop (4) implement and (5) evaluate. In detail step by step are as follows

#### a). Analyze

Based on the general analysis of students' abilities during the learning process they have not been able to understand energy material and have not been able to identify problems in everyday life that have to do with energy. This is because the learning process is still fixated on explanations from lecturers without adding from other learning sources. Students are also not optimally able to develop a theory or concept independently. So that the ability of students to understand and apply a theory to solve problems that exist in the environment is still low and this is certainly not in accordance with 21st Century learning and does not meet the expectations of the KKNI.

Based on the above, an effort is needed to develop textbooks that can become the basis for lecturers and students during learning. So that students are more motivated to learn and have a broad picture of the material being studied, especially since the energy course in living systems is very close to everyday life. The developed textbook contains physics material, especially about Energy which is in accordance with the RPS for the Energy Subject in Living Systems.

b). Design

After completing the analysis phase, proceed to the design stage, the specifications to be made are the *Energi Dalam Sistem Kehidupan* (EDSK) Textbook Based on 7 Components of Effective Learning with a Contextual Approach. The details of the textbook design to be developed are as follows:

- Material Assessment

Based on the analysis phase that has been carried out to compile textbooks is material on energy which will be divided into 8 chapters covering energy business material and the relationship between the two, energy in the body, renewable energy, non-renewable energy, metabolism, bioenergy, application of energy in simple tools, and energy in Islamic studies. The steps for compiling the product design for this textbook include adjusting the RPS for the *Energi Dalam Sistem Kehidupan* course in accordance with the KKNI. This energy material was also chosen because it is one of the important materials in physics. With the advancement of technology, energy as a concept has become a part of every aspect of life, and it is becoming more and more important day by day. Related to daily life, energy exists in various forms, such as heat, light, electricity, chemical energy, kinetic energy, petroleum, sound, and nuclear energy, and these energy forms can be transformed from one form to another. With the advent of industrialization and the increase in population, the use of the concept of energy has also increased. In this respect, it is evident that teaching energy, which has a very important place in our lives, has become more and more essential (Bezen et al, 2016).

- Preliminary Design

These two components are combined in one activity because they are able to complement each other. At this stage students are asked to answer questions related to situations that are often encountered in everyday life, either through simple practicum first or thinking first so that the hope is that with the questions given students will find a concept or answer to the existing problem. The next stage is modeling. At this stage students demonstrate or are asked to give an example of something related to the material. The hope is that other students will understand more because they see an example or an incident firsthand. The next stage is reflection. This stage contains all the material conclusions from beginning to end. Then the last stage of the assessment. This stage contains practice questions. Students are asked to answer existing questions as a reference to determine student understanding of the material that has been studied. The hope is that with contextual and effective learning so that there is good collaboration between lecturers and students in discussing a material. This is in accordance with the findings of research conducted by Shawn M Glynn namely The findings indicated that the conditions that fostered the implementation of CTL strategies were a collaborative interaction with students, a high level of activity in the lesson, a connection to real-world contexts, and an integration of science content with other content and skill areas. The hope is that with contextual and effective learning so that there is good collaboration between lecturers and students in discussing a

material. This is in accordance with the findings of research conducted by Shawn M Glynn namely The findings indicated that the conditions that fostered the implementation of CTL strategies were a collaborative interaction with students, a high level of activity in the lesson, a connection to real-world contexts, and an integration of science content with other content and skill areas (Glynn, 2004).

- Manufacturing Kit

The equipment used for making this textbook is software and hardware devices. The software tools used in making this textbook are Microsoft Office 2013 and Canva, while the hardware devices used are printers.

- Instrument Planning

The instrument used is a questionnaire designed with the aim of evaluating the textbooks that have been developed. The instrument is composed of aspects that are tailored to the objectives of each questionnaire. Instruments were given to the validator team to test the validity of textbooks before testing was carried out, and questionnaires were given to students after the product was feasible for testing. The feasibility questionnaire used for product assessment was developed based on national education standards which cover material aspects, linguistic aspects and media aspects.

The product quality assessment instrument that has been developed is in the form of a checklist questionnaire which will be assessed by four validators and students. Assessment instruments were given to experts to determine the quality of the textbooks, as well as questionnaires that students would fill in to find out responses and responses to the textbooks that had been developed.

c). Development

When the planning stage has been completed, proceed to the development stage. The purpose of the development stage is to develop a textbook design into a textbook that aims to broaden the scope of students' knowledge and thinking skills and to facilitate students in constructing their knowledge regarding all matters related to energy studied in the *Energi Dalam Sistem Kehidupan* (EDSK) course.

d). Implementation

Implementation is the stage after the completion of the development stage. Of course, until the developed product has been validated and revised as well. Products that have been revised based on assessments, criticisms and suggestions for improvement from expert validators then enter the implementation stage. At this stage, the revised product is tested on students and carried out in several stages as follows:

1. Student Response Questionnaire Test

This response was carried out to determine the level of attractiveness of the EDSK textbook from the student's point of view, therefore a field test was needed. This field test can be carried out by applying the developed teaching materials when learning in class (Rayanto, 2020). Data from student response questionnaires are then used as a reference for the development and improvement of existing products.

a). First Trial

The first trial was conducted in the Science class.A Semester 3 in which there were 22 students. Questionnaires were given to students after completing learning using this developed EDSK textbook. The average score obtained from student responses to the textbook on *Energi Dalam Sistem Kehidupan* using a contextual approach based on the 7 components of effective learning is 77% with an interesting interpretation.

**Table 1.** Percentage (%) student responses IPA.A

No	Assessment Aspects	Achievement Level	Percentage (%)
1	attractiveness	Interesting	80%
2	Material	Interesting	76%



No	Assessment Aspects	Achievement Level	Percentage (%)
3	Language	Interesting	75%
Average amount			77%

#### b). Second Trial

The second trial was conducted in Semester 3 IPA.B class in which there were 22 students. Questionnaires were given to students after completing learning using this developed EDSK textbook. The average score obtained from student responses to the textbook on *Energi Dalam Sistem Kehidupan* using a contextual approach based on the 7 components of effective learning is 76% with an interesting interpretation.

**Table 2.** Percentage (%) student responses IPA.B

No	Assessment Aspects	Validity Level	Percentage (%)
1	Attractiveness	Interesting	78%
2	Material	Interesting	76%
3	Language	Interesting	74%
Average amount			76%

#### c). Third Trial

The third trial was carried out in Semester 3 IPA.C class in which there were 24 students. Questionnaires were given to students after completing learning using this developed EDSK textbook. The average score obtained from student responses to the textbook on *Energi Dalam Sistem Kehidupan* using a contextual approach based on the 7 components of effective learning is 78% with an interesting interpretation

**Table 3.** Percentage (%) student response IPA.C

No	Assessment Aspects	Validity Level	Percentage (%)
1	Attractiveness	Interesting	77%
2	Material	Interesting	79%
3	Language	Interesting	78%
Average amount			78%

Based on trials conducted in IPA.A, IPA.B, and IPA.C classes, the average student response to the EDSK textbook was 77% with an interesting interpretation. This can be a reference in deciding to use this textbook during energy learning, of course by enriching knowledge through other reading sources.

#### **The results of students' conceptual understanding tests in solving real assessment questions in the EDSK textbook**

Student concept understanding tests were carried out in IPA.A and IPA.B classes consisting of 22 students and 22 students. The reason for choosing these two classes was that the number of students was almost the same and that the IPA.A and IPA.B classes had an average understanding of concepts lower than the IPA.C class, which also had fewer students. For example, from the value of the exercise on understanding concepts related to energy in the body, the average conceptual understanding of students in IPA.B class is 55 and IPA.A is 60 while in IPA.C class is 70. Based on this, the researcher is interested in testing the problem of understanding the concept is at the stage of real assessment in IPA.A and IPA.B classes, especially in the renewable energy chapter. The following describes the results of students' understanding of concepts in solving questions in the EDSK textbook.

**Table 4.** Results of students' concept understanding of IPA.A

No	Concept Understanding	Student name	Mark
1	Highest	OCT	70
2	Lowest	ADL	45
3	Average	22 Students	61.8

**Table 5.** Results of students' concept understanding of IPA.B

No	Concept Understanding	Student name	Mark
1	Highest	JMS	90
2	Lowest	ARF	53
3	Average	22 Students	77.5

Based on the table above, it can be seen that on average there is an improvement in the value of the practice questions given by the lecturer before using the EDSK textbook and after the lecturer uses this EDSK textbook. Previously, the average score for IPA.A class was 60 to 61.8 in renewable energy, even without using the EDSK textbook, then the comparison in IPA.B class, which was originally 55, became 77.5. Through the use of this EDSK textbook in IPA.B class, it turns out that student scores in the next chapter, namely in the real assessment exercise on renewable energy materials, get an average of 77.5. If further observed based on the answers given, students are quite good at answering the essay questions given. The answers given are quite understandable and not just quoting from a book. Based on this, it appears that students understand the material that has been studied. Students are able to answer in their own language and sentences, indicating that students understand what they have learned. To realize effective learning, it is necessary to eliminate misconceptions first. Different teaching approaches can be used to overcome students' misconceptions (Oskan, 2020). Through textbooks based on effective learning, misconceptions are minimized so that understanding of concepts is more optimal.

### Evaluation

The evaluation stage consists of perception assessment, performance assessment and performance assessment (Robert, 2010). Evaluation of the textbooks that have been developed are as follows:

#### 1. Assessment of Student Perceptions

Assessment of student perceptions or responses is carried out using a questionnaire to find out the attractiveness aspects, material aspects and linguistic aspects. The results of the questionnaire recapitulation show that the three aspects have an average acquisition score which is categorized at quite interesting intervals. The lowest average score given by students is found in language items that cannot be understood quickly and correctly because there are many foreign terms or terms that are rarely heard so that students find it difficult to understand them.

#### 2. Performance assessment

Assessment of student performance in completing each stage of the EDSK textbook, starting from constructivism to real assessment, is considered good. This is because at each stage of the seven components of effective learning students follow it in an orderly manner and do everything in the guide properly. The seven components of effective learning are indeed intended so that during learning from start to finish it can run optimally and the expected learning objectives can be achieved. Based on these seven components, according to students, the lowest and most difficult part is the learning community. This is because at the learning community stage students are asked to discuss real problems in everyday life which sometimes students don't think about that when studying energy.

#### 3. Performance Assessment

The performance assessment is based on the results of the expert validator's assessment. Criticisms and suggestions submitted by the validator for the development of this EDSK textbook are better. These criticisms and suggestions include adding instructions for using textbooks, adding Islamic integration, then reference sources for existing tables and writing procedures, etc. In addition, the performance assessment is based on a validator assessment feasibility questionnaire compiled based on national education standards.

## **Textbook Feasibility Assessment**

After the product has been developed, the next stage is submitting the product that has been developed, namely the EDSK textbook with a contextual approach based on these 7 effective learning components to 4 expert validators namely media experts, linguists, materials experts and learning experts. The goal is to review the feasibility and get suggestions for comments on the textbooks that have been developed. This is so that the developed textbooks are feasible in terms of material, learning, media and language.

### **1) Test results for the validity of the material and learning characteristics in the EDSK textbook**

Assessment of content or material aspects in this EDSK textbook contains various aspects of feasibility which include the suitability of the material with learning objectives, the suitability of the material with the themes discussed, the material in the textbook can stand alone not depending on other books, the material is in accordance with scientific developments, the accuracy of the material and content accuracy. Data from the assessment carried out by the validator were then analyzed quantitatively to determine the feasibility category of the EDSK textbooks that had been developed.

Based on the research results obtained, the aspects that were asked on the validation sheet indicated the feasible and very feasible categories. On average in all aspects of material and learning that is developed is 83%. This average is included in the very feasible category to use. Then, in addition to the assessment in the form of a score, there are criticisms and suggestions for improvement given by the expert validator on the material and learning characteristics contained in the textbook, namely the need for improvement in the illustration section, it will make the reader understand better if the images used are taken from original photos if possible. If not, the images need to be adapted to the users, namely students and lecturers, so the images listed before the material at least don't draw children. Apart from these suggestions, The validator also provides suggestions so that each chapter is integrated with Islam and each chapter is equipped with a summary. This EDSK textbook summarizes the material in reflection, so because of the different names, it seems that there is no conclusion. The validator also provides suggestions regarding metabolic material coupled with images that can better understand readers as well as on energy material in the body added a table of BMI threshold limits in Indonesia. Then in the matter of work and energy, even though it is in the stage of constructivism, it is suggested that it still displays the formula or equation of work. For non-renewable energy materials, it is recommended to provide pictures or information related to multilevel distillation. On renewable energy, In the inquiry section, it is recommended that there be a section that trains students to calculate daily electricity needs, for example in one house. This suggestion is in accordance with the findings of previous research that if a material is directly applied between theory and practice it will further enhance understanding. The research was conducted by Banda and Nzabahimana the results are Conceptual understanding is vital in helping students to transfer knowledge to new situations they encounter (Banda and Nzabahimana, 2021). The next suggestion is that there are stages or sections where students are given the opportunity to do simple practicums in certain parts, although not in all chapters.

### **2) Media and Language validity test results in EDSK textbooks**

The assessment of media and language in this EDSK textbook contains various aspects of feasibility which include aspects of book size, book cover design, book content. Data from the assessment carried out by the validator were then analyzed quantitatively to determine the feasibility category of the EDSK textbooks that had been developed. Based on the results of the research, the aspects asked on the validation sheet show the feasible and very feasible categories. On average, the aspect of media and language developed is 74.6%. This average is included in the feasible category to use. In addition to providing a quantitative assessment,

the validator also provides suggestions and comments, namely, among other things, the color of the writing on each header (at the very top of each page) is less assertive. Need to change the color of the text darker so that it is clear and not blurry or blurry. On the main cover page, the textbook author's name should be replaced with a bold color. For example black. For contrast and easy to read. Then in the content section it is still necessary to pay attention to the use of comma (,) punctuation so that sentences are not ambiguous or cause double understanding. Also pay attention to the punctuation for the imperative sentence form, there are several paragraphs where the sentence part is too long so it needs to be made into two sentences. Then for the use of prepositions in almost all of the textbooks, it is not in accordance with the writing rules. Everything is still written in series that should be separated.

### **3) Test results of the validity of the Concept Understanding Test Questions**

In this study, in addition to developing the EDSK textbook, research was also carried out related to understanding the concepts of students who used this EDSK textbook during lectures. Before the test is carried out on students, the validity of the test questions is tested first.

The average result for the eligibility validity of the students' concept understanding test questions was 82.23%. So it can be concluded that the feasibility of the concept understanding test questions that have been developed by researchers is in accordance with the three aspects of the assessment which include aspects of material, construct and language. The assessment given by the validator on material aspects has an average percentage of 80% which is categorized as feasible. Then on the construct aspect it has an average percentage of 86.7% which is categorized as very feasible. In the language aspect, it has an average percentage of 80% with a decent category.

Instrument validation was also carried out by testing the validity and reliability using the SPSS 25.0 application. Testing was carried out with the aim of ensuring the distribution of questions created to test students' understanding of concepts was valid and reliable. The following presents the results of the analysis of the validity of the questions.

Based on the data on the results of the validity test, that of the 10 essay questions given, the overall valid test results were obtained. The criteria for the validity of the items are based on the results of Sig (2 tailed) > significance level (0.05) and a positive Pearson Correlation. While the reliability test results are listed in table 4.13, it is known that the test items have reliable test results based on the Cronbach Alpha value of 0.743 > 0.05. Based on the validity and reliability tests that have been carried out, it can be concluded that the problem instruments can be used in research.

### **EDSK Textbook Effectiveness Test Results with a Contextual Approach Based on 7 Components of Effective Learning on Student Concept Understanding**

Some of the stages that the researcher went through in developing the EDSK textbook (*Energi Dalam Sistem Kehidupan*) with a contextual approach based on 7 effective learning components included analyzing the needs and appropriate themes to optimize students' concepts related to energy while also analyzing the needs for textbooks in energy courses. in living systems. After analyzing these needs, the next steps are designing products, developing products, validating products, implementing products and then analyzing research results. The purpose of this development research is to optimize students' understanding of concepts with research samples from IPA.A and IPA classes. B semester 3 To find out the effectiveness of using this EDSK (*Energi Dalam Sistem Kehidupan*) textbook on students' understanding of concepts. At the trial stage, the researcher provided material in chapter 1 of the textbook, which is related to energy in the body. Meanwhile, at the time of data collection related to student conceptual understanding, researchers provided material in chapter 3, namely the chapter on renewable energy. This adjusts to the student's class schedule. Students' understanding of the concept is known by giving a test with a total of 10 essay questions and

all of them are related to the renewable energy material that has just been discussed. In IPA.A class learning is carried out using learning resources from the internet that discuss renewable energy. In the IPA.B class, learning is carried out using the EDSK textbook learning resources developed by this researcher.

After both classes received the same material, namely renewable energy, the test was then carried out. The test was given on the same day with the help of a physics lecturer so the science class was supervised by fellow physics lecturers. Meanwhile, the IPA.B class was directly supervised by the researcher. The results obtained from the test results were that in class IPA.A the highest score for students was 70, the lowest score for students was 45 while the average grade for class IPA.A was 61.8. IPA.B class results are better, the highest score is 90, the lowest score is 53, while the average value of IPA.B is 77.5. These results indicate that the understanding of physics concepts, especially in this renewable energy material, is higher in the IPA class.

In detail, the test results need to be tested as a whole to find out the differences in the test results in the two study groups. Data on the results of the conceptual understanding test were then analyzed using an independent sample t-test to find out the difference in the mean of student scores in the control class and the experimental class. Before being tested using an independent sample t-test, the data was analyzed first to determine whether or not the test was normally distributed using the Kolmogorov Smirnov test. Then a homogeneity test was carried out using the Levena Statistical test.

**Table 6.** Results of the kolmogorov smirnov normality test

Class	Count Value	Significance Level	Test Decision
Control	0.150	0.05	Normal
Experiment	0.250	0.05	Normal

The results of the Kolmogorov Smirnov normality test listed in table 4.15 show that the significance value in the control class is 0.150 ( $p > 0.05$ ) and the experimental class is 0.250 ( $p > 0.05$ ). This shows that the data on the test results in the two research classes are normally distributed. While the results of the Levena Statistic homogeneity test can be seen in the following table:

**Table 7.** Levena statistical homogeneity test results

Variable	Count Value	Significance Level	Test Decision
<b>Homogeneity</b>			
Control-Experiment	0.055	0.05	Homogeneous
Control-Experiment	0.055	0.05	Homogeneous

The results of the Levena Statistic homogeneity test listed in table.7 show that the significance value is 0.055 ( $p > 0.05$ ). This shows that the test results data in the two study classes are distributed homogeneously.

After the test data were carried out by the Kolomogorov Smirnov and Levena Statistic tests, it was found that they were normally and homogeneously distributed, then an independent sample t-test was carried out to see the difference in the acquisition of students' concept understanding scores in the control class and the experimental class. In the independent sample t-test, the hypothesis proposed with reference to the research methodology book written by Sugiyono is:

$H_0$  : The EDSK Textbook with a contextual approach based on the 7 components of effective learning is not effective in increasing students' understanding of concepts

$H_1$  : The EDSK Textbook with a contextual approach based on the 7 components of effective learning is effective in increasing students' understanding of concepts

Data from independent sample t-test results are presented to see the difference in student scores in the control class and the experimental class as follows:

**Table 8.** Independent sample t-test results

t-test	Count Value	Significance Level	Test Decision
Control-Experiment	0.025	0.05	Ho rejected

The results of the independent sample t-test as shown in table 4.17 show that the significance value obtained reached  $0.025 < 0.05$ , so that  $H_0$  in the test was rejected. This shows that there are differences in the acquisition of students' scores in the control class and the experimental class.

Based on the results of the research that has been done, the implications for learning physics, especially in the EDSK course, are that lecturers and students have learning resources that specifically discuss the material in energy. Energy material is one of the important materials and is close to life so it needs to be understood in depth and in teaching it must be constructive. As a guide to how one might introduce the concept of energy in the classroom, consider the following: there is matter, it interacts, and that interaction produces observable changes (Hecht., 2019). Energy matter is also very diverse and can be viewed from biology, chemistry, physics. Through this textbook, energy material from the physics side will be easier to learn in detail. Although the hope is that students are able to understand energy and its relation to the three fields of science. This is in accordance with the standards of science learning. Science standards of different countries introduce disciplinary core ideas and cross-cutting concepts such as energy to help students develop a more interconnected science understanding (Opitz et al., 2017). Energy in physics is the ability to carry out all activities, energy in biology is a living thing which is a source of energy for other living things. Meanwhile, according to energy chemistry is *energystored* in chemicals and produced by chemical reactions or form a chemical reaction. Based on this, energy when viewed from the three sciences is a process of change and the medium is the body. Body position and movement affect the body's energy balance. In biology and physics, the sequential, yet overlapping progression of energy understanding along energy forms, transfer, degradation, and conservation. In chemistry, students' understanding of energy transfer was low and did not progress, while understanding of degradation was surprisingly well established (Opitz et al., 2017).

EDSK courses are more effective because each student has a source of learning so they no longer rely solely on the lecturer's explanations. Students are required to be more active and maximize their thinking skills from the constructivism stage to evaluation. This EDSK textbook also supports the achievement of learning objectives, this is evident from the better understanding of student concepts. In addition, the results of this study have a real impact that contextual and effective learning which in this case is in accordance with the characteristics of textbooks, is able to increase activity in class, understanding and enthusiasm to want to know the next concept up to the final material. This is in accordance with research related to contextual learning that has been carried out by Banda and Nzabahimana namely Conceptual understanding helps students make connections between what is already known to new physics phenomena. Good linkage of knowledge helps students to develop a good rapport for understanding new knowledge in physics. Transferring the conceptual knowledge of physics to real life is a critical component of physics learning that triggers students' innovative skills (Banda and Nzabahimana., 2021).

## CONCLUSION

Based on the results of the analysis that has been carried out, it can be concluded that the research on the development of the EDSK (*Energi Dalam Sistem Kehidupan*) textbook with a Contextual Approach Based on the 7 Components of Effective Learning uses the ADDIE research model which has several stages, namely the analysis stage, the design stage,

the development stage, the implementation stage and finally the evaluation stage. Then EDSK textbook (*Energi Dalam Sistem Kehidupan*) with a contextual approach based on 7 components of effective learning that has been developed by researchers is declared feasible, both from the aspects of material, learning, media and language. The percentage of assessment on the material and learning aspects is 83%, while on the media and language aspects is 74.6% so that the EDSK textbook (*Energi Dalam Sistem Kehidupan*) with a contextual approach based on 7 effective learning components is declared feasible to use with improvements based on suggestions and input that has been given by the expert validator. While the attractiveness assessment carried out by students in the EDSK textbook (Energy in Life Systems) with a contextual approach based on 7 components of effective learning received a positive response in three trials which were carried out by obtaining a percentage of 77% in the first class, 76% in the second class, second class, and 78% in the third class. Finally, the EDSK textbook (*Energi Dalam Sistem Kehidupan*) with a contextual approach based on the 7 components of effective learning has an effect on students' understanding of concepts. This is based on the results of the independent sample t-test showing that the significance value obtained reaches  $0.025 < 0.05$

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