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Research Artikel

DEVELOPMENT OF ISLAMIC-INTEGRATED CHEMISTRY TEACHING MATERIALS ON CELL AND BIOMOLECULE MATERIALS

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Abstract

Integration between science and Islam is still not maximally applied in Chemistry Education UIN Syarif Hidayatullah Jakarta. This is because learning facilities regarding Islam and science are still lacking. This study aims to develop an Islamic integrated enrichment book of chemistry which focus on structure and function of cells material. The method that used is 4STMD (Four Step Material Development). There were four steps conducted by the researcher, it was a selection, structuring, characterization, and reduction. The evaluation were carried out by the experts on Islamic integration material, using test cloze and intervention of feasibility test from language, presentation, performance, and graphics aspects. The results obtained at the selection stage are 12 of the 21 concepts declared feasible with the results of the percentage of material eligibility of 100%. At the structuring, 12 valid draft teaching materials were obtained. Validation result showed the appropriateness of each concept from the expert. Assessment for characterization test obtained an average of 12 concepts have a high level of understanding with 84,33% are belong in easy category. Feasibility test present a very good categorized which proven by the percentage 85,94%. The enrichment book can be used as a reference of integrated Islamic chemistry for students in Biochemistry courses, especially the material structure and function of cells in order to integrate Islamic science and science in daily life.

Keywords*: Critical Thinking; Climate Change; Junior high school students; Problem Based Learning (PBL); TPACK.*

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INTRODUCTION

State Islamic Religious Universities (PTKIN) in Indonesia, with the largest Muslim majority in the world, is committed to integration by trying to eliminate the dichotomy between science and religion and focusing on developing human resources. One of these universities is UIN Syarif Hidayatullah Jakarta, which has a vision of becoming a world-class, research-based university with the advantage of integrating science, Islam and Indonesianism. (Lubis et al., 2022). The integration developed at UIN throughout Indonesia refers to the divine truth that the source of all knowledge comes from God, namely Allah SWT. In other words, scientific integration actually wants to combine the truth of the Qur'an with the truth of science which is implemented in the educational process (Rifai et al., 2014). This is important because the integration of Islam and science requires real action and not just a concept for the entire academic community (Suciati et al., 2022; Suyadi & Widodo, 2019). Curriculum integration is also important in order to implement the integration of Islam and science which must be carried out by all educational actors, in this case teachers who teach in class. (Woodford, 2020; Fauzan, 2017). Integration can be interpreted as a combination of its constituent elements (Z. Zain & Vebrianto, 2017). The term integration of Islam and science is also understood as an effort to bring together, combine or establish a partnership between science and religion in an effort to mix and match science and religion. (Khalid et al., 2022). This concept tries to provide an equal portion between science or knowledge and the Islamic religion based on Islamic universal values, which are based on qauliyah verses (Al- and hadith) and kauniyah verses (natural phenomena) (Hasan, 2023); (Yani & Joewono, 2021); (Nadila et al., 2022). The combination of affairs of the world and the hereafter, physical and spiritual, material and spiritual into one unity that both originate from Allah SWT (Fauzan, 2017).

The integration of chemistry with Islamic values is important as an effort to mix and match chemistry with Islamic values so that the two become a unified whole in order to eliminate the dichotomy between the two (*Muslim, 2016*). The integration of science (chemistry, physics and biology) with Islam is an effort to mix and match between science and religion, by combining the two sciences which are sourced from the Qur'an and Hadith as well as surrounding natural phenomena (Nuryantini, 2018; El-Seedi et al., 2019). There are various models and interpretations in explaining the word "Integration", one possible meaning of "Integration" is the combination of science and chemistry (Aqsha et al., 2009).

The integration of chemistry with Islamic values has been implemented in several countries, including Malaysia with the ASASI (Malaysian Islamic Science Academy) scientific integration model, England with the Personal Religious Beliefs (PRB) Integration model, France with the Bucaillism integration model, Iran with the Philosophy-Based Scientific Integration model Classical, Palestine with the IFIAS (International Federation of Institutes of Advanced Study) scientific integration model and others (Hashim & Ssekamanya, 2013; Freitas et al., 2018). Integration in higher education is carried out by Malaysia by implementing integration between chemical and Islamic concepts, such as at the International Islamic University of Malaysia. Meanwhile, UIN Jakarta applies integration between chemical concepts and basic concepts of Islamic values in the Value Integration and IIP (Islam and science) courses (Ramli & Muslim, 2019).

The Value Integration and IIP courses require students to be able to integrate Islamic values in the chemistry learning process. According to Buchori (2016), integrating chemical concepts with Islamic values is very important in the chemistry learning process. The reality shows that the integration between chemical concepts and Islamic values has not been fully implemented. One of the things that

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hinders the implementation of integration between chemistry and Islamic values is that there is no integration model between chemical concepts and Islamic values in the courses taught. In fact, Islamic integration has been developed in universities in Malaysia (IIUM) (Hashim & Ssekamanya, 2013; Zain et al., 2016).

Debate regarding integration has occurred among Islamic scholars, some state that there is no correlation or relationship between chemistry and Islamic values, but there are also those who state that there is a close relationship between chemistry and Islamic values (Munadi, 2016; Rachmatullah et al., 2022; Zain et al., 2020; Tajuddin et al., 2014; Kasmo et al., 2015). For this reason, it is necessary to develop an integration model between chemistry and Islamic values to obtain chemical material that is integrated with Islam. There are 5 stages of the integration model between chemistry and Islamic values. First, determine the chemical material. Second, carry out concept analysis. Third, create a macro structure. Fourth, integration or merger. Fifth, the chemical construct is integrated with Islamic values. The expected research results are to obtain an integration model between chemistry and Islamic values and produce chemical materials integrated with Islamic values (Jamal, 2017).

Islam does not differentiate between religious and general education (Rasyid et al., 2022). Both complement each other and are studied simultaneously in an Integrated Education system which aims to instill prosperity in this world and akhirat (M. A. Lubis & Wekke, 2009). Islam is a religion that is in accordance with human nature, where its sharia not only encourages humanity to study the concepts of science and technology, then build and foster world civilization, it can even direct its people towards the salvation of this world and akhirat (Z. Zain & Vebrianto, 2017). The Islamization of science is an important step to return to the main legacy of Islamic knowledge to reconstruct the revival of superior Islamic civilization (Zain et al., 2020; Fauzi, 2017).

As a form of implementation of UIN Syarif Hidayatullah Jakarta's vision of integrating Islam and science, the Chemistry Education Study Program applies these two sciences in chemistry learning, one way is by developing teaching materials in the form of chemistry enrichment books integrated with Islamic values in several courses, one of which is in the Biochemistry courses, especially cell structure and function (Issn & Issn, 2023; Mustafa et al., 2021); AlJuwaie et al., 2020).

The development of teaching materials in the form of a chemical enrichment book integrated with Islamic values was developed using a method developed by Anwar in (Arifin, 2015). In the process of processing teaching materials, there are four stages that must be taken before the teaching materials are suitable for delivery to students. The four steps are the selection, structuring, characterization and reduction processes. These four steps are referred to as 4STMD (*Four Steps Teaching Material Development*) (Arifin, 2015). 4STMD is a method for developing teaching materials that can be used to obtain quality teaching materials according to the needs and demands of the curriculum (Ashri et al., 2015; Ashri & Hasanah, 2019). Use of the Four Steps Teaching Material Development (4STMD) as a guideline in developing quality teaching materials, because 4STMD has clear stages (Syar, 2016). The advantage of the Four Steps Teaching Material Development (4STMD) is that it not only selects or selects subject material from teaching material sources, such as: textbooks or other reference books, but also develops values that students can explore when studying the subject material (Hendri & Setiawan, 2016).

The aim of this research is to develop teaching materials in the form of a chemical enrichment book integrated with Islamic values in material on cell structure and function using four steps for developing teaching materials

(4STMD). This enrichment book can be useful as a chemical reference integrated with Islamic values for students in Biochemistry courses, especially material on cell structure and function so that they can integrate Islamic knowledge and science in daily life (Liany et al., 2018).

METHOD

This research uses the Research and Development (R&D) method, which is a research method used to develop or validate products used in education and learning. The subjects of this research were students of Chemistry Education at UIN Syarif Hidayatullah Jakarta, semester 7 class 2016/2017 with a total of 60 students using a purposive sampling technique. The product obtained is in the form of quality teaching materials in the form of a chemical enrichment book integrated with Islamic values in material on cell structure and function which was developed using 4STMD including four stages of development, namely selection, structuring, characterization and didactic reduction (Andrianto, 2017).

The selection stage carried out activities, analyzing several needs including determining the main textbook on cell structure and function which will be used as the main reference source in developing enrichment books, conducting PLO (Program Learning Outcome) and CLO (Course Learning Outcome) analysis, developing indicators, conducting analysis concepts, Islamic integration related to cell structure and function material, and analyzing the relationship or connection of Islamic integration related to cell structure and function material which will be presented in the enrichment book. After that, at the selection stage, the first revised draft of the material is prepared. At the structuring stage: create a concept map that is integrated with Islam, create a macro structure, namely create a sequence of material that will be presented in learning so that learning will take place systematically, and create multiple representations (compound representations) (Zain et al., 2020). Then after that, draft material 2 which is a combination of concept map, macro structure and multiple representations. Draft 2 was prepared based on the revision of draft 1.

In the characterization stage, the following activities were carried out: 1) Creating a characterization instrument in the form of random test questions equipped with a level of understanding of 12 questions for each question. 2) Conduct product trials that have been created at the selection and structuring stages. 3) Conducting a comprehension test on a trial class of 60 people. 4) Identifying difficult concepts through analysis of the results of comprehension tests and identification of difficult concepts in the feedback section of teaching materials. The didactic reduction stage includes the stage of compiling a didactic reduction grid that includes the original text, the chosen reduction method, and the text that has been reduced, carrying out a didactic reduction of the concept. The reduction process is carried out by reducing difficult concepts based on the identification results at the characterization stage and preparing draft material 3 which is the result of didactic reduction which has been neatly arranged and ready to be tested in the field.

The data obtained in this research is the suitability of teaching materials and students' understanding of teaching materials. The appropriateness of teaching materials includes four aspects, namely language, presentation, performance and graphics. The feasibility of teaching materials can be determined by the percentage of each component of feasibility. A book is said to be eligible if it meets the following criteria:

Table 1. Criteria for assessing the appropriateness of teaching materials

Intervals	Category
81% - 100%	Very good
61% - 80%	Good
41% - 60%	Pretty good
21% - 40%	Not good

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0% - 20%	Very Not Good

(Muslim et al., 2021)

The criteria for the characterization results that have been obtained can be categorized based on comprehensibility categories according to which can be seen as follows:

Table 2. Criteria for Text Comprehensibility

Percentage	Level of Understanding
$60 < P \leq 100$	High (Self Category)
$40 < P \leq 60$	Medium (Instructional Category)
$P \leq 40$	Low (Difficult Category)

(Arifin, 2015)

RESULT AND DISCUSSION

Prospective teachers who graduate from UIN Jakarta chemistry education will be placed in SMA/MA/SMK schools, of course the scope of determining the chemical material that will be integrated will be adjusted to school needs. The following is the material taught in high school, namely: History of Chemistry, Systems Periodic Table of Elements, Chemical Bonding, Chemical Formulas and Nomenclature of Chemical Reaction Equations, Atomic Model Structure, Intra-Intermolecular Forces, Hybridization, Molecular Geometry, Stoichiometry, Electrolyte and Non-Electrolyte Solutions, Petroleum, Hydrocarbons, Acid-Base Solutions, Buffer Solutions, Salt Hydrolysis Solutions, Solubility and Solubility Products (KSP), Colloid Systems, Thermochemistry, Reaction Rates, Chemical Equilibrium, Colligative Properties, Elemental Chemistry, Radiochemistry or Core Chemistry, Oxidation-Reduction Reactions, Electrochemistry, Corrosion (Rusting), Macromolecules, Functional Groups, Benzene and its Derivatives (Safkolam et al., 2021; Donia & Mortada, 2021).

The development of teaching materials in the form of chemical enrichment books integrated with Islamic values in the material of cell structure and function through 4STMD (Four Steps Teaching Material Development) includes four main stages, namely: First, the selection stage, namely selecting textbooks according to biochemical material which will be integrated with Islamic values as main reference source. The second stage is structuring, namely sorting the concepts of biochemical material integrated with Islamic values in the draft collection of selection material in the form of a layout (product display). The third stage of characterization, namely writing or conveying the main idea in a teaching material to determine the level of understanding of the discourse and the level of difficulty (complicated or complex) of the concepts, which will later be reduced if the concept is still considered difficult. and Fourth, the reduction stage, namely simplifying discourse that is considered difficult in a teaching material. The following is a presentation of the research results at each stage.

1. Selection Stage

At this stage the researcher analyzed several needs to obtain draft material 1, including selecting the main book as the main reference source, namely the book by Anna Poedjiadi and Titin Supriyanti in 2012 with the title Dasar-dasar Biokimia. After that, carry out a PLO and CLO analysis to determine the implementation of UIN Syarif Hidayatullah Jakarta's vision regarding Islamic integration as applied to the Chemistry Education Study Program. From the analysis results obtained, it is known that the Chemistry Education Study Program has made efforts that are in accordance with the vision of UIN Syarif Hidayatullah Jakarta in terms of integrating Islam with general science, especially in this case chemistry, which is outlined in learning activities.

Building an integrated chemistry concept with Islamic values is different from concepts that do not have Islamic values because it requires harmony in conveying the material to be taught. The sub-concepts contained in the concept map are then integrated or combined with Islamic values originating from Allah

SWT, such as: the Al- and Hadith and phenomena of the universe (Yani & Joewono, 2021);(Fahyuni et al., 2020). Chemical sub-concepts that have Islamic value will be processed and proceed to the next stage, namely the integrated chemical construct, while chemical sub-concepts that do not have Islamic value will not proceed to the next stage. This can be proven by the existence of PLO which states that students are able to master basic scientific, Islamic and Indonesian concepts in school chemistry material. Then after that the researcher developed indicators that had been made into Islamic integrated indicators, analyzed the concepts from the initial 21 concepts to 12 concepts that could be integrated with Islam, then the 12 concepts were validated by material and integration experts. Of the 12 concepts validated by experts, 12 concepts were declared valid with a percentage of 100%.

Concept analysis is the identification of chemical material concepts that refer to journals (Herron et al., 1977) in which the main basics will be presented and refer to the basic competencies and indicators that have been determined. Or it can also refer to learning outcomes and learning outcome programs. Concept analysis consists of concept labels, definition/understanding of concepts, types of concepts, concept attributes, concept hierarchy (superordinate, coordinate and subordinate), examples and also non-examples that are appropriate to the concept to be analyzed.

Lastly, analyze the relationship between Islamic integration and the structure and function of cells. As a reference in integrating Islam into the material of cell structure and function, the researcher refers to the Technical Guidelines (Juknis) for the Implementation of Madrasah Science Competitions (2018), research by Munadi (2016), Fauzan (2017), and Nuryantini, (2018) who say that Islamic integration is categorized if it contains qauliyah verses (and hadith) and qouniyah verses (natural phenomena). According to (Muslim et al., 2021) the sources of Islam and science consist of four sources, namely, the and Sunnah, as well as the universe (Afaq), humans themselves (Anfus), and history (Qashash). The results obtained from this stage are in the form of a table of the relationship between the integration of Islam and chemistry.

2. Structuring Stage

The structuring stage consists of three steps. First, create a concept map. Second, create a macro structure. And third, create multiple representations. First, namely making a concept map from the results of the concepts that have been obtained in the draft collection of material from textbooks or other reference sources from the selection stage. According to (Muslim et al., 2021) making concept maps in the structuring stage aims to help students build a structure of student knowledge (cognitive) related to the material to be studied. In preparing a concept map, it will be seen which concepts fall into the superordinate category, coordinate concepts and subordinate concepts, which is a process that involves identifying concepts from the material to be taught. In simple terms, the preparation of a concept map only consists of two concepts connected by one connecting word to form a proposition that can be observed how these concepts are related to each other. The second is to create a macro structure which is a pointer to an overarching theme or topic that language users can highlight from the given discourse (Marfu'ah & Anwar, 2018). There are 12 concepts obtained from the results of concept analysis which are based on concept position/hierarchy. The macro structure is a description or general overview that will be displayed in the Islamic integrated enrichment book by sorting the material concepts in the draft collection of selected materials.

Third, namely creating multiple representations with the aim of making it easier to understand and explain concepts mathematically according to the levels in the multiple representations. The final step is to adjust and collect the draft teaching materials that have been created and then put them

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together in a draft collection of materials (Andrianto, 2017).

Concept maps, macro structures and multiple representations which are part of the structuring stage have also been carried out in research on the development of other teaching materials (Muslim et al., 2021);(Syamsuri et al., 2017a).

3. Characterization Stage

The characterization stage uses a gap test instrument or can also use a writing test or conveying the main idea in a teaching material to determine the level of understanding of the discourse and the level of difficulty (complicated or complex) of the concepts, which will later be reduced if the concept is still considered difficult.

Based on the characterization test results obtained in table 3, the concept that received the lowest percentage results was the nucleoplasm concept with a percentage of 67%. This could be because the researcher was incomplete in writing the questions so that students found it difficult to answer the questions. With a percentage result of 67%, the concept falls into the category of "high" level of understanding. Material concepts that are below 60% fall into the "medium" level of understanding category so they need to be reduced.

Table 3. Overlapping Test Results

Concept Label	Question Comprehen sibility (%)	Question Understanda bility Criteria
cell	88	high
eukaryotic cells	85	high
prokaryotic cells	85	High
plant cells	68	High
animal cells	73	High
nucleoplasm	67	high
mitochondria	73	high
chloroplast	75	high
oxygen	98	high
hydrogen	100	high
nitrogen	100	high
carbon	100	high
Average Percentage	**84,33**	**high**

However, with the results that have been obtained based on trials on students with an average result of 84.33%, this means that all the concepts that have been developed and tested can be understood easily. So it can be concluded that the level of understanding in the characterization test is in the "high" category, so there is no need for reduction. This is in line with research conducted by (Rahman et al., 2019; Hendri & Setiawan, 2016); Wahidiyah, 2018) who explains that it is necessary to carry out a characterization test with the aim of determining the level of understanding and difficulty of students regarding the teaching materials that have been developed.

4. Reduction Stage

The reduction stage can be carried out if at the characterization stage the results of the level of understanding are in the difficult category, so that the percentage obtained is low, namely below 60%. In this study, the characterization results obtained met the criteria, each concept had a percentage above 60% and had a high level of understandability. Therefore, the researcher did not carry out the reduction stage in this study.

5. Feasibility of Teaching Materials

The results of the four stages that have been carried out are in the form of a chemical enrichment book product integrated with Islamic values in the structure and function of cells, which is then tested for feasibility by two media experts to provide an assessment of the enrichment book that has been made. The assessment by media experts of the enrichment books that have been developed includes several aspects, including language, presentation, performance and graphics. The purpose of conducting a feasibility test by media experts is to provide suggestions and input regarding these four aspects, so that the enrichment book that has been developed is suitable for use.

The results of the enrichment book feasibility test for the four aspects assessed by the first media expert, namely the language

aspect, were 81.25%; presentation 75%; 100% performance; and graphics 95.83%. From these four aspects, an average percentage of 88.02% was obtained with very good criteria. Meanwhile, the assessment by the second media expert on these four aspects was the language aspect 87.5%; presentation 81.25%; 100% performance; and graphics 66.67%. From these four aspects, the average percentage was 83.85%. From the percentage scores obtained from the two media experts, a total average of 85.94% was obtained.

Table 4. Feasibility Test Data Results

Media Expert	Persentase Aspek Penilaian (%)				Average (%)	Criteria
	Language	presentment	Performance	Graphics		
1	81.25	75	100	95,83	88.02	Very Good
2	87.5	81,25	100	66,67	83,85	Very Good
				Total Average	**85.94**	**Very good**

Table 4 shows that the teaching material in the form of a chemical enrichment book integrated with Islamic values in material on cell structure and function that has been developed is suitable for use and received an average score of 85.94% with very good criteria. Testing the suitability of teaching materials has also been carried out in the research (Astuti & Anwar, 2018; Syamsuri et al., 2017b); Hasanah & Anwar, 2018).

CONCLUSION

Islamic integrated chemistry enrichment book teaching materials on cell structure and function are suitable for use as student learning resources. Feasibility is based on validation results on four aspects, namely, appropriateness of language, presentation, performance and graphics. As a follow-up to this research, the researcher put forward several suggestions, including the need for more validators to test enrichment books, because the more validators, the better the resulting book product. Apart from that, the development of Islamic integrated enrichment books can still be developed on other chemical materials. Or you can also develop teaching materials using the integration model applied in several other countries, including: Yemen, Malaysia, and Brunei Darussalam. The increasing demand for integration models in Islamic education from school to university level and getting a positive response from parents and students sees the prospects of this field. Therefore, government support and regulations are needed in implementing the integration model in Islamic education which has provided a positive response to support Islam in various fields of work.

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