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HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW
KARYA ILMIAH: PROSIDING

Judul Prosiding Ilmiah (Artikel) : Textbook on Material Classification and Its Change Based on STEM Approach

Penulis Prosiding Ilmiah : Lina Arifah Fitriyah, Humaidillah Kurniadi Wardana
Identitas Prosiding Ilmiah
a. Nama Prosiding : Proceedings of the 3rd International Conference on Learning Innovation and Quality Education (ICLIQE 2019)
b. Volume : 397
c. Halaman : 988-998
d. Penerbit : Atlantis Press Advances in Social Science, Education and Humanities Research
e. ISSN : 2352-5398
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Kategori Prosiding : ☐ Prosiding Ilmiah Internasional Terindeks

☑ Prosiding Ilmiah Internasional

☐ Prosiding Ilmiah Nasional

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4	Kelengkapan unsur dan kualitas penerbit (30%)			4,5		4,35
	Total = (100%)			15		14,3
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2	Ruang lingkup dan kedalaman pembahasan	- Pendahuluan telah memuat latar belakang, kajian literatur terdahulu dan tujuan penelitian. Pendahuluan diadakan oleh penulis dengan baik dan mendalam. - Artikel ini menekankan pada proses pengembangan buku ajar dan hasil validasi buku tersebut. - Buku ajar yang dikembangkan oleh penulis menggunakan tahap-tahap pendekatan STEM yang terdiri dari pendekatan SAINS, teknologi, teknik dan matematika yang disebutkan di setiap BAB buku. Buku ajar juga berisi eksplorasi untuk peserta didik dan materi serta terdapat rangkuman dan soal. Hal ini tersirat dalam artikel - Pengukuran validasi buku ajar berdasarkan penyajian buku, materi dan soal yang terdapat dalam buku
3	Kecukupan dan kemutakhiran data dan metodologi	- Data penelitian berupa deskripsi proses pengembangan buku ajar dan hasil validasi buku ajar. - Penggunaan pendekatan STEM termasuk kemutakhiran penggunaan pendekatan pembelajaran. - Daftar Pustaka yang digunakan oleh penulis masih ada yang menggunakan sumber pustaka di bawah 10 tahun terakhir yaitu 1990 dan 2006.
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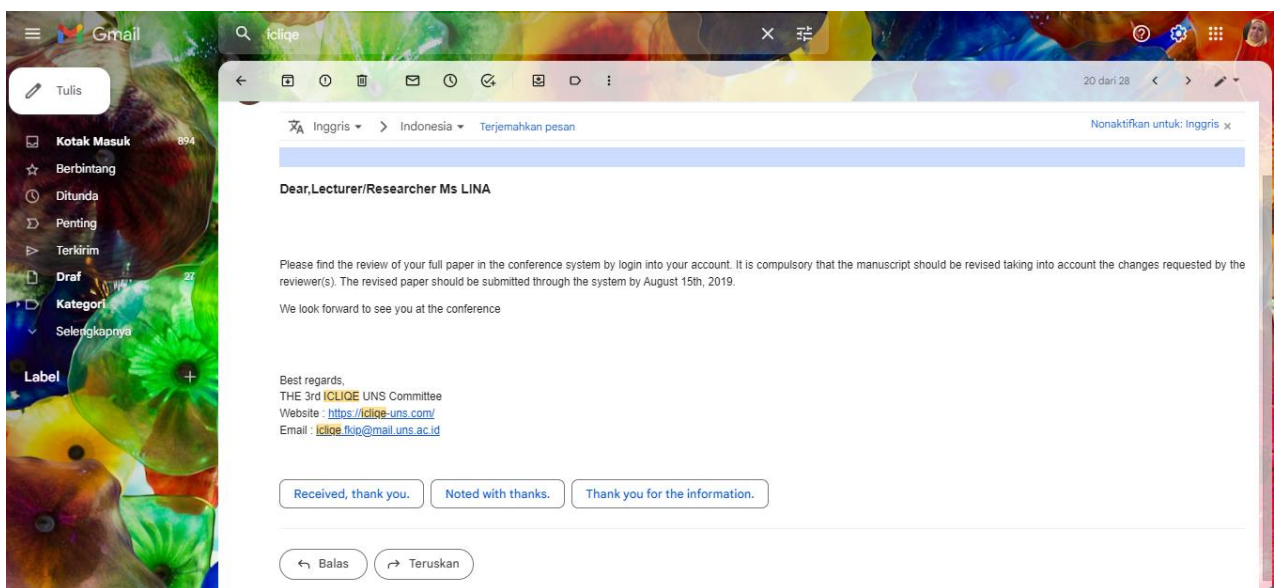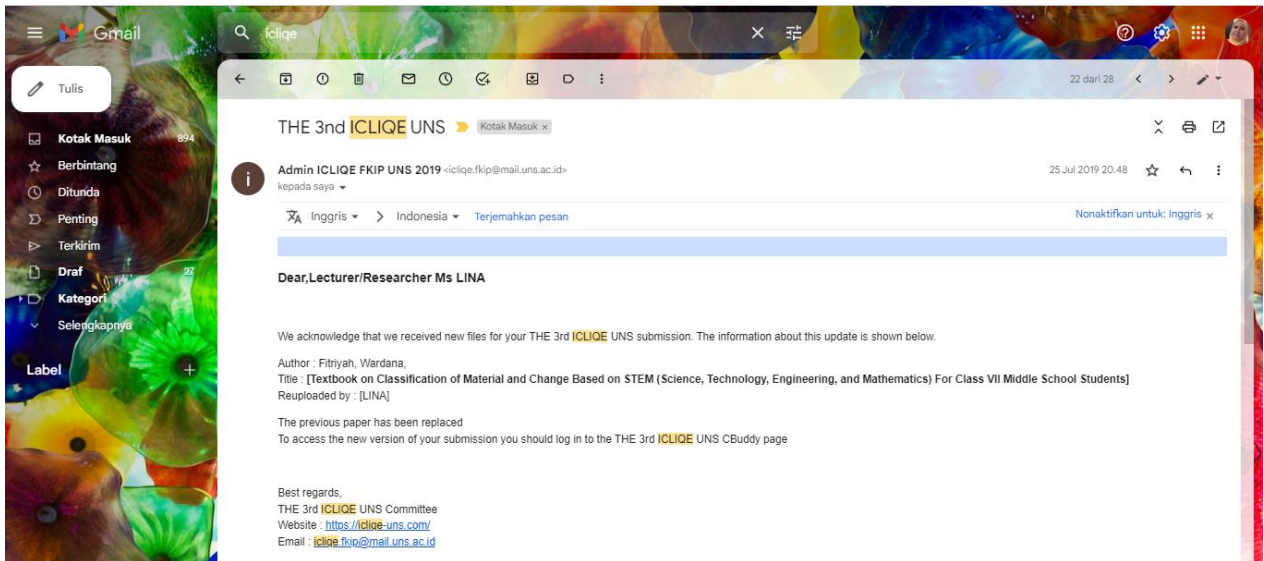**Febi Dwi Widayanti, S.Pd, M.Pd**
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Dear,Lecturer/Researcher Ms LINA

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Author : Fitriyah, Wardana,
Title : [Textbook on Classification of Material and Change Based on STEM (Science, Technology, Engineering, and Mathematics) For Class VII Middle School Students]
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The previous paper has been replaced
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Dear,Lecturer/Researcher Ms LINA

Please find the review of your full paper in the conference system by login into your account. It is compulsory that the manuscript should be revised taking into account the changes requested by the reviewer(s). The revised paper should be submitted through the system by August 15th, 2019.

We look forward to see you at the conference

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Dezya Salsabila Prawira, Pedri Haryadi, Irani Soraya

Adolescents are actually the next generation and future human resources who play an important role in the times. Psychological Well-Being is a condition of an individual who

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Textbook on Material Classification and its Change Based on STEM Approach

Authors
Lina Arifah Fitriyah, Humaidillah Kurniadi Wardana

Corresponding Author
Lina Arifah Fitriyah

Available Online 6 February 2020.

Abstract
Students in the 21st century are required to master a variety of skills in order to compete globally. The STEM approach in science learning is expected to deliver students to meet 21st century abilities including learning and innovating skills which include critical thinking and being able to solve problems, creative, and innovative, and be able to communicate and collaborate, skilled to use media and skilled in Information Communication Technology (ICT); adaptability, appropriate and attractive, initiative, able to develop, have social and

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Abstract
Students in the 21st century are required to master a variety of skills in order to compete globally. The STEM approach in science learning is expected to deliver students to meet 21st century abilities including learning and innovating skills which include critical thinking and being able to solve problems, creative, and innovative, and be able to communicate and collaborate, skilled to use media and skilled in Information Communication Technology (ICT); adaptability, appropriate and attractive, initiative, able to develop, have social and cultural abilities, productive, trusted, have leadership spirits and responsibilities (Winarni, Zubaidah, & Koes, 2016). This study aims to: (1) produce a book of the material classification and its changes using the STEM approach; (2) find out the feasibility of a book based on the STEM approach. The process of making this book includes the preparation, the production and the completion stage. The data obtained from this textbook were analyzed using qualitative descriptive analysis methods. Data collection techniques in the form of observation and questionnaire. Textbook assessments by adding up scores obtained from all experts who then interpret into the average score if obtained ≥ 2.51 or percentage ≥ 60, including valid. The results of the development are: (1) Book consisting of cover, preface, table of contents, instructions for using the book, the contents of the material for each chapter that is designed for each item, summary, competency questions and bibliography. (2) The results of the expert validation test which state that the book on the classification of material and its changes using the STEM approach meets the criteria of being eligible for use as teaching material. The developed textbook which is taught is about technology, engineering, and mathematics so that students find it easier to learn science. The use of textbooks on material classification and its change to improve students' understanding of material classification concept and its changes so that it has an impact to satisfy learning outcomes.

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Textbook on Material Classification and its Change Based on STEM Approach

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Abstract: Students in the 21st century are required to master a variety of skills in order to compete globally. The STEM approach in science learning is expected to deliver students to meet 21st century abilities including learning and innovating skills which include critical thinking and being able to solve problems, creative, and innovative, and be able to communicate and collaborate, skilled to use media and skilled in Information Communication Technology (ICT); adaptability, appropriate and attractive, initiative, able to develop, have social and cultural abilities, productive, trusted, have leadership spirits and responsibilities (Winarni, Zubaidah, & Koes, 2016). This study aims to: (1) produce a book of the material classification and its changes using the STEM approach; (2) find out the feasibility of a book based on the STEM approach. The process of making this book includes the preparation, the production and the completion stage. The data obtained from this textbook were analyzed using qualitative descriptive analysis methods. Data collection techniques in the form of observation and questionnaire. Textbook assessments by adding up scores obtained from all experts who then interpret into the average score if obtained ≥ 2.51 or percentage ≥ 60, including valid. The results of the development are: (1) Book consisting of cover, preface, table of contents, instructions for using the book, the contents of the material for each chapter that is designed for each item, summary, competency questions and bibliography. (2) The results of the expert validation test which state that the book on the classification of material and its changes using the STEM approach meets the criteria of being eligible for use as teaching material. The developed textbook which is taught is about technology, engineering, and mathematics so that students find it easier to learn science. The use of textbooks on material classification and its change to improve students' understanding of material classification concept and its changes so that it has an impact to satisfy learning outcomes.

Keywords: textbook, STEM, material classification and its changes

INTRODUCTION

The learning paradigm of the 21st century emphasizes on the mastery of cognitive (knowledge) and psycho-motor (skills) so we need reliable, adaptive and competent humans. It takes a reliable human resources as a main pillar in the development of the nation and country to face the 21st century (Mitchell, 2008). In the 21st century, it must also need to develop (HOTS) higher-order thinking skills (Basuki & Hariyanto, 2014). The era of globalization is demanded to have the ability to compile, synthesize, and comprehensively integrate that is called knowledge. Meeting the needs of life in various contexts is more knowledge based (Mukhadis, 2013).

It is believed that science as a basic science has an important role in the development of science and technology in the 21st century. Science learning educators must be able to bring up the concept / knowledge, the process, the creativity, the attitude, the application domain and linkages so that they can realize 21st century skills (Purwanti Widhy H, 2013). Learning that is relevant to the integration between cognitive and psycho-motor is based on STEM (Science, Technology, Engineering, and Mathematics) learning. STEM is a problem that is put forward in

nowadays education that has a positive effect on student learning (Becker & Park, 2011). The STEM approach in science learning is expected to deliver students to meet 21ˢᵗ century abilities including learning and innovating skills which include critical thinking and being able to solve problems, be creative and innovative, and be able to communicate and collaborate, skilled to use media and ICT (Information, Communication and Technology); the ability to carry out routines and careers which include adaptability, appropriate and attractive, have initiative, develop, have social and cultural abilities, productive, trusted, have leadership and responsibility (Winarni et al., 2016)

During the learning process, both educators and students need learning resources to be utilized and needed, which are available in the learning environment. Learning resources in the education unit, especially in schools are usually very monotonous. One source of learning that is often used by educators and students is textbooks/ printed books. Development of teaching materials is needed to help educators deliver material in learning (Bappenas, 2009). Books with the STEM approach are printed books that can integrate science, technology, engineering, and mathematics to advance and expand the creativity of students through the process of solving problems in daily routines. Based on research by (Utami, Jatmiko, & Suherman, 2018), modules with the STEM approach have advantages as an independent learning guide, making it easier for students to find a concept so that they can find out how the concept was obtained, having many illustrations that can facilitate students in understanding the material. It is also being strengthened by the results of research conducted that STEM-based teaching materials contain material about dynamic fluid equipped with problems, procedures, practicum, the making of projects related to STEM aspects which show the categories of teaching materials that are appropriate to use, easy to understand, and the teaching material is able to increase the mastery of the students participant concept.

The material presented in the book based on the STEM approach is the classification of materials and its changes. The choice of material was due to many activities that could be applied in daily routines. Classification of material and its changes can be learned by using the STEM approach. Those are science in finding concepts, technology which can be learned by explaining various applications of technology, engineering which can be learned by making simple tools related to material, and mathematics which is used to formulate mathematical equations as well as in terms of calculations. Some studies related to the classification of materials and their changes include:

1. Science, technology, society, and environment can be developed in teaching material classification and changes. The integration of science, technology, society, and environment changes the view of learning from teaching to learning, knowing to thinking, lower-ordered teaching skills to higher-ordered cognitive skills (HOCS), reductionist thinking to evaluating thinking, disciplinary teaching (physics, chemistry, biology, etc.) to interdisciplinary teaching, conceptual to problem solving, teacher centered to student centered, real world, project / research (Riswahyuningsih, 2017).

2. The development of multiple representation students worksheet on classification material. It refers to training students' basic science process skills, that is the skills of observing, inferring, predicting, classifying, and communicating using the steps of a scientific approach, accompanied by pictures and phenomena that support students in learning based on fact; viewed from the aspects of suitability, readability, and attractiveness which have very good criteria and are suitable for use in learning in schools (Fallis, 2013)

Based on this description, it is necessary to develop textbooks on material classification and its changes based on STEM to meet the learning needs of the 21st century. Classification

textbooks by integrating the STEM approach is a scientific approach as the main focus in the concept of textbooks which are then followed by other approaches which are technology engineering and mathematics. The purpose of this study is to develop textbooks on material classification and its changes based on quality STEM based on eligibility. This product is expected to; (1) students and educators are accustomed to have a comprehensive mindset in viewing learning material as a science that is integrated with technology, engineering and mathematics, (2) technology, engineering, and mathematics to facilitate learning science (IPA), (3) become more interested in learning with STEM material because it is accompanied by events that occur every day so as to gain understanding and skills of the knowledge possessed.

METHOD

This research uses development procedures consisting of preparation, manufacture and completion. The process is illustrated as in Figure 1 below:
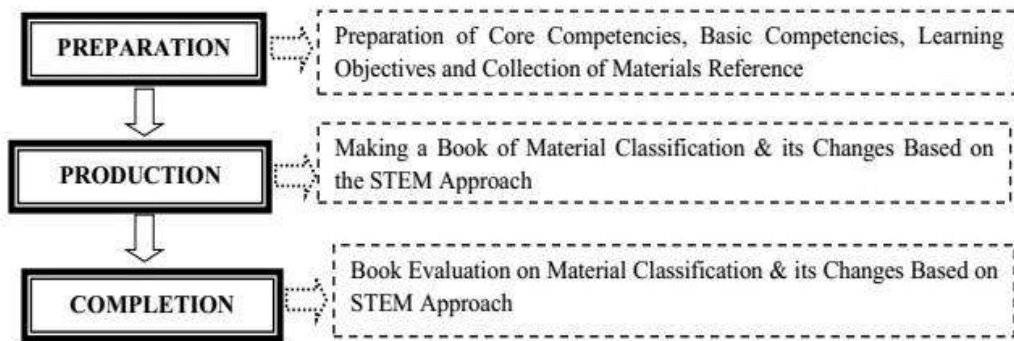

Figure 1. The Flow of Book development based on STEM

The instruments used in developing this book are:
1. Book Validation Sheet on Material Classification & its Changes Based on the STEM Approach with aspects assessed include construction aspects (completeness of contents, sentences and appearance, didactic aspects, technical aspects, and characteristics of the STEM approach.
2. Material Validation Sheet on Material Classification & its Changes Based on the STEM Approach with the aspects assessed include the contents of the book which based on the STEM approach, material suitability, language, and material presentation.
3. Question Validation Sheet on Material Classification & its Changes Based on the STEM Approach with aspects assessed include material aspects, construction, and language domains.

The data which is obtained from the development of books in this study used descriptive analysis techniques. The calculation is done by calculating the scores obtained from all validators. The data collection techniques are in the form of observation and questionnaire. The data on product assessment were analyzed using a textbook feasibility assessment technique based on the STEM approach.

Calculation of the average score of the validation is interpreted into the criteria as in Table 1 below:

Table 1. Criteria for Interpretation of Validation Analysis of Average Values

Average Score	Validation Criteria
3,26–4,0	Very Valid
2,51–3,25	Valid
1,76–2,50	Quite Valid
1,00–1,75	Less Valid

(Adapted from Arikunto, 2006)

Validation criteria used in assessing the percentage of products developed can be seen in Table 2 below:

Table 2. Kriteria Validasi Analisis Persentase

Answer Percentage	Validation Criteria
80–100	Strongly Valid
60–79	Valid
40–59	Quiet Valid
0–39	Less Valid

(Adapted from Sudjana 1990)

RESULTS AND DISCUSSION

Results

This development research resulted a product in the form of a book based on the STEM approach. The analysis of curriculum and materials used based on Permendikbud Number 24 of 2016 are Core Competencies number 3 and 4, which read:

- Core Competencies 3. Understanding knowledge (factual, conceptual, procedural) based on curiosity about science, technology, culture related with the phenomena and the events is visible to the eye.
- Core Competencies 4. Trying, Processing and Presenting in the realm of concrete (Using, Decomposing, Constructing, Modifying, and Creating) and the realm of abstract (Writing, Reading, Counting, Drawing, and Writing in accordance with what is learned in school and other sources from the same point of view / theory.

While the Basic Competencies used are:

3.3 Explaining the Concept of Mixtures and Single Substances (Elements and Compounds), Physical and Chemical Properties, Physical and Chemical Changes in Daily Life

4.3 Present the results of the investigation or the nature of the solution, physical and chemical changes, or mixture separation

So the material in this book is the classification of material and its changes. The book includes the discipline of physical chemistry that is associated with events related to everyday life. The book based on the STEM approach consists of four sub materials. Those are (1) material classification, (2) elements, compounds, and mixtures, (3) physical and chemical properties, and (4) physical and chemical changes.

This book is completed with an introduction, book instructions, and a table of contents. The material in this book is presented using a scientific approach to the first focus of learning then integrated with technology, techniques, and mathematics in each chapter. There are five chapters in the material, which are: (1) explore yourself; which aims to explore and understand the concepts of the material being studied by conducting simple experiments, (2) fostering creativity and innovation; intended to present information in supporting the concepts that have

been learned as well as a thinking space of the concepts being studied, (3) testing yourself; aims to find out and practice understanding of the concept material being studied, (4) a summary of all material, and (5) competence question to test how to understand the concept being studied.

In the book, there are some interesting displays. For each sub-material, there is a description of the material being studied along with pictures and illustrations that are relevant to the material.

Figure 1. Display of Textbooks with a Science and Technology Approach
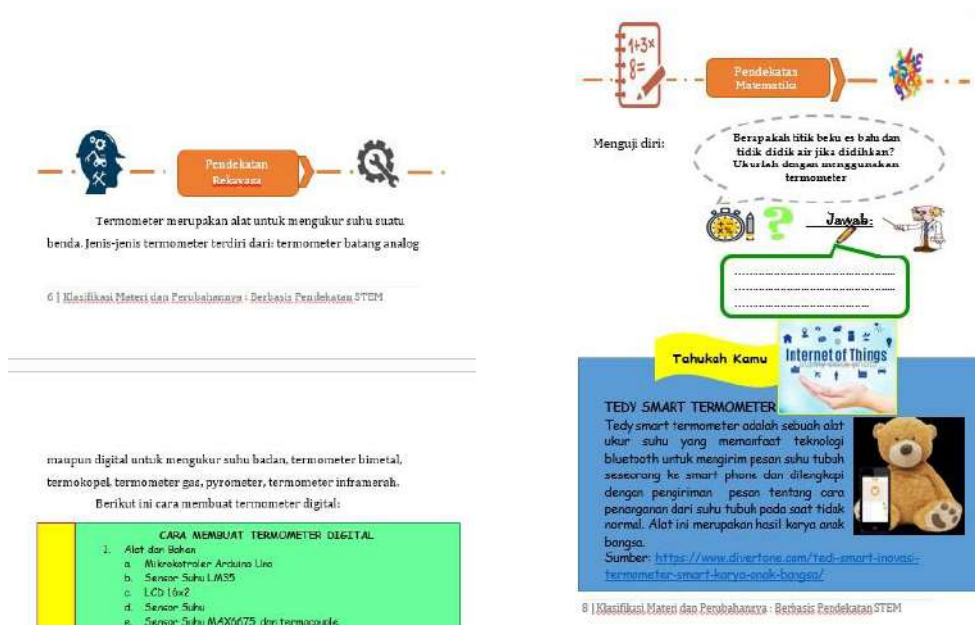
Figure 2. Display Textbooks with Artificial and Mathematical Approaches

After the book has been developed, an expert assessment or validation is carried out to determine the feasibility of the book. Validation is done by filling out a questionnaire that has been prepared. The questionnaire was adjusted to the criteria for a good book instrument. A suggestion sheet was also prepared so that the validator could provide suggestions to improve the book.

Validation data analysis aims to determine the quality of products in the form of a book. The data quantity is done by adding up the scores for each aspect assessed. The results of expert validation can be seen in Table 3 below:

Table 3. The Validation Result from The Book Expert

No	Validated Instrument	Average Feasibility	Assessment Criteria	Average Percentage of Feasibility (%)	Percentage Criteria
1	The Presentation of Material Classification Book & Its Changes Based on the STEM Approach	2.96	Valid	73.96	Valid
2	The Material in Classification Book & Its Changes Based on STEM Approach	3.75	Strongly Valid	93.75	Strongly Valid
3	The Question of Material Classification & Its Changes Based on the STEM Approach	3.83	Strongly Valid	95.83	Strongly Valid

Based on the results of the validation in Table 3 above, it can be concluded that (1) the aspect of book presentation has valid criteria, (2) the material aspects described have strongly valid criteria and (3) the questions given in the book have strongly valid criteria. So the results of the expert validation test stated that the book on material classification and its changes using the STEM approach met the criteria to be used as a teaching material.

The STEM-based textbook draft that has been made and then validated to the experts, then gets criticism and suggestion from the experts. The results of criticism and suggestions and also the results of revisions can be seen in Table 4.

Table 4. Expert Critics and Suggestions and also the Revision Results

No.	Critics and suggestion	Revision Result
1.	The title of the material should be bigger than the others.	Change the *font size* in the cover.
2.	Adjust the image to the title of the book.	Change the book cover

No.	Critics and suggestion	Revision Result
3.	It needs conjunctive sentence before table	Add conjunctive sentence before
4.	The Usage instructions of teaching materials in the mathematical approach must be repaired in their aims and objectives.	Repair the aims on the mathematical approach in the usage of instructions
5.	The engineering approach is changed to the artificial approach because the word engineering means engineering.	Change the term "engineering" to "artificial"

No.	Critics and suggestion	Revision Result

Discussion

The research conducted is a research development type of STEM textbooks based on material classification material for grade VII SMP/MTs. This research begins with the preparation phase, starting with curriculum and material analysis. The curriculum used is the 2013 curriculum. The next analysis is the material analysis by identifying core and basic competencies. The chosen competencies are Core Competencies number 3 and 4 with Basic Competencies 3.3 and 4.3. Then, the researcher formulate the learning objectives presented in each chapter in the book, which include:

After reading Chapter I, students are expected to be able to:

1. Classify material (substances) based on their appearance and application in everyday life.
2. Identify the characteristics of material (substances).
3. Explain the material measurement

After reading Chapter II, students are expected to be able to:

1. Explain the concepts of elements, compounds and mixtures

2. Classify the concepts of elements, compounds, and mixtures in everyday life

After reading Chapter III, students are expected to be able to:

1. Explain the characteristics of a material

2. Describe the phenomena of physical and chemical changes in daily life

After reading Chapter IV, students are expected to be able to:

1. Describe the phenomenon of physical and chemical changes in everyday life.

2. Observe and explain physical and chemical changes.

The next stage is the making of a book about material classification and its changes based on the STEM approach. At this stage, the textbooks are made based on the integration of science, technology, engineering and mathematics. (Beers, 2011) stated that STEM learning is an integration of science, technology, engineering and mathematics learning that is suggested to help the success of 21st century skills.

In this product, the author presents a scientific approach to the main focus of each material per chapter with the aim of conceptual knowledge and understanding which then linked to technological, engineering, and mathematical approaches to facilitate learning of science and have skill in exploring themselves by experiencing firsthand how to do simple labs. The implementation of STEM learning in schools is to prepare a future labor that is strengthened with scientific, technological, engineering and mathematical work backgrounds to enhance the development of STEM interdisciplinary (Stark, 2016). Stated that STEM learning for students has the opportunity to study science (Lutfi, Ismail, & Azis, 2017).

The finished product is then assessed by experts. Validation is carried out by the experts whose validation results can be seen in Table 3 which shows that the material in textbooks based on the STEM approach gets an average score of 3.75 with a percentage of 93.75 which means strongly valid. The aspects assessed consist of construction requirements (completeness of contents, sentences and appearance), didactic requirements, technical requirements, and the

characteristics of the STEM approach. A good teaching material has readability requirements, clarity of information and compliance with Indonesian language rules (Depdiknas, 2008). Cognitive is the content of learning material as a didactic resource that can motivate in the development of meaningful learning in Indonesia (Mendoza & Mendoza, 2018)

The whole textbooks based on the STEM approach have a validation score of 2.96 and a percentage of 73.96 which is valid. Aspects assessed include the contents of the book based on the STEM approach, the suitability of the material, linguistics, and presentation of the material. Cook (2008) stated that teaching materials must have illustrations (presentation of material) in order to help students understand and absorb the concepts of knowledge.

The questions on textbooks based on the STEM approach have an average score of 3.83 and the percentage of 95.83 which is strongly valid. Aspects assessed include aspects of the material region, the region of construction, and the region of language. A test / question is said to be good as a measurement if the test / question can measure what you want to measure (Arikunto, 2006). Learning with the STEM approach is able to train students in cognitive, affective and psycho-motor, and students also experience the learning process directly (Anggita Septiani, 2016).

Based on the description above, it can be concluded that the textbook of material classification and its changes based on the STEM approach developed was declared feasible. This is evidenced by the results of expert validation that all aspects are good.

CONCLUSIONS

The book is about the material classification and its changes which based on the STEM approach consisting of covers, preface, table of contents, instructions for using the book, the contents of the material per chapter designed per item, summary, competency questions and bibliography. The results of the feasibility test or validation of the expert stated that the book about the classification of material and its changes using the STEM approach met the criteria to be used as a teaching material. From the aspect of content, this STEM based textbook is in accordance with the core competencies and basic competencies in the 2013 curriculum. From the construction aspect, the textbooks that are developed are well structured and in accordance with STEM learning characteristics. From the aspect of language, the developed textbooks have used communicative sentence formulations, simple sentences, which are easy to understand and are in accordance with EYD.

The developed textbook is about technology, engineering, and mathematics so that students can easily learn science. The use of textbooks on material classification and its changes can improve students' understanding of a concept of material classification and its changes so that it has an impact on satisfying learning outcomes.

Based on the results of research and discussion, it can be suggested to the further research, as follows:

1. Product development is adjusted to the needs and adequate infrastructure to support product development.
2. The use of teaching materials based on STEM approaches in science learning should be done with careful preparation.
3. Further research and development needs to be conducted on learning resources in the form of books / teaching materials based on the STEM approach in other materials so that they are able to meet the needs of schools.

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