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Development of Textbook Integrated of Metacognition, Critical Thinking, Islamic Values, and Character

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Abstract

This study aims to develop an integrated textbook called "MERISKA" (an acronym of Metacognition, Critical Thinking, Islamic values, and Character in Indonesian). This integrated textbook MERISKA with content to practice metacognitive skills (include planning, monitoring, and evaluation in the learning process), critical thinking skills in the form of questions (which include interpretation, analyzing, evaluation, inference, explanation, and self-regulation), and the content of Islamic values through "comparative-confirmation" integration techniques in the form of relationships between verses of the Qur'an or Hadith with biology concepts, especially Cell and Molecular Biology, then finding an example of character (*Akhlaq*) from that relation. The development steps refer to the 4D model (defined as: define, design, develop, and disseminate). This approach is appropriate where each stage describes the process of compiling the MERISKA integrated textbook. The results indicate that the integrated textbook MERISKA, has the required criteria of validity, practicality, and effectiveness. The validation results show that the MERISKA textbook has an average validity value of 4.53 (very valid or high). The practicality results obtained an average score of 4.00 (by lecturers) and 4.53 (by students). Dissemination of product development is held through the Webinar (Web seminar) series "Integration of Islam and Science" and the publication of the textbook MERISKA with ISBN. The development of the integrated textbook MERISKA certainly provides benefits for students and lecturers. Students are facilitated by the MERISKA textbook as a learning resource, while lecturers are helped to improve their metacognitive skills, critical thinking, Islamic values, and character in the learning process.

Keywords: Integrated textbook, metacognition, critical thinking, Islamic values, character.

Introduction

During the COVID-19 pandemic, learning activities at schools have been temporarily suspended. This of course makes students have an increased burden. The limitations of insufficient facilities and infrastructure throughout COVID-19 pandemic are an obstacle to the implementation of an optimal teaching and learning process. This problem certainly makes forces teachers/lecturers to think about some solutions in order that the learning process can works properly even in a pandemic situation.

On the other side, the influence of the 21st century education concept causes curriculum changes that have an impact on the demands of graduates to be competent in their fields (Mas'ud, 2017). Transformations in the world of education also occur, including the transformation of learning media. Media is one of the supports in the learning process so that the material taught can be understood well by students (Mirici, 2019; Atsani, 2020). Therefore, it is necessary to develop media and learning resources, especially in student textbooks (Muriati, 2014). The development of textbooks is one of the efforts to overcome problems in learning activities, because it plays an important role in learning, as well as facilitating students in independent learning (Murditya et al., 2016).

Based on research result by Safitri et al. (2014), reported the limited number of textbooks, especially 'Cell biology' courses, is known from students of Universitas Nusantara PGRI Kediri have a shortage of learning resources for cell biology. Meanwhile, based on the observations in some universities like Universitas Muhammadiyah Prof. DR. HAMKA Jakarta, Universitas Muhammadiyah Malang, and Universitas Muhammadiyah Surakarta on December 2018 to March 2019, it showed that there were still few textbooks for these courses. As we know that the concepts in cell biology are fundamental concepts in life, because they are related to the next level and have an impact on students' learning abilities to understand the next course (Ford, 2009; Lukitasari & Susilo, 2014).

Students' difficulties during the COVID-19 pandemic are more advanced as they learn about concepts that need deeper understanding, such as concepts in "Cell Biology". This case has an impact on their learning outcomes. Students'

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understanding is low towards a concept that has been taught can be seen by students' inability to relate theory with illustrations. Furthermore, term in "Cell Biology" also make students less understanding that concepts (Lukitasari & Susilo, 2014; Maulina et al., 2012; Patro, 2011). Therefore, textbooks existence has a significant influence on learning process, and helps students' thinking processes in understanding concepts, especially Biology (Anagnostopoulou et al., 2012; Pop-Pacurar & Ciascai, 2010). Necessity of textbooks development especially cell biology material, based on overcoming students' difficulties to understanding the content of foreign language textbooks (not in Indonesian-Bahasa). Accordingly, the textbooks need to be prepared following the development of science and technology, and curriculum (Istiningrum et al., 2016; Puspitasari et al., 2016).

Several studies showed that metacognitive and critical thinking skill are important as supporting life skills in the 21st century. Metacognitive skill has a role in realizing successful learning in terms of good academic achievement (Dye & Stanton, 2017; Stanton et al., 2015; Vukman & Licardo, 2010; Young & Fry, 2008). The integration of metacognition in learning has impact to enhance students' learning abilities and metacognitive skills' aspect especially self-regulation. Students' self-regulation become better with integrated metacognition in learning process (Flavell, 1979; Livingston, 2003; Millis, 2016; Sawhney & Bansal, 2015). In actuality, students' metacognitive skills are relatively low. It seems by their inability to learn independently, and lecturer have not empowered students' metacognitive skills in their course (Adnan & Bahri, 2018; Danial, 2010; Lukitasari et al., 2014; Pujiank et al., 2016; Setiawan, 2018).

The same fact also occurs in critical thinking skills. Students' critical thinking skills are at the basic level and classified as low order thinking, so critical thinking skills need to be trained continuously during the learning process then student can be accustomed to using critical thinking in their life (Behar-horenstein & Niu, 2011; Fong et al., 2017; Hashemi et al., 2010; Kusumoto, 2018; Shim & Walczak, 2012). A Person who have good critical thinking skills will be able to apply their critical thinking process to solve their problems. Therefore, critical thinking skills also have an important role in life (P. A. Facione, 2000; Fong et al., 2017; Kim et al., 2013).

Beside of thinking skill, integrated between science and religion also importance to make students' character more religious. Science in Islam is defined as a form of internalizing Islamic values in learning science (Biology) to foster religious character in life (Turgut, 2016). The integration of *Qauliyah* verses in biology course can strengthen students' understanding and character which has an impact on the quality of learning (Arnentis & Suryawati, 2015). The integration of science in the "Muhammadiyah Higher Education/Perguruan Tinggi Muhammadiyah" environment means that there is no longer a separation between science and religion.

This paper explores the development of an integrated textbook with four components which is abbreviated to MERISKA (in Indonesian: "metakognisi, berpikir kritis, nilai Islam dan karakter"). Metacognition as outlined in the form of learning planning, monitoring, and evaluation of student learning processes. The critical thinking components that are practiced in the MERISKA textbook are in form of questions that integrated with critical thinking indicators (Interpretation, Analysis, Evaluation, Inference, Explanation, and Self-Regulation). Meanwhile, the components of the integration of Islamic values and characters are expressed in the form of the relationship between the biological content and the verses of the Qur'an.

The researcher noted that the development of textbooks was based on the role of textbooks that could help student learning activities and of the course help students' independent learning process at home during the Covid-19 pandemic (School from home). In addition, the limited number of textbooks on "cell and molecular biology" that are easily understood by students is also one of the reasons why this research was conducted. Although there has not been much research on the development of books on integrated metacognitive skills, critical thinking, Islamic values, and character, this research is expected to provide an overview of the combination of these components. Thus, the hypothesis in this study is that the development of textbooks integrated of MERISKA can be used to practice metacognitive and critical thinking skills, and embed students' religious character.

Method

Research Design

The research design of this study was a Research and Development (R&D). The development model used in this study is 4D (Define, Design, Develop, and Disseminate) by Thiagarajan *et al*. The 4D development model is used because this model is suitable for the development of printed textbook or PDF formats and the steps are systematic (see Figure 1). The aim of this study is produce a textbook "MERISKA" integrated with Metacognitive, Critical Thinking, Islamic Values and Character (acronym in Indonesia: MERISKA) focused on Cell and Molecular Biology course. This study involved elements that exist in university; they are students, experts, and lectures. Data collection techniques consist of (1) observation, (2) interviews, and (3) documentation studies.

The first stage of R&D research is Define. Define stage is a needs analysis stage which includes curriculum analysis (including Lesson Plan documents), student character analysis, task analysis, concepts, and learning objectives. This stage involved students and teacher from four universities, namely Universitas Muhammadiyah Prof. DR. HAMKA, Universitas Muhammadiyah Surakarta, Universitas Muhammadiyah

Malang, dan Universitas Islam Negeri Jakarta. Next is the Design stage consisting of the preparation of tests, selection of media, format, and preparation of the initial draft of MERISKA textbook. The third stage is Develop stage includes expert assessment and limited trials. The limited trial is a small group trial consisting of 23 students, and 2 lecturers as user of MERISKA textbook. The last stage is the Disseminate, which is promoting product development (MERISKA textbook) through Webinar series integration science and Islam. All stages of this research implemented by online considering the condition of the COVID-19 pandemic.

Data Collection and Analysis

The research instruments used include interview guides for subject lecturers, expert validation sheets, practical validation sheets by experts and users (lecturers), and a small group limited trial assessment questionnaire to assess the readability of the MERISKA textbook. Data were analyzed using descriptive statistics and converted in the form of percentages. The calculation results are matched into the validity criteria table (Table 1).

Table 1: Classification of textbook validity/practically

Interval Validity Score	*Category*
> 4.2	Very Valid/Practical
3.40 – 4.10	Valid/Practical
2.60 – 3.39	Valid enough/Practical enough
1.81 – 2.59	Not valid/Not practical
< 1.80	Very not valid/Very not practical

(modified by Jamrah et al., 2020)

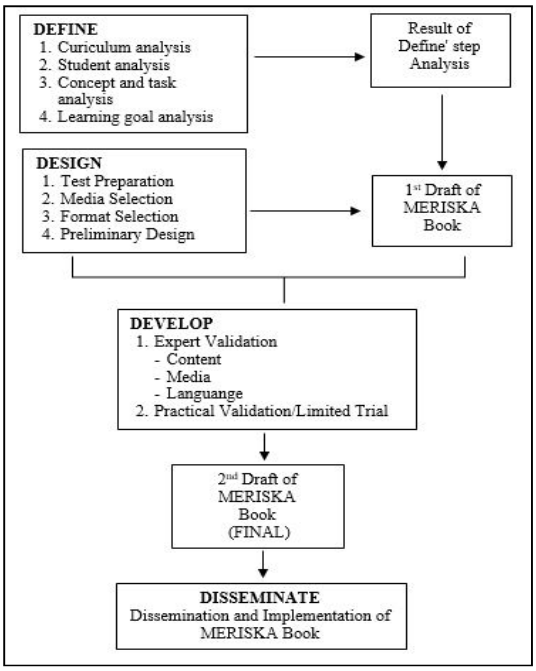

Fig. 1: 4-D Design research method are Define, Design, Develop, and Disseminate. Each stage represents the correlation between the overall stage to produce a textbook of integrated of MERISKA (Metacognition, Critical thinking, Islamic value, and Character).

Findings

The Textbooks are books that contain a particular field that are systematically arranged as a means of supporting learning, containing materials, methods, limitations, and evaluations. Textbooks are arranged with flow and logic in accordance with the learning plan, and according to the learning needs of students to achieve learning objectives (Susilowati, 2017) MERISKA's integrated Molecular Cell Biology textbook is a development textbook that is integrated with metacognitive, critical thinking, Islamic values and character values.

Cell and molecular biology is a branch of biology that studies the organization of living things at the cellular and sub-cellular levels. Cell biology and molecular biology are compulsory subjects that discuss about cell and molecule, including developmental phenomena that occur at the cellular or molecular level. Technological sophistication often makes people lulled towards anthropocentric and even secular tendencies. Whereas science studies can act as an interpretive tool that will elaborate further on the provisions contained in the Qur'an and hadith, which will ultimately lead to belief in the existence and power of God. Bransford, *et al*. (2000) identified metacognition as one of the three main principles in learning and recommended that the teaching of metacognitive skills should be integrated into curricula in various fields of study. Millis (2016) adds that there are at least 3 steps in integrating metacognitive skills in learning, namely: training them by taking notes from their own understanding, maximizing them with active learning strategies, and providing fee-backs for their practice efforts. Sabel *et al*. (2017) explained that training metacognition can be done by providing answer keys (keywords) and making learning reflections. Both of these things train students to be able to develop answers based on the concepts that have been studied and understood. Thus, the concept of metacognitive integration referred to in this book is to train students' metacognitive skills through metacognitive strategies during the learning process, such as taking notes, resumes or learning reflections and developing answers based on concepts that have been understood, and optimized by using active learning.

Not much different from metacognitive, Facione *et al*. (2016) explains that critical thinking can be trained by asking questions or problems. Chapman (2010) added that questions (questions) can be given at every meeting, so that students' critical thinking skills and understanding of concepts can be increase. Adams (2003) argues that lecturers who use handouts

(books) as a basis of knowledge, then discuss the questions given and communicate the results of these discussions, will indirectly train students to be skilled in answering and asking questions so that they will develop critical thinking processes as well as understand the concepts he learns. Therefore, the form of critical thinking integration in this book is described in the form of critical thinking questions and then discussed together. These activities are useful for training and improving students' critical thinking skills.

The integration of Islamic values with science material (Biology) in learning can be through by the development of learning tools that contain the contents of the verses of the Qur'an as a form of belief and devotion to Allah SWT (Amri et al., 2017; Hamzah, 2015; Hanif et al., 2016; Muspiroh, 2013; Nurdyansyah & Arifin, 2018). Arnetis & Suryawati (2015) explained that students' competencies will be better and have character if learning is inserted with Islamic values by providing examples of topic material discussed with Qauliyah verses (verses from the Qur'an). Another way is give a students' task to explore the relationship between the topic studied and the Qauliyah verse. For that, a lecture needs to create a textbook that integrated on Islamic values that contains with the verses of the Qur'an. Muspiroh (2013) also conveys that the Qur'an clearly states scientific matters through the existence of verses about nature (verses of kauniyah) so they instruct His servants to meditate. The integration of Islamic values needs to be supported by character strengthening through emphasizing the values given in the learning process. Giving simple examples related to useful values in life will make it easier for students to remember these examples. Thus, it is hoped that the MERISKA integrated book will not only help improve students' metacognitive and critical thinking skills but can grow their religious character, especially material of Cell Biology and Molecular course.

Assesment Results by validation Experts

Based on the results of validation by experts' material, media, and language, each validation aspect is matched with the product validity percentage table. The following summarizes the results of expert validation in Table 2.

From the Table 2 showed that the result of "MERISKA" textbook on average gets 4.53 or in category of Very valid. It seen by every aspect that assessed, namely content, graphics/layout, and language shows category Very valid category. The

Table 2: The result of MERISKA textbook validation by experts

Rated aspect	*Score validator*	*Category*	*Average score*
Content	4.43	Very valid	4.53 (Very valid)
Graphics/layout	4.40	Very valid	
Languange	4.75	Very valid	

content that integrated into the MERISKA textbook is assessed to have complied with the validity criteria. All validators agree to state that "MERISKA" textbook is suitable for use with minor revision. All aspects assessed are within acceptable criteria, so there is no need for major revision.

In addition, in the content section of each aspect of metacognition, critical thinking, Islamic values, and characters need to be clarified. This change can be seen from the composition of achievements from the Metacognition aspect, starting from "Planning", "Monitoring", and "Evaluating" which appear on the first page of each Chapter and also appear among the contents of the Chapter to indicate the achievements of the learning process that has been passed. Here's the graphic/layout view from the MERISKA textbook on Figure 2.

From Figure 2, it can be seen that the MERISKA textbook was revised according to advice by experts. Every indicator of metacognition and critical thinking is contained in the text. Metacognition indicators used are planning, monitoring, and evaluating (in Indonesian: "Rencanakan Belajarmu!", "Kontrol Belajarmu!", and "Evaluasi Belajarmu!"). *Planning* means that students are prepared their knowledge about the topics are learned on that day. In the textbook MERISKA, first page in each chapter explained and refers to target of learning process (in Indonesian: Sub-CPMK/Capaian Pembelajaran Mata Kuliah). Next is *Monitoring*, meaning that students have to re-explain or rewrite the concepts that they have learned to see how far they understand or not.

In addition, students are also answer some question about that concepts for practice their critical thinking skills. The last aspect of metacognition in the MERISKA textbook is evaluating. *Evaluating* means that students are forced to evaluate their understanding of all concepts in the learning process that they have been through. The evaluation technique used is to repeat all concepts that has been learned on that day by making "self-reflection" in form like a journal that contains concepts, answers of critical questions, and results of discussions in the learning process. Meanwhile, the display of critical thinking is contained in the form of critical questions that refer to Facione's critical thinking indicators. The following is a display of critical thinking content presented in Figure 3.

Another revised note by experts is integration of Islam and science. The content of integration of Islamic values is in the form of quotes from the Qur'an which are interpreted to have implied meanings and are related to the concepts being learned. Placement of integration Qur'an verses are conducted to reinforce concepts that was proved in Qur'an. Based on Fig. 3b, explained that integration of Qur'an verse reinforce concepts about the source of life comes from water, then followed by finding values of character (*Akhlaq*) from that integration. Meanwhile, according to advice by experts,

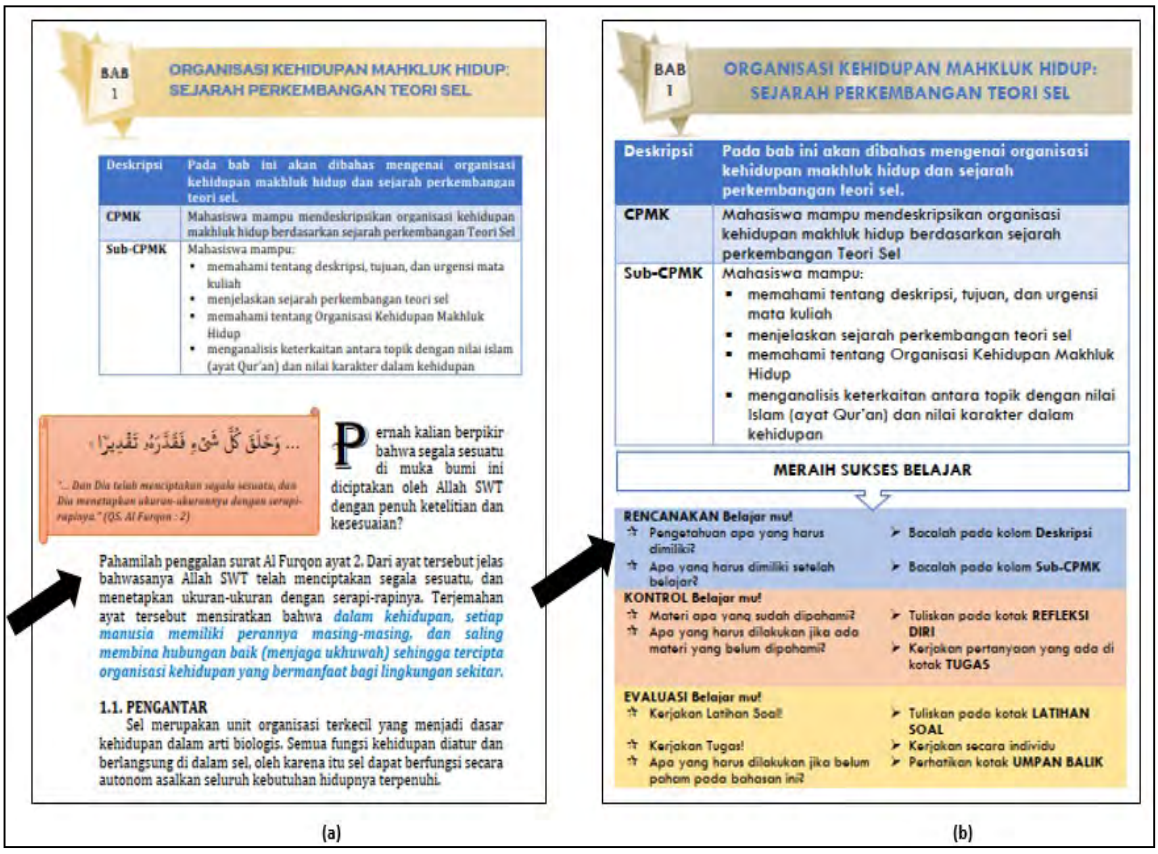

Fig. 2: Graphic/Layout view from MERISKA textbook; (a) before revision, (b) after revision. The arrow sign is the changes of the graphic/layout in the MERISKA textbook content according to advice by experts. The metacognition aspect performed on the first page of each chapter

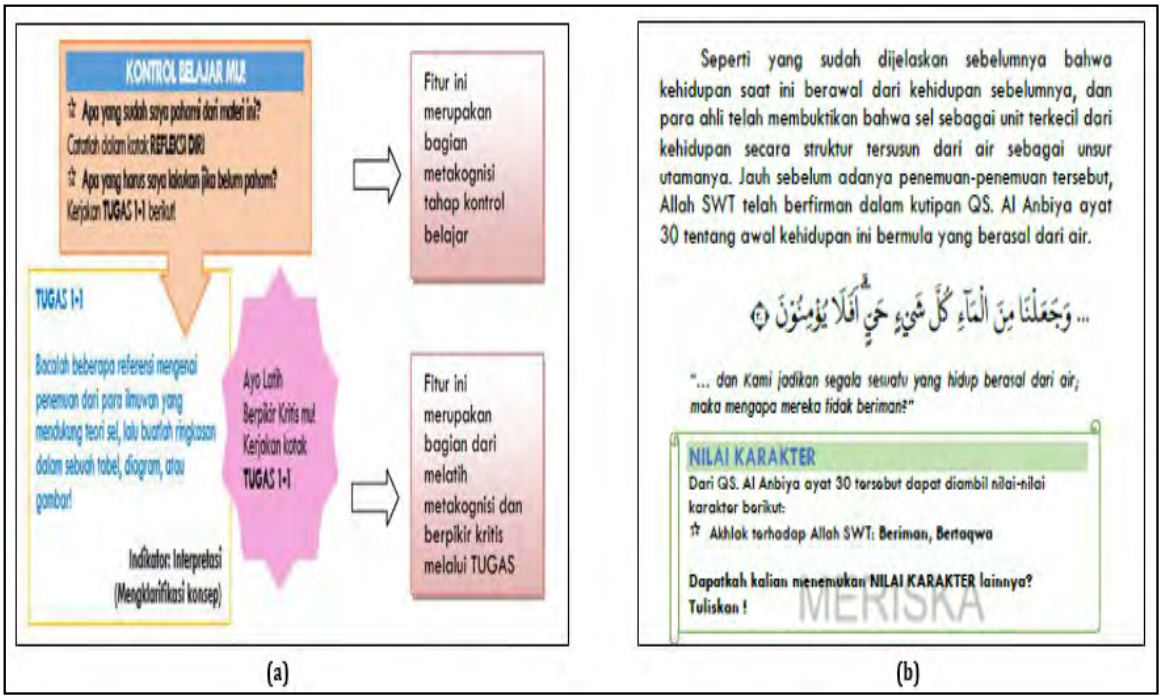

Fig. 3: Graphic/Layout view from MERISKA textbook; (a) metacognition aspect: Monitoring, then below is display of critical thinking aspect in form a question, (b) integration of Qur'an verse and Islamic value or character

MERISKA textbook need additional pages that containing of information "how to use MERISKA textbook" so it can help students to understand the concepts more clearly (see Figure 3a).

Individual and Small Group Trial

After the initial draft was completed, the next stage was individual and small group trials to see the practicality and legibility of this MERISKA textbook. The practical test was executed by two lecturers of Cell and Molecular Biology courses, while the readability test was performed in small groups involving 23 students. The following summarizes the results of practical and readability tests on Table 3 and 4.

MERISKA textbook were also rated "very good" by students as user, seen from the instructions for using the book, the key answers, and the assesment. It shown in the following Figure 4.

Product Revision

The next stage is the completion of the final draft before it is finally disseminated and implemented in Cell and molecular biology course. At this stage, several notes of improvement are summarized from the results of individual trials (practical tests) and small group tests (readability tests). The revised product is not only the MERISKA textbook, but the lesson plans and worksheets for students are also revised.

After revising according to suggestions from the parties involved, the product developed is ready to be implemented and enters the next stage, namely the Disseminate stage. The disseminate stage of the 4D Thiagarajan method has been modified as needed, so that the disseminate stage does not only promote the dissemination of the developed product but also conducts trials to see the effect of using textbooks on several components in the textbook, namely the metacognition component, critical thinking, and religious-Islamic character. Figure 5 is the cover design of MERISKA's integrated Cell and Molecular Biology textbook which has been revised as suggested.

Table 3: The result of MERISKA textbook validation by practicioners

Rated aspect	*Score Validator*	*Category*	*Average score*
Practicality for users	4.00	Practical	4.00 (Practical)
Content	3.75	Practical	
Languange & Graphic/layout	3.75	Practical enough	
Benefits	4.50	Very practical	

Table 4: The result of MERISKA textbook validation by students

Rated aspect	*Score Validator*	*Category*	*Average score*
Practicality for users	4.20	Practical	4.45 (Very practical)
Content	4.39	Very practical	
Languange & Graphic/layout	4.37	Very practical	
Benefits	4.83	Very practical	

Discussion

Based on the results of the research that has been analyzed, it is known that the development product in the form of the Cell and Molecular Biology textbook MERISKA is declared to satisfy the requirement for validity as a textbook. All inputs and comments from experts and users (both lecturers and students) provide improvements to the perfection of the textbook MERISKA then it suitable for use in the Cell and molecular biology learning process. MERISKA integrated textbooks received positive responses by lecturers and students. Students find it very helpful to learn by using MERISKA integrated textbooks, especially the conditions at the time of

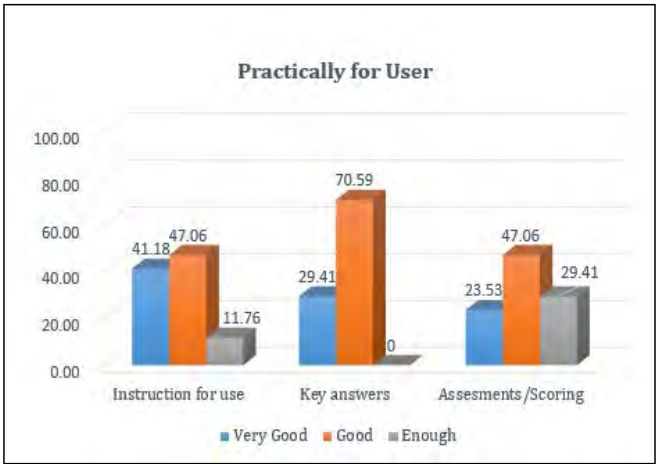

Figure 4. Diagram of Practically user (students)

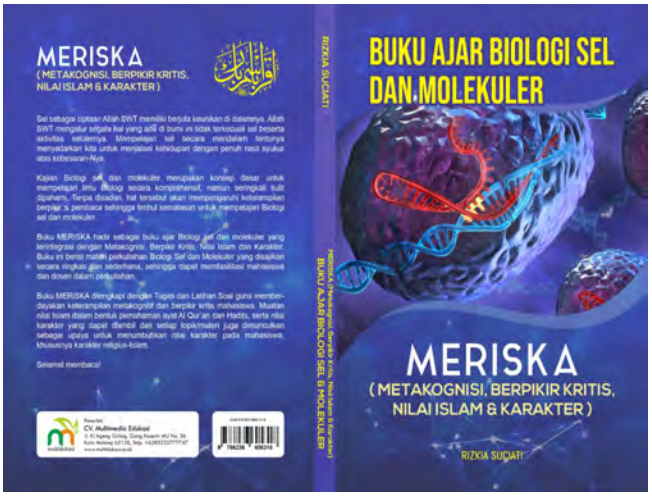

Fig. 5: Cover design of final draft the textbook of integrated of MERISKA

implementation were during the Covid-19 pandemic so that an online learning process (Study from Home). Students also argue that the textbooks presented make it easier for them to understand the content of material about cells and molecular that before considered abstract by them.

The existence of a load of thinking skill that lead to metacognition and critical thinking makes students have the motivation to change their learning style which was previously monotonous and lecturer centered. Rustham & Arifin (2012) said that the provision of content for science lessons (Biology) and the use of effective learning methods can develop reasoning and metacognitive skills and improve student learning outcomes. Kudari (2016) also said that through a combination of material content and the de-termination of academic skills, as well as interactive skills, lecturers can have a positive influence on student learning and development. Beside that the content of Islamic values in the form of linking the material with the verses of the Qur'an and finding character values in the material makes students motivated in learning, paying more attention to lessons, using various supportive learning strategies, and trying to read material to understand the lesson content. The insertion of verses of the Qur'an and hadith (verses of *Qauliyah*) in science learning content (verses of *Kauniyah*) provides an opportunity for students to think and reflect on the power and oneness of Allah SWT as the creator and ruler of the universe and its contents. Wulan *et al*. (2021) also argues that the integration of Islamic values in learning aims to improve the field of science by not being separated from improving the quality of faith and piety. More specifically emphasized by Ramli (2014) that the integration of Islamic religious teachings (Islamic religious values) into related sections in science subjects is an effort to form students who have Muslim personalities and make religious teachings a way of life, forming a physically balanced person, intellectual, spiritual and emotional (Rekan et al., 2016).

The disposition of important parts contained in the Qur'an and hadith in science learning content are spiritual strategies in integrated learning of Islamic values that enable students to gain more meaningful learning (Sabki & Hardaker, 2013). In the textbook MERISKA, students are stimulated to be able to relate the scientific knowledge they have learned to the basic concepts of Islam and their religious experiences as Muslims that already exist within them. Every material learned is certainly related to their daily lives and will be able to enrich students' understanding (Haristiani et al., 2017) and helps students feel the meaning of each subject matter they receive and can implement it in various aspects of life so that it is firmly embedded in students' memory and not easily forgotten (Sahlan, 2011). Djudin (2011) also conveys that the integration of Islamic values is carried out so that students do not fall into teachings that are contrary to creed and faith. These objectives are responsible for determining Islamic values that will be instilled in learning. The presentation of the discussion on aspects of product studies and the application of integrated learning of Islamic values as stated above, shows that the integrated textbook MERISKA has required criteria, namely the criteria of validity, practicality and effectiveness. So, the existence of the textbook MERISKA is expected to facilitate lecturers and students in an effort to improve metacognitive skills, think critically, and embed religious character in their life.

Conclusion

This study showed that result of developing the textbook MERISKA was have validity, practically, and effective criteria. Validity are obtained by the results of expert assessments, then practically and effectivity are shown through by the use if the textbook in learning process. MERISKA is a textbook for Cell and molecular biology course that integrated textbook with element of metacognition, critical thinking, Islamic values and character content to enhance metacognitive skill, critical thinking skill, and Islamic-religious character. Theoretically, this research certainly implies that MERISKA textbooks can help students' comprehension of biology material which is considered difficult, and limitation of textbooks. Insertion aspects of metacognition, critical thinking, Islamic values and characters contained in MERISKA textbooks can be enhance their metacognitive and critical thinking skills, and the insertion of Quranic verses provides an understanding to them that the dichotomy between Islam and science have no debated.

The results of this study has implication as practically that MERISKA textbook can be applied with all models of learning, so it helps students to understand Cell and molecular biology' concepts especially during pandemic situation, because the MERISKA was have receives ISBN and student can read by PDF form. Therefore, further studies are not limited only for widespread MERISKA textbook but for sustainable use of MERISKA to provide positive values in an effort to realize the main learning outcomes, like applied of metacognitive and critical thinking skill in their life, and also religious attitude. Furthermore, MERISKA textbook can be re-created series for another material Biology, like Evolution, Genetic, Human Physiology or Ecology.

Limitation

This study develops a textbook that integrates metacognition, critical thinking, Islamic values, and characters that specifically discuss the topic of Cell and Molecular biology. The contents of the book are topics that will be studied so that they are limited to theories about Cell biology and Molecular biology, not including practical content. The element of metacognition that is integrated is limited to the indicators of Planning, Monitoring, and Evaluation. The integrated critical thinking element refers to the indicators developed by Facione. Meanwhile, the elements of Islamic values are integrated with

the form of confirmation of the verses of the Qur'an or Hadith, which is followed by the character values (Akhlaq) implied from the content and verses of the Qur'an.

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