
THE DEVELOPMENT OF ISLAMIC INTEGRATED BIOCHEMICAL TEACHING MATERIALS USING FOUR STEPS TEACHING METHOD

Siti Suryaningsih^{1*}, Buchori Muslim¹ and Via Fitriani¹

¹*Department of Chemical Education, Tarbiya and Teacher Training Faculty,
UIN Syarif Hidayatullah Jakarta, Jl. Ir. H. Juanda, No. 95, Ciputat, Tangerang Selatan
15412, Indonesia*

**E-mail: siti.suryaningsih@uinjkt.ac.id*

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ABSTRACT

Islamic-integrated learning is one of the implementations in realizing UIN Syarif Hidayatullah Jakarta's vision. So, the teaching materials which are integrated with Islamic features are needed. This research aims to develop a biochemistry teaching material in the form of an Islamic-integrated enrichment book specifically on the theory of amino acid and protein that is feasible to be used. The method used in this study is the research and development method through the Four Steps Teaching Material Development (4S-TMD), which consists of selection, structurization, characterization, and reduction. The research data are obtained from the validation of Islamic-integrated chemical study by expert lecturers. The validation result was analyzed using the Guttman Scale, a comprehensive test of concept in the form of the main idea writing test on 60 students of 2016 generation of chemistry education were analyzed by giving a score of 1 for each correct answer, and a score of 0 for wrong answers, and the book's feasibility test in terms of language, presentation, performance, and graphic validated by media expert lecturers, and were analyzed using the Rating Scale. The validation of the Islamic-integrated chemistry shows that all concepts are powerful and worthy of being presented, with the percentage of 91.4%. The comprehensive test of concept shows that all of the concepts have a high level of comprehension. The percentage of students' comprehensions of all concepts amounted to 92.7%, and all of the concepts are included in the easy category. Therefore there is no need for a reduction phase. Based on the results of the feasibility test of the book, it is obtained the average percentage of 85.5%, which indicates that the Islamic-integrated enrichment book of amino acid and protein material is suitable to be used in the learning of Islamic-integrated biochemistry course to increase student knowledge on biochemical concepts through Islamic aspects which can increase the faith to Allah SWT.

Keywords: biochemistry, enrichment book, islamic integrated learning, teaching material

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1. INTRODUCTION

Education aims to bear human beings who are proficient in science and technology and create human beings who have moral and religious. It is based on the objectives of national education contained in *UU No. 20 Tahun 2003*: "...to be human beings who believe and fear to God the almighty, noble, healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens." According to Fauzan (2017), in the era of Science and Technology (IPTEK), which is loaded with information acceleration, technology demands the existence of universities to be able to bear human beings who are not only capable of overall science and intelligence with professional abilities but can also forcefully instill positive values contained in religion (Islam) in every movement of their life. Because ignoring Islamic values in the development of science and technology will have a tremendous negative impact on social-humanity and the universe (Batubara, 2018). Islam succeeds in creating an integrated science through an adjustment to Islamic values (Muslim & Fajriah, 2017).

UIN Syarif Hidayatullah Jakarta, as one of the Islamic Religious Universities, have a role in creating the professional and religious generation. This is reflected in the vision of UIN Jakarta. UIN Jakarta itself tries to reformulate its institutional vision, and there is "becoming a national and international campus that integrates Islam, science, Indonesia, and humanity" (Fauzan, 2017). One of the pillars mentioned in the vision of UIN Jakarta is excellence in the integration of science. The integration of science with Islam is an effort to integrate but not in the meaning of "mixed," between the source of science in Islam Al-Qur'an and Hadith because both have the same function, there is to understand

nature and life (Suprayogo, 2017). Integrated learning of Islam derived from Al-Qur'an and Hadith will guide learners in gaining strong beliefs and cultivate personality (Nugroho, 2017). The study of Islamic integration in science fields is very appropriate to do. Because there are many verses in *Al-Qur'an* that describe natural phenomena in several disciplines, such as environmental science, biology, and chemistry (Al-Hadabi, 2016). God created the universe for mankind (Muslim, 2016). Muslim et al., (2017) explains that most chemistry teachers in his research stated that chemistry learning based on Islamic knowledge would support students' knowledge of God's Omnipotence awareness.

Based on the explanation above, it does not close the possibility of Islam and science integration applied in biochemistry study because biochemistry is a branch of science that studies how chemical processes occur in living organisms, which in Al-Qur'an and Hadith discuss a lot about a living organism. Applying the integration of Islam and science to learning requires supporting learning tools such as Islamic integrated teaching materials. Enrichment book is one form of effective teaching materials to use by students in order to enrich the knowledge or material under review, another source of textbooks as the primary teaching material (*Pusat Kurikulum dan Perbukuan*, 2014).

The purpose of this research is to develop an Islam integrated enrichment book in biochemical study, especially amino acid and protein materials using the development model of Four Steps Teaching Material Development (4S-TMD) because the advantages of this development model are that the resulting product not only presents the selected material from several sources but also developed values that can be explored when studying the material (Hendri &

Setiawan, 2016), so the Islamic values derived from Al- Qur'an and Hadith can be contained in the material developed. This development model consists of four stages: selection, restructuring, characterization, and reduction (Arifin, 2016; Chasanah et al., 2019; Hendri & Setiawan, 2016). So, this development model is expected to produce an integrated biochemical enrichment book of Islam that is worthy of being used by students and other educational elements as an effort to enrich biochemistry based on Islamic views in Al-Qur'an and Hadith to foster a sense of faith in God for His power made for living things.

2. RESEARCH METHOD

This research took place in April 2019-June 2020. The object of this research is an Islamic integrated biochemical enrichment book on amino acids and proteins. These research subjects are chemistry education students UIN Syarif Hidayatullah Jakarta in the class of 2016/2017, also integration experts and media experts.

The method used is the research and development method, or Research and Development (R&D), producing educational products by following certain steps. The steps are carried out in accordance with the stages in the Four Steps Teaching Materials Development (4-STMD) model, which consists of the selection stage, the restructuring stage, the characterization stage, and the reduction stage. At the end of the study, the book feasibility test was conducted according to non-textbook assessment standards by *Pusat Kurikulum dan Perbukuan* (2014).

The initial stage of this research is the selection stage. The selection stage is a literature study to collect information related to the curriculum, select sources of teaching materials, and develop teaching materials

(Hendri & Setiawan, 2016). So there are several activities carried out at the selection stage, there are (1) analysis of Program Learning Outcomes (PLO) and Course Learning Outcomes (CLO) programs contained in the Semester Lesson Plan of biochemical courses, (2) analysis of Islamic integration models, (3) collecting sources of teaching materials related to the material, (4) developing indicators, (5) making concept analysis, (6) making a conformity table of Islamic integrated biochemical material, (7) conducting material validation.

The structure stage is a stage that is carried out to develop the material in a didactic. Some of the activities carried out at this stage are (1) making concept maps, (2) macro structures, (3) multiple representations, (4) drafting teaching materials.

At the characterization stage, the concept that has been developed to be further developed into a basic idea writing test was tested to 60 chemistry education students in the class of 2016/2017, aiming to be able to test the level of students' understanding toward the draft teaching materials (Ashri & Hasanah, 2016). In addition, at the bottom of the instrument test, there is also a feedback column for students to assess the difficulty level of the concept, so the data from the characterization stage can identify easy and difficult concepts (Arifin, 2016).

The didactic reduction stage reduces difficult concepts from the characterization stage to be retested, so all the resulting concepts have an easy category.

This research is expected to produce products in the form of enrichment books worthy of being used in biochemistry courses. Therefore, this research's final stage is to conduct an appropriate test of enrichment book that has

been developed using teaching material properness test instrument adapted from Non-Text Book Assessment Guidelines by Pusat Kurikulum dan Perbukuan (2014). The tests conducted at this stage include aspects of languages, presentations, performances, and graphics.

There are several data analysis techniques used. It is in the material validation data used the Guttman scale with a score calculation of 1 for the answer "yes" and a score of 0 for the answer "no" (Riduwan, 2010). The data is then analyzed by calculating the percentage of totals obtained using the formula (Riduwan, 2010):

$$\text{Percentage} = \frac{\text{Total Score}}{\text{Maximum Score}} \times 100\%$$

According to Riduwan (2010), the percentage obtained is then interpreted into the eligibility criteria with the categories contained in Table 1 as follows:

Table 1. The Appropriateness of Teaching Materials

Percentages (%)	Categories
0 - 20	Highly Unworthy
21 - 40	Not Worth It
41 - 60	Pretty Decent
61 - 80	Worth
81 - 100	Very Worth It

Data gained at the characterization stage is analyzed by providing a score of 1 for each correct answer and 0 for the wrong answer. The total value obtained is calculated the percentage as in the previous stage, then making groups level of understanding based on the criteria in accordance with Rankin and Culhane (Arifin, 2016) contained in Table 2.

Table 2. The Criteria Level of Text Comprehension

Criteria Level of Text Comprehension (%)	Comprehension Level
$60 < K \leq 100$	High (Independent Category)
$40 < K \leq 60$	Medium (Instructional Category)
$K \leq 40$	Low (Difficult Category)

Data analysis techniques used in the results of appropriate book test is scoring with Rating Scale, according to Riduwan (2010) with the score in the range scales 1 to 4. The resulting data has calculated the percentage as the previous stage, and the data is interpreted by grouping the appropriate criteria of a book in the material validation results at the selection stage; therefore, it can be known whether the resulting of Islamic integrated biochemical enrichment book is appropriate to use or not.

3. RESULT AND DISCUSSION

In producing Islamic integrated biochemical teaching materials, researchers used the Four Steps Teaching Material Development (4S-TMD) model, which consists of selection, restructuring, characterization, reduction, and the resulting teaching materials are worth to be used, so at the end of the study conducted appropriateness test of teaching materials. Thus the results and discussions will be explained based on the stages that have been done.

3.1. Selection Stage

The selection stage includes several activities carried out as the initial stage of enrichment book development. The first activity is to analyze the Learning Outcome Program (PLO)

and Course Learning Outcome (CLO) in the lesson plan biochemistry course. The results of the analysis of PLO and CLO showed that the study of biochemistry courses is expected to foster a sense of piety in God's and religious attitudes of students, master the concept of biochemistry and connect it with daily life. Lesson plan researchers also know the scope of what sub materials should be mastered from the study of biochemistry on amino acid and protein materials. Therefore, from the analysis of learning achievements in lesson plan, the development of amino acids and proteins that are integrated into Islam is the right thing to realize the learning achievements. Lesson plan analysis is also carried out by (Muslim et al., 2020) to adjust the concept to be taught in lectures.

After knowing the learning achievements in lesson plan, an analysis of Islamic integration is carried out to determine the integration of biochemical material with Islam. Obtained from the research, the integration carried out is with the Al-Qur'an, Hadith, moral faith, and fiqh. Integration in this research refers to the Integration Guidelines listed in the Decree (SK) Rector UIN Jakarta (2017), there is in the integration of natural sciences, and Islam can be done by making the text of the Al-Qur'an and Hadith as a source of inspiration or reference source of science development, providing Islamic values as the basic and reference for the application of science. Supported by several studies that have been done, including research by Fauzan (2017) which makes the Al-Qur'an and Hadith as a source in integrating Islam and science presented in an integrated manner, Zain & Vebrianto (2017) stated that the subjects of science clumps (Physics, Chemistry, Biology) could be integrated with religious materials (Qur'an, Hadith, Fiqh, moral faith), and also Yusuf's research (2011) states that science can

be integrated with Islam sourced from the Qur'an in which it has moral value.

After the results of the analysis of learning achievements and integration models, the collection of references in the form of several biochemical textbooks that are used as the primary sources, namely the book Biochemical Basics (Sumarlin, 2018), The Basics of Biochemistry (Poedjiadi, 1994), Biochemical Basics (Lehninger, 2005) and other references as supporting sources in the form of encyclopedias of Islamic science and interpretation of the Al-Qur'an. Material analysis based on sourcebook collection resulted in 36 concepts on amino acid and protein materials analyzed in concept analysis tables. Concept analysis is compiled to maintain the concept's purity and avoid misconceptions (Ramli et al., 2019).

From the 36 concepts, 21 concepts can be integrated with Islam. Therefore, the integrated chemical concept is developed indicators of integrated amino acid material Islam, along with a description of its connection to a table of amino acid and protein material relationship with Islam, which is further validated by the material's expert lecturer. Validation by experts is carried out to determine the relationship between the concept of chemistry and aspects of Islamic integration, whether appropriate or not (Suryaningsih et al., 2020). Validation of material obtained a percentage value of 91.4%, a powerful category according to Riduwan (2010), with some improvements in the writing of Hadith translations, which indicates that the material presented is very worth to use. All concepts have been integrated with aspects of Islam. Some concepts are integrated with verses of the Qur'an, Hadith, fiqh, and moral faith. This result is in accordance with Muslim research

(2017), which states that chemical concepts can be integrated with Islam.

This selection stage has produced a draft of amino acids and proteins that are integrated into Islam and have been in accordance with the learning achievements (PLO and CLO) in the lesson plan. This is in accordance with the purpose of the development of teaching materials using the Four Steps Teaching Material Development (4S-TMD) model that is to produce quality teaching materials in accordance with the demands of the curriculum (Ashri & Hasanah, 2015), and the development of values that can be explored when studying the material (Hendri & Setiawan, 2016), in this study the value developed in Islam.

3.2 Structurization Stage

The structurization stage is carried out to develop the material that has been validated at the selection stage. Therefore the concepts in the material can be structured in a didactic. According to Syamsuri et al. (2017), this can facilitate students associating one concept with another then student knowledge can be more structured. This stage produces several research results based on several activities carried out. The first is the concept map. The concept map was created to connect the concepts available because, according to Arifin (2016), the concept map can show one concept's relationship with another. Concepts are structured from a familiar concept to a specific concept accompanied by examples.

The second is the macrostructure. The creation of macro structures is carried out to outline the concepts presented in the enrichment book. From the macro structure which has been created, it can be determined that the enrichment book developed contains 6 chapter titles.

The last result obtained from the structure stage is multiple representations. All concepts contained in the concept analysis are equipped with three levels of representation consisting of microscopic, submicroscopic, and symbolic levels. The three levels of representation made to arrange the useful material to provide understanding to students in learning the materials in teaching materials because the material to be presented on the teaching material will be adapted to the image, symbols, or other chemicals, visual languages related to the material, in line with Windayani et al. (2018) to minimize misconceptions in students. The teaching materials used should look at the completeness of some levels of chemical representation. The creation of structure or material structure in the concept maps, macrostructures, and multiple representations at the structurization stage was also carried out by Rahman et al. (2019) and Wahidiyah et al. (2018) in their research to produce teaching materials, so the material presented has a systematic arrangement.

These structure stage results are used to compile the material in the enrichment book to be produced. The difference of biochemical teaching materials in this study is located in the integrated biochemical material of Islam. So the researchers compiled amino acids and proteins with explanations in terms of Islam that is strengthened by verses of the Al-Qur'an and Hadith. In addition to arranging the material to be structured, the author also arranges the layout between biochemical material, the writing of Al-Qur'an verses and Hadith, and images related to the material. Researchers also designed the contents of the book to add aesthetic value.

3.3 Characterization Stage

The characterization stage is carried out to determine the level of students'

understanding of the concept presented in the teaching material and to identify whether there are complicated concepts of all available concepts. From the basic idea writing test results containing 21 concepts, the whole concept gets a percentage result of the concept understanding level above 80%, so the total percentage of average obtained is 92.7%, as shown in table 3. The 21 concepts tested were: (1) amino acids, (2) amino acids with non-polar side chains (hydrophobic), (3) negatively charged amino acids, (4) positively charged amino acids, (5) electrolyte solution, (6) protein, (7) enzyme, (8) protein structure, (9) protein movement, (10) protein defense, (11) protein transport, (12) primary protein, (13) secondary protein, (14) tertiary protein, (15) keratin, (16) collagen, (17) albumin, (18) globulin, (19) histon, (20) protamine, (21) denatured proteins.

Table 3. Characterization Basic Idea Writing Test Results

No.	Concept Comprehension Percentage (%)	Comprehension Levels	Categories
1	82	High	Easy
2	87	High	Easy
3	90	High	Easy
4	93	High	Easy
5	98	High	Easy
6	98	High	Easy
7	97	High	Easy
8	100	High	Easy
9	92	High	Easy
10	98	High	Easy
11	97	High	Easy
12	92	High	Easy
13	97	High	Easy
14	80	High	Easy
15	93	High	Easy
16	97	High	Easy
17	95	High	Easy
18	98	High	Easy
19	98	High	Easy
20	98	High	Easy
21	68	High	Easy

No.	Concept Comprehension Percentage (%)	Comprehension Levels	Categories
Average	92,7	High	Easy

Based on the grouping of understanding levels, if the range is between 60% to 100%, it is classified as high (independent category) (Arifin, 2016). So it can be known that all concepts presented have a high level of understanding by students.

The feedback section at the bottom of the main idea writing test sheet is provided with the aim that students can respond to general concepts, whether they fall into easy or difficult categories. The results obtained from the feedback section are all concepts provided are easy for students to understand. The level of understanding of teaching materials is an important thing that must be considered in developing teaching materials. As Ashri & Hasanah (2016) stated, suitable teaching materials are teaching materials that are easy to understand by the user.

The main idea writing at the characterization stage was also carried out by Arifin (2016) and Hendri & Setiawan (2016) in the research to find out the level of understanding of concepts by students and identify difficult concepts.

3.4 Reduction Stage

The reduction stage is carried out when a concept has a low and moderate level of understanding. According to Munawwarah & Anwar (2016), they say the reduction stage is a stage that is carried out to reduce the problematic concept of teaching materials developed. Hence, teaching materials are more comfortable for students to understand. In this research, all concepts that have been tested to students have a high level of understanding and fall into an easy category,

and then the reduction stage is not necessary to do in this research.

3.5 Appropriateness Test of Enrichment Book

This research's final result is developing teaching materials of biochemical enrichment books integrated Islam worthy of use. Therefore, after passing the stages in the development model of Four Steps Teaching Material Development (4S-TMD), at the end of the research conducted appropriate book test that aims to provide an assessment of enrichment books, then it can be determined whether the resulting book is worthy to use or not. Expert lecturers of learning media carry out the test. The aspects assessed on enrichment books are based on the Guidelines for Non-Text Book Assessment by *Pusat Kurikulum dan Perbukuan* (2014). Assessment of material aspects has been done at the selection stage by expert lecturers. By adapting the assessment instruments by *Pusat Kurikulum dan Perbukuan* (2014), the book's assessment is entirely done on aspects of language, presentation, performance, and graphics. The results of the assessment by expert lecturers of learning media can be seen in table 5.

Table 5. Appropriateness Result Test

Assessment Aspects	Percentage Score	Categories
Language	81,2%	Good
Serving	75%	Good
Performance	80%	Good
Grafika	87,5%	Very Good
Average Percentage of Total Score	85,5%	Very Good

In the table above, it can be shown that the graphic aspect gets the highest percentage value of 87.5%. This indicates that the book contains writing with selection type and size of letters that are easy to read, have a clear and interesting design and layout, and contain clear illustrations. This is because researchers have made improvements to selecting previously less readable typefaces replaced with typefaces with a high readability rate (clearly readable). After all, the important part for readers is the readable typeface (Ambarwati, 2019). In addition, books have been designed to add aesthetic value. According to Ambarwati (2019), the main focus of readers in terms of graphics is the use of color and attractive graphic design to make the reader want to read the book's contents. The resulting teaching material is an integrated biochemical enrichment book of Islam, so there are many Verses of the Qur'an and Hadith, which are displayed with visual frames in each verse, thus adding aesthetics to the book. The book has also arranged the layout to match some material explanations, verses, and images on each page.

The average percentage gained in the second-highest score is the language aspect, which is about 81.2% with good categories. This indicates that the language used is in accordance with the rules of good and correct Indonesian language. The language used is communicative, and the sentences arranged are easy to understand. Before conducting the due diligence, the author has made several improvements to the language aspect to get good writing results, because according to Jannah et al. (2018), the language needs to be presented as best as possible; therefore, the message conveyed is easy to understand.

The third score is in the performance aspect with a percentage value of 80% and classified as a good category, indicating that the

resulting book has a neat-looking finishing touch. The book is easy to use. This relates to book printing activities. Undeniably, the printer is one of the important elements that contribute to working with the author to create a book. *Pusat Kurikulum dan Perbukuan* (2014) states that the printer is related to visuals (books) and books' physical embodiment.

The presenting aspect gets the lowest percentage value of 75% with a good category. The presentation aspect referred to the statement from the Center for Curriculum and Books (2014). It is noted that the presentation is related to the packaging or structuring of the material to affect the reader. Based on the value obtained indicates, the enrichment book has presented well-packaged material and supported by illustrations that correspond to the material so that it is interesting to read.

4. CONCLUSION

Based on the research, it can be assumed that the development of teaching materials in the biochemical enrichment books integrated by Islam can be carried out using the development model Four Steps Teaching Material Development (4S-TMD), which consists of several stages, there are selection, restructuring, characterization, and reduction. At the end of the study, the appropriate teaching materials test was completely done to determine that the resulting teaching materials were appropriate for use. The existence of Islamic integrated biochemical teaching materials that have been produced is expected to support the study of biochemistry integrated Islam.

This study limits the focus of the material studied, namely amino acids and proteins in biochemical courses. It is expected that further

research can be carried out on the integration of Islam in other chemicals.

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