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Islamic Environmental Ethics in the Math Learning: Does It Make Sense?

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Abstract

The interdisciplinary-multidisciplinary approach is good to solve complex problems. In Islamic studies, this approach has been used for several cases. However, in education, these approaches are seldom used moreover in elementary school learning. This paper will try to explain, how to make an integration of second-grade learning, based on Islamic Environmental Ethics. The qualitative explain with the literature review in this paper is started by reading all primary resources, reduce, and formulate to a structural format. Then ended by making analysis to make an integration matrix. The matrix has m-rows and n-columns, with rows as the sum of basic competencies, and the columns as the sum of domains. The result is the integration matrix of Islamic Environmental Ethics in the second grade for thematic learning.

Keywords: Islamic Environmental Ethics, math learning, basic competencies, interdisciplinary-multidisciplinary approach.

Introduction

Experts and researchers have widely discussed environment ethics in various ways. (Abdollarash, 2017; Baker et al., 2019; Gola, 2017; Govil, 2019; Liu & Chen, 2017) These studies were reviewed through character education, general environmental ethics education, studying elementary textbooks in Poland, as well as environmental ethics in India, and use of virtual technology.

However, environmental ethics in the context of religious values, including Christianity, has not become a political force in environmental change (Eaton, 2007). Also, in Islam, the discussion has not been as much as environmental ethics in general. Moreover, to be integrated in mathematics learning, there are still many people who consider it to be impossible (Jianguo, 2004). Therefore, research on Islamic Environmental Ethics needs to be developed.

On the other hand, mathematics learning still faces obstacles, namely the persistence of anxiety (Mollah, 2017; Amam, Darhim, Fatimah and Noto, 2019; Nur Wangid, Rudyanto & Gunartati, 2020), learning strategies that must be developed (Lin, Durbin & Rancer, 2016; Calkins, Grannan, & Siefken, 2020), the provision of suitable teaching materials (Melvinasari, & Suparman, 2019; R. Maskur, Permatasari, & Rakhmawati, Nurhidayati, Tayeb, & Abbas, 2017) and concerning the creation of meaningful worksheets (Garcia, 2017; Murtikusuma, Oktavianingtyas, Putri, Krisnawati, & Fausi, 2017)

See the fact; mathematics learning needs to be carried out with activities, strategies, methods and more exciting ways. A possible alternative is to integrate mathematics learning with the surrounding environment. Using the surrounding environment as a learning resource encourages students to improve their learning outcomes (Van den Heuvel-Panhuizen, & P. Drijvers, 2020; Papadakis, Kalogiannakis, & Zaranis, 2017)

Exploration the use of the environment, especially the green lifestyle as an optimal source of learning, continues to be on-going research and development. Researchers have researched on environmental in various mathematics learning. (Malo, Gunardi, & Situmorang, 2017; Gunur, & Kurnila, 2018) However, regarding spiritual awareness, awareness of God's command to be kind to the environment has not been much researched. Therefore, this paper

will try to present comprehensively how Islamic Environmental Ethics can be integrated with mathematics learning by encouraging students' religious, spiritual awareness.

Method

This literature research tries to explain the integration of Islamic Environmental Ethics on math learning. Primary sources are in the form of books and articles on environmental ethics theory, especially in Islam. Articles on Islamic Environmental Ethics from Manoiu et al., Santoso, Naff, Nisa, Rahman and Ali & Gul were also primary sources. Theories regarding the implementation of Islamic values, taken from Amin Abdullah et al. Besides, books and articles on mathematics learning related to environmental care are also a primary source. Secondary sources came from international and national research journals, regarding the integration of mathematics learning with Islamic values, especially the discussion on environmental awareness. From various primary and secondary sources, they are reduced, compared, synthesized and analyzed. The results are presented in the result & discussion section and be compressed in the conclusion.

Result and Discussion

Interdisciplinary-multidisciplinary approach: the excellence in the industrial era 4.0

The development of increasingly complex problems in various fields, including education, encourages the need to link science together in solving them. For this reason, academics, policymakers, and members of the public and private sectors are looking for approaches to help organize and integrate the sciences currently produced in research and at all levels of education (Frodeman, 2017). Not only through a monodisciplinary approach, but with multidisciplinary, also interdisciplinary. In Islamic studies, multidisciplinary-interdisciplinary approaches have also been widely used in various studies (Sari & Amin, 2020), so that in looking at religious issues can be more comprehensive and per the development of the era (Rohmatika, 2019). Moreover, in the industrial era 4.0, various institutions and departments need to work more closely together to be able to teach actual topics, including about the development of the industrial era 4.0 itself (Wermann, Colombo, Pechmann & Zarte, 2019)

Integration of Islamic values and science

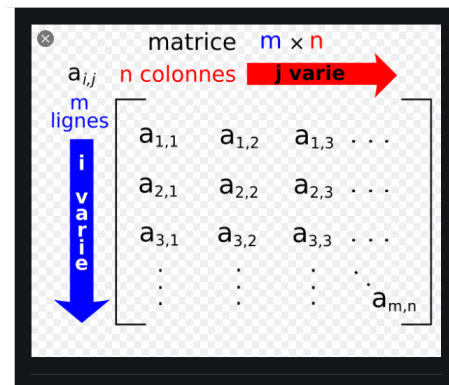
The combination of Islam and science in this paper chooses a model of dialogue and integration by Ian G. Barbour, not a conflict model (Hidayatullah, 2019) In this paper, also introduces the concepts of *Bayani* reasoning (relying on the text), *irfani* (relying on inner-Sufism) and *Burhani* (relying on empirical-logic) (Mubin, 2020; Samsudin, 2019; Wibowo, 2017). These three concepts can be considered - used for the basis of a comprehensive blend of Islam and science. That is, in looking at the problem, not only using the text (the Qur'an-hadit) but also combined with the conditions of reality, also considering the subtlety of mind, feeling and heart.

In implementing it, Amin Abdullah offered four domains for integration (Abdullah et al., 2014) Four domains (D1, D2, D3, D4) for integration, including Domains: philosophy, methodology, strategy and material. By using

these four domains, abstract concepts of integration can be implemented in learning. The trick is to arrange the matrix. The matrix is an arrangement of objects consisting of m rows and n columns (Gunawardena, 2006) For the integration of Islamic values in mathematics learning, matrix rows and columns are arranged: rows consist of the essential competencies of the subject; while the columns consist of four columns, containing four components namely four domains (Mauluah, 2012)

In this paper, a simple way as an alternative to filling four domains can be in the following way. In the realm of philosophy: can be presented verses of the Qur'an and the hadith that animates the Basic Competence. The methodology can be filled with examples of the spirit of the pious in Islamic history, how they preach or teach their students. In the realm of strategy can be filled with five ways of active learning, for example, the implementation of the Prophet taught (Salafudin, 2011), as well as with modern strategies. The five ways of the Prophet are direct practice, gradual learning, paying attention to students' uniqueness, question and answer and dialogue, discussion and dialectics. In the realm of material, it can be filled with appropriate material IEE1-IEE5. (See the Principles of Islamic Environmental Ethics)

The four columns can be added to the information column 1 and information 2 to write the visual aid, tools and materials in the learning process. The way to read the matrix is as follows.



Picture1: Matrix with m -rows and n -column

a_{11} : element matrix on the first row, first coloumn

a_{12} : element matrix on the first row, second coloumn

... a_{32} : element matrix on the third row, second coloumn

... a_{mn} : element matrix on the m -th row, n -th coloumn

Principles of Islamic Environmental Ethics (IEE)

Islam is a religion that is very concerned about environmental sustainability (Abdul-Matin, 2010; Killawi, 2014; Khalid & Ali, 2007) The Qur'an and the hadith have many rules how to treat the environment properly (Harahap, 2015; Rodin, 2017; Mauluah, 2017; Muslim, 2018)

The term Islamic Environmental Ethics began to be used by Samarrai in 1990 in his article entitled: Islamic Environmental Ethics, Law, and Society Ethics of Environment and Development (Gottlieb, 2004) and by Fazlun Khalid in Richard C. Foltz's (Editor) book entitled Environmentalism in the Muslim World (Khalid, 2005) The IEE principles in this paper specifically cover how to treat water, animals, plants, earth and air (Manoiu, V.M,

Düzgüneş, Azzeddine and Manoiu, V.S., 2016; Mian, Khan, & Rahman, 2013)

Islamic Environmental Ethics about water (IEE 1)

Water as a source of life is contained in the Qur'an 21:30, 25:54, 24:45 (Santoso, 2014) Also, Islam has a great attention to the importance water resources and its equipment in the form of rivers and so on. The attention is seen in the many mention of the term water (*maa'*), rivers and rivers (*nahr* and *anhar*), drinking water 63 times, 54 and 39 times each in the Qur'an (Naff, 2009; Nisa, 2017)

Islamic Environmental Ethics about animal (IEE2)

Islamic attention in reminding people of the awareness of the creation of animals for the benefit of humans is contained in several verses of the Qur'an as follows. QS. 16 (An Nahl) verse 5: Farm animals for their feathers and food use. QS.16 (An Nahl) verse 7: animals are used to lift weights, Verse 8: horses, mules and donkeys for mounts and jewellery; QS 22 (Al-Hajj): camel for food and *sodakoh* (Rahman, 2017)

Islamic Environmental Ethics about plant (IEE3)

Islam has a deep attention to the relationship between humans and plants. It is contained in the Qur'an QS An-Nahl: 141 (Mamat & Mahamood, 2017), which explains the importance of using plants without overdoing it. The importance of planting trees, planting trees as *sodakoh* (if there are animals and humans use them), it is prohibited to cut trees without specific reasons; commanded by the Prophet in his hadith (Gul, & Ali, 2018)

Islamic Environmental Ethics about earth (IEE4)

Islam refers to humans as the *khalifah fil-ard* (God's representative on earth). The meaning of the representatives of God, God Almighty, Merciful, Preserver, and 99 *Asmaul-husna*, then, of course, the weight and full of honour of the task of the Caliphate. Mention of humans as the caliph at the earth has shown the concern of Islam for the preservation of life on earth (Mardiyah, Sunardi, & Agung, 2018). In the Koran mentioned *khalifah fil-ard*, among others, on QS. Al-Baqarah (2): 30, which is having faith and doing good deeds, then God will make them (humans) as rulers of the earth. (Q.S. An-Nur (24): 55).

Broadly speaking, these verses show the task of humans is to protect the earth in its entirety. It is also as stated in Q.S. Al-An'am: 165 (Iqbal, 2016) The meaning of the caliph at the earth has broad meaning, the noble task of man is to prosper the earth, including in the social dimension and care for the environment materially. (Safei, 2016) Earth's vital function, as a place all sentient beings are essential topics in the Qur'an. Earth, as a place for the growth of all plants, also needs to be guarded, as long as humans do not exaggerate/exceed the limits (QS. 16: 11); The Earth is the place of birth and death of humans written in the book of the Qur'an: 71: 17-18. The Earth as a stretch, so that humans can travel around it, contained in QS 71: 19-20 (Manoiu, Düzgüneş, Azzeddine and Manoiu, 2016)

Islamic Environmental Ethics about air (IEE5)

Islamic Environment Ethics about air has to do with the importance of humans protecting water. Water availability is related to the smooth process of the water cycle (Bellette and G. Lee, 2003). This is stated in the Qur'an QS 56: 68-70. How does God send wind (air) to barren regions to make it rain, also written in the Qur'an, namely: QS 7:57 (V.M. Manoiu, Düzgüneş, Azzeddine and V-S. Manoiu, 2016)

How to Implement the Integration?

There are several steps to implement integration of IEE on math learning. The main step is creating integration of the matrix. The other step before creating the matrix is preparing curriculum documents. Then choosing basic competencies will be developed.

After that, then think create, how to teach it, with what strategies, what models are displayed, as well as what kind of process and material requirements and materials. The results of these thoughts, outlined in the integration matrix, contain the lines of basic competencies. The columns contain the domains of integration, and information can be added. The five IEE principles are filled in the appropriate rows and columns. Not every row and column need to be completely filled, but as long as each row, there is one IEE component that can be integrated, it meets the requirements. This means that Mathematical Basic Competence can be integrated with IEE values. Tabel below can give an explanation.

Table. 1: Intergration matrix of Basic Competencies (BC) and Islamic Environmental Ethics (IEE).

NO	BC	D1	D2	D3	D4	NOTE 1	NOTE 2
1	BC1	Q1			IEE3	Math tools:leaves and flowers	
2	BC2				IEE2	Livestock	
3	BC3	Q2		Problem Based Learning	IEE5	Volume of gas	
4	BC4	H1			IEE4	Math tools: bottle caps, saving the world from plastic	
5	BC5	H2		Project Based Learning	IEE1	Volume of water, velocity, rasio	

Note: D=Domain, BC=Basic competence, Q= Qur'an Verse, H=Hadith

Guided by a compiled matrix, then the lesson plan is prepared for the preparation of learning. The device is also added, for example reading books, worksheets, and online learning resources.

Integrating Islamic Environmental Ethics in the Math Learning via Four Domains at Second Grade of Elementary School: an Example

The choosing of second-grade (young children) has some

important reasons. One of the reason is the purpose of multidimensional teaching will give opportunities for children to develop empowerment make a connectedness to the environment (Sundberg and Areljung, 2019). The same idea with Sundberg & Areljung, multidimensional aspect on teaching that connects with the environment make them be an as competent agent in their own lives (Heggen, 2019) Also, teaching maths based on environmental ethics can introduce the children to understand both world beauty and

vulnerabilities. Then, it can become the shared responsibility of all, including young children (Harwood, 2019)

In the first step, the researcher determines which BC will be implemented. In this paper, basic competencies are selected sourced from the 2013 curriculum. Basic

competencies come from Ministerial of Education and Culture Regulation Number 24 of 2016 (Permendikbud, 2016) which was perfected by Ministerial of Education and Culture Regulation Number 37 of 2018 (Permendikbud, 2018) for mathematics subjects in 2nd-grade elementary school. Read the table below.

Table. 2: Basic competencies of elementary school math on second grade.

No	BC3 Knowledge	BC4 Skill
1	3.1. Explain the meaning of whole numbers and determine the symbol based on place values with using a concrete model as well how to read it	4.1. Read and present whole numbers and the symbol based on place values with using a concrete model
2	3.3. Explain and do addition and subtraction numbers involving numbers count life as well associate the sum and subtraction	4.3. Solve problems addition and subtraction numbers involving numbers count up to 999 in daily life as well associate the sum and subtraction

Then, the integration of Islamic Environmental Ethics values and the math learning can be learned at the tabel 3 as below.

Table. 3: Integration matrix of IEE in the math learning for second grade.

NO	BC	D1	D2	D3	D4	NOTE 1	NOTE 2
1	3.1	Q1:QS Al Baqarah :261 H1:HADITH OF PLANT TREES		Explore the garden (direct practice)	IEE3	Math tools: big leave and small leave;big grain and small grain;as symbol of tens and unit	Use second hand box for keep the math tools
2	4.1	Q2: QS Al Hijr:19 H2:plant the tree as <i>sodaqoh</i>		Using math tools: leaves and flowers	IEE3	Written test with leaves and flowers pictures	
3	3.3	Q3:QS Al Kautsar:2			IEE2	Theme test is taken from <i>Idul-Adha</i> case	Online reading
4	4.3	Q4:QS Al Hajj:36-37			IEE2	HOTS Type for second grade	Buy and sell activity in the animal market:online reading sources

Note: D=Domain, BC=Basic competence, Q= Qur'an Verse, H=Hadith QS= Qur'an-Shurah=the Verses of Qur'an

The implementation of the grid based on the tables that have been prepared can be done by learning in the classroom, learning independently, or online. At the end of each learning session, the teacher or parents and family in the house invites to reflect, read the hadith and verses. After that, the teacher or parent directs directly or through activities on the worksheet, what is the purpose of the verse and the hadith, the relationship with learning. With the explanation from Qur'an & Hadith that God and the Apostle commanded to care for the environment, students are expected to have a spiritual awareness, that as humans, need to pay attention to the preservation of the environment, because it is the command of God and the Apostle

Conclusion

Islamic Environmental Ethics (IEE) values can be integrated with general knowledge and in practice, among others, can be integrated with mathematics learning. The concept of integration is based on the multidisciplinary-interdisciplinary approach which in the industrial era 4.0 is very much needed. That, looking at all the problems of humanity, and life, not only through text (the Qur'an-hadith), but also involves empiricism, real reality, and the subtlety of hearts and feelings. Implementation of integration can be done through four domains: philosophy, methodology, strategy and material. In the realm of philosophy: can be presented verses of the Qur'an and the hadith that animates the basic competence. The methodology can be filled with examples of the spirit of the

pious in Islamic history, how they preach or teach their students. In the realm of strategy can be filled with five examples of the implementation of the Prophet's teachings, as well as with contemporary strategies. In the realm of material, it can be filled with material related to IEE1-IEE5. By compiling an integration matrix, based on the basic competencies on the subject of mathematics versus four domains, it can become the basis for the implementation of Math learning in the classroom and outside the classroom. Through reflection on mathematics learning, students are invited to recognize the existence of spiritual awareness, that caring for the environment is the command of God and the Apostle in the Qur'an and Hadith.

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