

Integrative Mathematics: Mathematical Concepts in Hadiths with the Theme of *Uqiyah*

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ABSTRACT

The study of Islamic-integrated mathematics has goals that align with national education's goals, namely creating students who are devoted to God Almighty and have noble character. Islamic-integrated mathematics plays a role in collaborating mathematical concepts derived from the Quran and hadith. In the books of hadith, the discussion of *uqiyah* is always related to mathematical concepts. This study aims to explore the mathematical concepts contained in the *uqiyah*-themed traditions. A qualitative method with a literature review approach was used in this research. Data were obtained from analysing relevant books, books of hadith, journal articles, and proceedings. The results of this study revealed the existence of the concept of linear equation, the idea of equivalent comparison, the concept of function, and the concept of equation of a line through two points in the hadith related to *uqiyah*. In addition, examples of the application of mathematical integration in elementary and junior high school mathematics problems are presented.

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1. INTRODUCTION

The progress of a civilization cannot be separated from the results of quality education carried out by its people. A good education not only hones and sharpens students' cognitive abilities but also develops several other aspects, one of which is attitude, character and morals [1]–[3]. That is also regulated by The Law number 20 of 2003, which states that one of education's goals is to unleash the potential of students to become morally upright people who respect and revere God [4]. Therefore, attitude and character become important aspects expected from an education.

Mathematics, as one of the sciences taught at school, has a role to train students in cognitive aspects, reasoning, and problem-solving [5]–[7]. Because it introduces students' cognitive skills, math is often considered one of the fields that escape the responsibility of shaping students' attitudes, character, and morals [8], [9]. At the same time, the means in shaping students' attitudes and morals are not limited by science because the goal of education must be carried out in every lesson [3], [10]. Therefore, combining mathematics with aspects of attitude, character, and morals is essential.

Several efforts have been made to involve attitudinal and moral aspects in

mathematics. One incorporates and connects these aspects in mathematics learning [11]–[13]. If the element of introducing culture and customs in mathematics is integrated through ethnomathematics [14]–[16], the attitudinal and moral aspects in mathematics learning are integrated through Islamic integrated mathematics, known as integrative mathematics [3], [10], [11].

Integrative mathematics is seen as combining Islamic values with mathematics to produce a whole and inseparable unity [17], [18]. Integrative mathematics is not only defined as the process of finding religious propositions for mathematics or the Islamization of mathematics. Still, it is defined as an effort for students to get closer to Allah SWT through mathematics [3], [19], [20]. In addition, integrative mathematics also provides an opportunity for Muslims to repeat their glory days when Islamic values were incorporated into every mathematics lesson [21], [22].

Furthermore, efforts to introduce Islamic-integrated mathematics have begun to be loved. That is indicated by Islamic-integrated mathematics learning models at school and campus levels [3], [23]. Another effort is shown by the *Kompetisi Sains Madrasah* (KSM) or Madrasah Science Competition at the school level, which is integrated with Islam [24]. In addition, several studies have explored integrative mathematics in learning tools and Islamic-integrated math problems [12], [25]–[28].

Despite being the latest trend in education, integrative mathematics has not been fully realized. That is due to the lack of educators' ability to search for various literature on religious sources, understand their meaning, and the educators' inability to find Islamic values in harmony with mathematical concepts [19], [29]. Therefore, there is a need for valid and reliable references on mathematical concepts integrated into Islamic values, especially those sourced from the Al-Quran and Hadith.

Several studies have explored and explored mathematical concepts in Islamic sources, including *Rahasia bilangan dalam Al-*

Quran (The secret of numbers in the Quran) [30], *Matematika dalam Al-Quran* (Math in the Quran) [31], Fractional Numbers in the Quran and Hadith [19], [32], [33], *Teori Himpunan dalam ayat-ayat Al-Quran* (Set Theory in Quranic Verses) [34], and Arithmetic operations in the Quran and Hadith [29], [32].

However, prior research has only examined fundamental ideas in mathematics, such as numbers, sets, and their operations. Furthermore, these studies are also dominated by Islamic sources derived from the Quran. Islamic sources also consist of hadiths, books of scholars, and the history of Islamic civilization.

As a civilization, Islam is not only present as a religion in society but as a way of life and perspective based on Islamic values [21], [22], [35]. Historically, Islamic civilization has existed for around 1200 years. In its heyday for seven centuries [22], Islamic civilization has carved a new color in historical records. One of them is in the measurement field, which includes quantities and units. [22], [36].

History records that the quantities and units used in Islamic civilization include many things, ranging from length, area, weight, distance, and time [35]. Islamic civilization inherited from Arab culture has its weight units, namely *ratl*, *uqiyah*, *nish*, *nawat*, and *dirham*. These units have coloured the activities of Arab society during the Islamic civilization [35]–[37].

Uqiyah is one of the units of weight used during the Islamic civilization. The use of *uqiyah* was not only limited to trading activities but also to daily activities [38]. *Uqiyah* is used in several Islamic laws, such as payment of zakat, alms, and the Prophet's dowry to his wife [39]–[42]. The use of the *uqiyah* unit in the life of the Prophet is written in the famous books of hadith [43], [44].

The explanation of the *uqiyah* seems to be dominated by fiqh, history and religious science. Meanwhile, the description from the perspective of mathematics is still minimal. Therefore, an in-depth study of the mathematics in the hadith about *uqiyah* is needed.

The researcher proposes to investigate the mathematical ideas in context with the description given in the introduction. contained in the *uqiyah*-themed traditions. So, the research theme used is Integrative Mathematics: Mathematical Concepts in Hadiths with the Theme of *Uqiyah*.

2. LITERATURE REVIEW

2.1 Hadiths with the Theme of *Uqiyah*

2.1.1. Hadith Reported by Ibnu Majah number 1876

حَدَّثَنَا مُحَمَّدُ بْنُ الصَّبَّاحِ أَنبَأَنَا عَبْدُ الْعَزِيزِ الدَّرَاوَزِيُّ عَنْ يَزِيدَ بْنِ عَبْدِ اللَّهِ بْنِ الْهَادِ عَنْ مُحَمَّدِ بْنِ إِبْرَاهِيمَ عَنْ أَبِي سَلَمَةَ قَالَ سَأَلْتُ عَائِشَةَ كَمْ كَانَ صَدَاقُ نِسَاءِ النَّبِيِّ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ قَالَتْ كَانَ صَدَاقُهُ فِي أَرْوَاحِهِ اثْنَتَيْ عَشْرَةَ أَوْفِيَّةً وَنِسَاءً هَلْ تَدْرِي مَا النَّشُّ هُوَ نِصْفُ أَوْفِيَّةٍ وَذَلِكَ خَمْسُ مِائَةٍ دِرْهَمٍ

"Muhammad ibn Ash Shabbah reported: Abd. Aziz ad Darawardi reported from Yazed ibn Abdullah ibn Had reported from Mohamed ibn Abraham reported from Abu Salamah: "I questioned Aisyah, " How much did the Prophet's wives' marriage cost?" Aisyah replied, " He gave one Nassy and twelve Uqiyah as dowries to his brides, do you know how much a Nassy is? One Nassy equals a half of Uqiyah. And it came to a total of 500 dirhams." (Hadith Reported by Ibnu Majah number 1876)

2.1.2. Hadith Reported by An-Nasa'i number 2402

خَبَرَنَا عَبْدُ اللَّهِ بْنُ سَعِيدٍ قَالَ حَدَّثَنَا سُفْيَانُ قَالَ حَدَّثَنِي عَمْرُو بْنُ بَحْيَى ح وَ أَخْبَرَنَا مُحَمَّدُ بْنُ الْمُثَنَّى وَمُحَمَّدُ بْنُ بَشَّارٍ عَنْ عَبْدِ الرَّحْمَنِ عَنْ سُفْيَانَ وَشُعْبَةَ وَمَالِكٍ عَنْ عَمْرُو بْنِ بَحْيَى عَنْ أَبِيهِ عَنْ أَبِي سَعِيدٍ الْخُدْرِيِّ أَنَّ رَسُولَ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ قَالَ لَيْسَ فِيهَا دُونَ خَمْسَةِ أَوْسُقٍ صَدَقَةٌ وَلَا فِيهَا دُونَ خَمْسِ دَوْدِ صَدَقَةٌ وَلَا فِيهَا دُونَ خَمْسَةِ أَوْاقٍ صَدَقَةٌ

"Ubaidullah ibn Sa'id reported to us and said: Sufyan narrated to us, he said: 'Amr ibn Yahya narrated to me, and it was also narrated from another route, and it was narrated to us by Muhammad ibn Al Mutsanna and Muhammad ibn Basysyar from 'Abdurrahman from Sufyan and Shu'bah and Malik from 'Amr ibn Yahya from his father from Abu Said that Rasulullah tells: "There is no zakah on less than five wasaqs of

grain, no zakaah on less than five dhuds of camels, and no zakaah on less than five uqiyahs of silver." (Hadith Reported by An-Nasa'i number 2402).

2.1.3. Hadith Reported by Darimi number 1572

أَخْبَرَنَا الْحَكَمُ بْنُ مُوسَى حَدَّثَنَا بَحْيَى بْنُ حَمْرَةَ عَنْ سُلَيْمَانَ بْنِ دَاوُدَ الْخَوْلَانِيِّ حَدَّثَنِي الرَّهْرِيُّ عَنْ أَبِي بَكْرٍ بْنِ مُحَمَّدِ بْنِ عَمْرُو بْنِ حَزْمٍ عَنْ أَبِيهِ عَنْ جَدِّهِ أَنَّ رَسُولَ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ كَتَبَ مَعَ عَمْرُو بْنِ حَزْمٍ إِلَى شُرْحَبِيلِ بْنِ عَبْدِ كَلَالٍ وَالْحَارِثِ بْنِ عَبْدِ كَلَالٍ وَنُعَيْمِ بْنِ عَبْدِ كَلَالٍ إِنَّ فِي كُلِّ خَمْسِ أَوْاقٍ مِنَ الْوَرَقِ خَمْسَةَ دَرَاهِمٍ فَمَا زَادَ فَفِي كُلِّ أَرْبَعِينَ دِرْهَمًا دِرْهَمٌ وَلَيْسَ فِيهَا دُونَ خَمْسِ أَوْاقٍ شَيْءٌ

"Al-Hakam ibn Musa reported to us Yahya ibn Hamzah reported to us from Solomon ibn David reported to us Az Zuhri reported from Abi Bakr reported from his father through grandfather that Rasulullah wrote a letter for 'Amru ibn Hazm addressed to Shurahbil ibn 'Abdu Kulal, Harith ibn 'Abdu Kulal, and Nu'aim ibn 'Abdu Kulal, saying that for every five uqiyah of silver there is a zakaah of five dirhams. to Shurahbil ibn 'Abd Kulal, Al Harith, and Nu'aim, that for every five uqiyah of silver, there is zakaah of five dirhams, and if there is more, then for every forty dirhams there is one dirham, and for anything less than five uqiyah there is no zakaah due on it." (Hadith Reported by Darimi number 1572)

2.2 Mass Units of the Arab Societies

Measurement includes many things, ranging from measuring length, weight, volume, distance, time, and others. Weight measurement is one of the measurements that has an essential role in people lives [45]. In measuring weight, an agreed unit and the measuring instrument are needed. Generally, the measuring instrument used is a scale [36], [46]. The Muslim community has studied the knowledge of weight measurement for hundreds of years. That is because weight measurement is related to the laws of Islam, such as zakat, marriage dowry, buying and selling, almsgiving and others [38], [47], [48].

Mass units often used in everyday life to indicate an amount include milligrams,

grams, ounces, kilograms and tons. As for the units of weight in the Islamic treasures that were used in the previous Arab society, they are *ratl*, *uqiyah*, *nish*, *nawat*, and *dirham*, as shown in Figure 1. [36].

R.A. about the Prophet's dowry to Siti Khadijah. The hadith, as narrated in Sunan Ibn Majah, explains the conversion of *uqiyah* units to *nish*, *uqiyah* units to *dirham*, and *nish* units to *dirham*. [43], [44].

213.2 Units of Weight					
Arabian scale					
					Metric
ratl, riṭl, or ruṭl					~1.44 kg
12	ūqīyah				~120 g
24	2	nish			~60 g
96	8	4	nawāt		~15 g
480	40	20	5	dirham	~3 g

Figure 1. The unit of weight of the early Arab societies

The units of weight used by Arabs differ from those used by modern society. While international units of weight have a fixed multiple of each unit, Arab units have different multiples. The multiples of *ratl*, *uqiyah*, *nish*, *nawat* and *dirham* are different. Here are the different levels of international weight units and Arabic weight units, as shown in Figure 2 [36], [45], [46].

3. METHODS

In this study, a literature review strategy is combined with a descriptive qualitative methodology. Hadith books, math books, integrative math books, books on the history of Islamic culture, journal articles, and conference papers were all employed in this study's literature review. The researcher then reviewed all the literature diligently and in detail [49], [50].

The data collection technique in this study uses secondary sources. That means the data obtained is not directly given to the researcher but is obtained through other intermediaries [51]. literature on mathematics, mathematics in Islamic civilization, mathematics integrative article, and hadith books are examples of secondary data in these fields. The data collected in this research is presented descriptively in words, tables, and pictures.

The research procedure is carried out through four stages. (1) Determining the research theme, (2) Collecting data, (3) Conducting reviews, (4) Analyzing data, (5) Writing down the results of data analysis. These stages are a form of synthesis standard in literature studies [49].

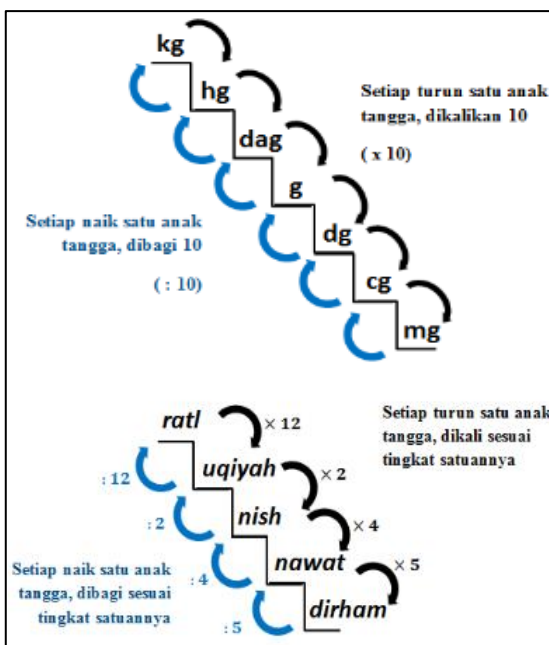


Figure 2. Differences in multiples of international and Arabic units of weight

The difference between units on the scale of Arab society comes from several references. For example, the hadith narrated by Aisha

4. RESULTS AND DISCUSSION

4.1 One Uqiyah in Linear Equation Concepts

Hadith reported by Ibn Majah no. 1876, provides several statements about *uqiyah*, *nassy* and *dirham*. These statements are formal sentences with mathematical equations, for example, $U = uqiyah$; $N = nassy$; $D = dirham$. Then, the following equations are formed.

$$12U + 1N = 500D \tag{1}$$

$$1N = \frac{1}{2}U \tag{2}$$

Then substitute (2) for (1), thus obtaining

$$12U + \frac{1}{2}U = 500D$$

$$12\frac{1}{2}U = 500D$$

$$1U = 40D \tag{3}$$

Equation (3) shows that one *uqiyah* is equivalent to 40 *dirhams*. Then, if equation (2) is multiplied by two in both segments and substituted into (3), we get

$$(1N) \times 2 = \left(\frac{1}{2}U\right) \times 2$$

$$2N = 1U$$

$$2N = (40D)$$

$$1N = 20D \tag{4}$$

Equation (4) shows that one *nasy* is equivalent to 20 *dirhams*.

Based on the mathematical equations in the hadith reported by Ibn Majah no. 1876, the following conclusions are obtained: (1) The conversion of the value of *uqiyah* to *nasy* and *dirham* can be determined by solving the problems in the hadith using the concept of linear equations. (2) One *uqiyah* is equivalent to 2 *nasy* or 40 *dirhams*. (3) The value of 1 *nasy* is equivalent to $\frac{1}{2}$ *uqiyah* or 20 *dirhams*. (4) The value of 1 *dirham* is equivalent to $\frac{1}{20}$ *nasy* or $\frac{1}{40}$ *uqiyah*.

4.2 Concept of Equal Comparison

Hadith narrated by Darimi number 1572, presents the following statement. "For every five *uqiyah* of silver, there are five *dirhams* of zakaah. If there is an excess, then one *dirham* is due on every forty *dirhams*. If it is less than five *uqiyah*, there is no zakaah due on it" (Hadith narrated by Darimi number 1572).

The first statement says that for every five *uqiyah* (200 *dirhams*), there are five *dirhams* of zakah. The second statement says that for every 40 *dirhams*, there is a zakat of 1 *dirham*. The first and second statements can be written in fraction form, with the ratio of the amount of wealth to the zakat that must be paid is $\frac{200}{5}$ and $\frac{40}{1}$. If simplified, the second form becomes $\frac{40}{1}$ or 40: 1. Based on these two comparisons, it can be concluded that for every 40 *dirhams*, there is 1 *dirham* of zakat. The concept of comparison found is the concept of equal comparison, which is shown in Figure 3.

Amount of Assets (in dirhams)	Zakat that must be paid (in dirhams)
40	1
80	2
120	3
160	4
200	5
400	10
4000	100

Figure 3. The concept of value comparison based on hadith Darimi number 1572

4.3 Concept of Function

The concept of function can be formed from hadith narrated by Darimi number 1572. The previous concept explains that the ratio of wealth to the zakat that must be paid is 40: 1. If x represents the amount of wealth in *dirhams* and y represents the zakat that must be paid, the comparison formula will be obtained.

$$\frac{x}{y} = \frac{40}{1} \text{ or } x = 40y$$

It can be seen that the value of x depends on the value of y . Mathematically, it can be said that x is a function in y or $x = f(y)$ [20]. In this case it is denoted by $f(y) = \frac{1}{40}y$. Suppose the amount of wealth is 1000 *dirhams*, then the amount of zakat that must be paid is $x = f(1000) = \frac{1}{40}(1000) = 25$.

So, the amount of zakaah must be paid with an asset of 1000 *dirhams* is 25.

4.4 The Concept of Linear Equations from Two Points

Another mathematical concept that can be formed from hadith narrated by Darimi number 1572 is the concept of linear equation from two points. The first provision mentions, "For every five *uqiyah* (200 *dirhams*) there is zakaah of 5 *dirhams*, and for every 40 *dirhams* there is zakaah of 1 *dirham*".

The statement can be written in consecutive pairs (200,5) and (40,1). The existence of two coordinates in this hadith seems to imply that to make a particular line, at least two different coordinate points are required. If only one coordinate point is mentioned, for example (200,5), then a line cannot be formed [20], [52].

Suppose (x_1, y_1) and (x_2, y_2) are two different coordinates, then the line through these two coordinates will have an equation

$$\frac{x - x_1}{x_2 - x_1} = \frac{y - y_1}{y_2 - y_1}$$

Then, it can be formed into a new equation, namely.

$$y = \frac{y_2 - y_1}{x_2 - x_1}x + \left(-\frac{y_2 - y_1}{x_2 - x_1}x_1 + y_1\right)$$

In a simple form, it can be expressed as

$$y = mx + c$$

With

$$m = \frac{y_2 - y_1}{x_2 - x_1} \text{ and } c = -\frac{y_2 - y_1}{x_2 - x_1}x_1 + y_1$$

The equation $y = mx + c$ is known as the general form of a line equation. The m is called the gradient (slope) of the line, and c is called a constant. Then, the existence of the three conditions in hadith narrated by Darimi number 1572 forms the equation $y = 1/40x$, with the gradient (m) formed is $\frac{1}{40}$ and the constant (c) is 0. The third provision limits

zakat to at least five *uqiyah*, limiting x to $x \geq 200$. Figure 4 depicts the resulting graph.

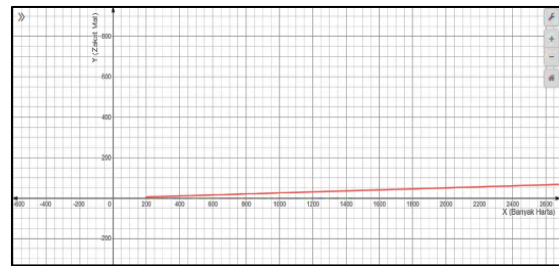


Figure 4. Linear equation graph based on Hadith narrated by Darimi number 1572.

4.5 Integrating Mathematical Concepts in Hadiths with the Theme of Uqiyah

4.5.1. The Class of Elementary School

The concept of linear equations related to *uqiyah* and *dirham* can be applied in mathematics. Suppose the teacher gives the problem "two meters + 300 centimeters = ... decimeters". In that case, the teacher can modify it to "If it is known that one *uqiyah* is equivalent to one *nasy*, and one *nasy* is equivalent to 40 *dirhams*. Then the value of two *uqiyah* + two *nasy* = ... *dirham*".

This concept not only involves students' ability to be able to operate and convert units. But it also introduces directly to students that other units were used during the Islamic civilization so that the application of Islamic integrated mathematics is also shown through the problems given.

4.5.1. The Class of Junior High School

At the junior high school, comparison is taught when students enter the seventh grade. Comparison is the process of comparing the values of two similar quantities. Comparison is usually expressed in fraction form. Often, teachers use the concepts of speed, discharge, and construction time as a context for problems in comparison.

Using Islamic-integrated math, teachers can use *uqiyah* as a context to explain the concept of comparison. Usually, teachers give

the problem, "A motorcycle needs 9 liters to travel 270 kilometers, so a 450-kilometer trip requires ... liters of gasoline". The concept can be replaced with "The provision of zakat in Islam states that for every 40 *dirhams*, there is 1 *dirham* of zakat. If Mr. Umar has 2440 *dirhams* of wealth, then how many *dirhams* are required to be zakaah?".

The concept of integrating the hadith narrated by Darimi number 1572 in the context of mathematics not only involves students' ability to solve mathematical problems. This integration also introduces students to rules related to the zakat of *dirhams* and the limits of silver assets that must be zakat. Therefore, integrating mathematics with Islamic concepts such as

hadith not only provides students with an understanding from the mathematical side,

but from the Islamic religion side, it also has a connection with mathematical problems.

5. CONCLUSION

The explanation of the hadith with the theme of *uqiyah* seems to not only be studied with Islamic-based knowledge but can also be studied mathematically. As a result, there are several mathematical concepts in the hadiths, such as linear equation, equivalent comparison, function, and linear equation. Then, these concepts can be applied in learning mathematics at the elementary and high school levels.










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