

## CHARACTER INTEGRATION IN MATHEMATICAL LEARNING AT ELEMENTARY SCHOOL (STUDY TO AL-KHWARIZMI'S THOUGHT)

Urip Meilina Kurniawati<sup>1\*</sup> & Muqowim<sup>2</sup>

<sup>1,2</sup>Faculty of Education and Teacher Training, UIN Sunan Kalijaga Yogyakarta, Indonesia

\*Correspondence address: [19204080046.student@uin-suka.ac.id](mailto:19204080046.student@uin-suka.ac.id)

### Abstract

*This study aims to analyze integration of character values in mathematics learning for Elementary School (SD) or Islamic Elementary School (MI) in particular Al-Khwarizmi's perspective. In this study, the method used is a qualitative method with a library research approach. The data collection technique in this research is documentation. Documentation includes searching for data in the form of articles related to the results of Al-Khwarizmi's thought and mathematical learning in SD/MI. The analytical technique used is content analysis which is carried out by selecting, analyzing, comparing and combining the various opinions listed in the articles analyzed so that they are found that are more relevant. Al-Khwarizmi is one of the Muslim scientists who contributed to the field of mathematics and is called the father of al-jabar. The results of this study found that the results of Al-Khwarizmi's thought in the field of mathematics have a specialty in which his thought contain many character values that can be imitated including religious value, discipline value, honest value, hard work value, critical, logical, creative thinking value. and innovative value, curiosity value, communicative value, independent value, responsibility value, self-confidence value, democracies value, reading value, and fair value, compassion, and friendship.*

**Keyword:** Character, Al-Khwarizmi's Thought, Mathematics.

### Abstrak

*Penelitian ini bertujuan untuk menganalisis integrasi nilai-nilai karakter dalam pembelajaran matematika khususnya di sekolah dasar (SD) atau madrasah ibtidaiyah (MI) dalam perspektif Al-Khawarizmi. Pada penelitian ini metode yang digunakan yaitu metode kualitatif dengan pendekatan studi pustaka atau Library Research. Teknik pengumpulan data pada penelitian ini yaitu dokumentasi. Dokumentasi meliputi mencari data dalam bentuk artikel-artikel yang berkaitan dengan hasil pemikiran Al-Khawarizmi dan pembelajaran matematika di SD/MI. Teknik analisis yang digunakan yaitu analisis isi, yang dilakukan dengan proses memilih, menganalisis, membandingkan dan menggabungkan berbagai pendapat yang tercantum di dalam artikel-artikel yang di analisis sehingga ditemukan yang lebih relevan. Al-Khawarizmi merupakan salah satu ilmuwan muslim yang berkontribusi dibidang matematika dan disebut sebagai bapak al-jabar. Hasil penelitian ini menemukan bahwa hasil pemikiran Al-Khawarizmi dalam bidang matematika memiliki ke istimewaan dimana dalam pemikirannya mengandung banyak nilai-nilai karakter yang dapat diteladani, diantaranya nilai religius, nilai disiplin, nilai jujur, nilai kerja keras, nilai berfikir kritis, logis, kreatif dan inovatif, nilai rasa ingin tahu, nilai komunikatif, nilai mandiri, nilai jawab, nilai percaya diri, nilai demokrasi, nilai gemar membaca, dan nilai adil, kasih sayang dan persahabatan.*

**Kata Kunci:** *Karakter, Pemikiran Al-Khawarizmi, Matematika.*

## **INTRODUCTION**

Mathematics is one of the subjects studied at every level of education, including elementary school (SD/MI). Mathematics is a central science which has been known from an early age and is useful in everyday life. According to Abdusyakir in (Huda and Mutia, 2017: 186), Mathematics is a science which studies relationship, quantity, logical structure and is deductive. Mathematics is studied in elementary schools (SD/MI) with the aim of developing students' creative, logical, critical, systematic, analytical, and cooperative thinking skill. Mathematical learning contains character values, namely the ability to solve various problems that exist in real life (Khamidah, 2014). The existence of this mathematical science makes a very large contribution in everyday life, including making it easier to form buying and selling transaction, calculating the number or weight of object, and being able to solve complex problems in everyday life. Extremely, it can be said that in everyday life, it cannot be separated from mathematical problem.

The essence of mathematics is as a subject about an arrangement or pattern and relationship such as mathematics as a language, mathematics as a way of thinking, mathematics as an art and mathematics as a tool (Maryati & Priatna, 2017:336). Mathematics is one of the thoughts of scientists. One of the mathematical scientists who is used as an example for us is Al-Khwarizmi (Ma'ruf, 2019:143). Al-Khwarizmi is an Islamic figure who plays a role in the field of mathematics. The branches of science which are contributed by Al-Khwarizmi are arithmetic, geometry, algebra, and others. His contribution in the field of mathematics has a great impact and contributed to pushing the wheels of human civilization until now (Kurnia, 2011: 161-165). However, students do not know what Al-Khwarizmi's contribution is in the field of mathematics. This should be improved by conveying to students about the contributions of previous mathematical scientists especially Al-Khwarizmi and the mathematical concepts found in order to instill the value of caring characters and motivate students in the learning process. The discovery of mathematical concepts by Al-Khwarizmi is used to solve problems in everyday life (Putri, 2019: 66).

Characters which can be developed in Al-Khwarizmi's concept of mathematics are creative-logical-innovative-critical thinking, curiosity, independence and self-confidence (Sinutomo, 2017: 59). In line with the results of research conducted by (Maryati & Priatna, 2017: 337-338), there are several character values which can be developed through mathematical learning including discipline, honesty, raising curiosity, being independent, creative, communicative, hard working, and reasoning discipline. According to the results of research conducted by (Maryati and Priatna, 2017: 337), mathematics contains several characters which can be developed in learning. Research created by (Khamidah, 2014) also shows that character can be instilled through mathematical learning, and applying the techniques and strategies which are in accordance with the characteristics of students and assistance from all parties, both parents and education staff. Thus, it can be said that the character development of students can be done through mathematical learning.

Character is a pattern of thinking and working together with the community, family, nation and state which is unique for everyone to survive (Andren, 2020: 44). According to (Rudyanto & Retnoningtyas, 2018: 36), character is behavior based on values in accordance with religious norm, law, custom, culture and aesthetics. Character is the values which exist in humans in the form of behavior related to oneself, nationality, God Almighty, the environment, and fellow human which are manifested in attitude, manner, thought, law, action, and word which are in accordance with religious norm, culture and custom (Ningsi & Zuliana, 2016: 175-176). In instilling the values

contained in al-Khwarizmi's thought about mathematics, it is necessary to integrate it in the process of mathematical learning in elementary schools (SD/MI). Integration is mixing, blending and combining (Nihayati & Suminto, 2020: 41) so that in instilling for students, the teacher can integrate when mathematical learning.

This research which distinguishes it from previous research is examining the results of Al-Khwarizmi's thought about his contribution to mathematics and analyzing the character values contained it. This study focuses on analyzing the character values of Al-Khwarizmi's thought in mathematics. In this case, how is the integration of the character of Al-Khwarizmi's perspective in the mathematical learning. The purpose of the research is interested in analyzing character values which are integrated with Al-Khwarizmi's thought, especially in SD/MI. Surely, this research can provide an understanding to teachers that there are a lot of character values contained in mathematical subject which are the result of thoughts of the scientists which needs to be instilled in students.

## **RESEARCH METHOD**

The research method utilized in this research is qualitative research with a library research approach. The literature study approach in this research is to collect data, analyze, and draw conclusion (Nihayati & Suminto, 2020: 42). The data collection technique in this research is documentation. Documentation includes searching for data from articles which have been published in journals related to Al-Khwarizmi's thought and mathematical learning in SD/MI. The object of research in this research is mathematical learning related to A-Khwarizmi's thought which is integrated with character. The analytical technique used is content analysis which is carried out by selecting, analyzing, comparing, and combining various meanings so that they are found which are more relevant. The steps taken in this research are looking for articles related to the thought of Muslim scientist, namely Al-Khwarizmi related to mathematics and conducting analysis by examining, comparing, and determining what values are contained in Al-Khwarizmi's thought in mathematics. The data sources in this research are primary data sources which include articles related to Al-Khwarizmi's thought and secondary data source including books and journals about mathematical learning in elementary school (SD/MI).

## **RESULT AND DISCUSSION**

### **Character in the Learning Process**

Character is a person's response to an event or events which are manifested in a natural nature in the form of actions shown by good behavior, honesty, responsibility, respect for others, and etc. Meanwhile, according to (Hidayah, 2015: 194), character is something related to a person's personality so that person is called a person with character. Character is a combination of all human behavior which is permanent and becomes a special sign that is used to distinguish each person (Putri, 2018: 41). The character which exists in a person cannot be separated from three factors including education, culture, and religion. According to Hasan in (Hidayah, 2015: 195), there are 18 values which include religious value, national spirit, love for the homeland, honesty, tolerance, hard work, social care, discipline, independence, love of reading, democracy, curiosity, appreciate achievement, communicative, responsibility, love peace, and care for the environment.

The application of character education to instill character in students can be applied inside or outside the learning process. This research focuses on inculcating character in the learning process that can be done by a teacher, namely by compiling a Learning Implementation Plan (RPP) which is integrated with characters into learning materials (Prabandari, 2020: 78). Instilling character values in students must pay attention to the five pillars of values which include peace, truth, virtue, love, and non-violent behavior. These five pillars can be linked to learning in elementary school (SD/MI). Instilling character in students can be done by a teacher when learning is carried out in the classroom or outside the classroom. One of them is by developing character in students through each subject studied at the elementary school level (SD/MI).

In accordance with the principles in developing character education, namely the noble values of the nation's culture, it is strengthened by integrating it with teaching materials. character is developed in every subject and in the learning process, the process of developing national character is a continuous process from students entering the education unit. it conducts discussions about various parables to raise self-awareness in fulfilling the demands of being a servant of God, as a nation and state community, and as part of the environment in which they live. the last principle with self-development programs, namely through activities carried out regularly such as school culture and integration referring to the basic competencies of each subject developed (Putri, 2018 42-43). According to (Zidniyati, 2019), the character of students can be developed by providing emotional understanding to students on the values taught so that students can believe that these moral values need to be used as guides in their lives.

### **The Contribution of AL-Khwarizmi's Thought on Mathematics**

AL-Khawariami has the full name Ibn Musa al-Khwarizmi from Persia. Al-Khwarizmi is an Islamic scientist who firstly developed the theory of numbers in mathematics (Muhtar, 2014). Al-Khwarizmi is a Muslim scientist who discovered a technique for solving problems which can be shown in mathematical form, namely algebra so he is often referred to as the father of algebra. According to (Putri, 2019) that Al-Kwarizmi's contribution to the field of mathematics in his discovery is that he can solve simple to complex problems with algebraic concepts. Al-Khwarizmi has intelligence so that he joins the *Dar al-Hukama* institution. One of Al-Khwarizmi's famous works in mathematics is *Hisab Al Jabr Wa'I Muqabalah* (Science of Equations). The contributions of Al-Khwarizmi in the field of mathematics include the use of Arabic number, algorithm, the discovery of the number zero notation, the notation of placement of numbers with base 10, modern algebraic concept, the use of irrational number, algebraic letter, and the value of the root of a number (Mohamed, 2004).

Algebraic method is used to solve problems in everyday life. This is what makes Al-Khwarizmi called the father of Al-Khwarizmi (Putri, 2019: 67-72). The contribution of Al-Khwarizmi in developing mathematics is to find the decimal or tenth and zero (Huda & Mutia, 2014: 188). The following are some of the contributions is formed by Al-Khwarizmi in mathematics which is very important, namely the discovery of the number zero, introducing decimal used for number operations after commas, the discovery of the symbol *phi* ( $\pi$ ) to show the ratio of the circumference of a circle, the use of variable and symbol, compiling lists of logarithm, algebraic method and find formula for solving quadratic equation with the concept of variables, square root, and parameter (Putri, 2019: 71).

### **Character Integration in Mathematical Learning in Study of Al-Khwarizmi's Thought**

Instilling character in students must pay attention to the five pillars of values including peace, virtue, love, truth, and non-violent behavior. These five pillars can be linked to learning

in elementary school (SD/MI). Instilling character in students can be done by a teacher when the learning process is carried out in the classroom or outside the classroom. One of them is by developing character in students through the subjects studied at the elementary school level (SD/MI). This study is conducted to analyze the characters contained in Al-Khwarizmi's thought about mathematics, especially in mathematical learning in elementary school (SD/MI). The integration of character in the process of mathematical learning in elementary school (SD/MI) can be done by teachers by linking the history of scientific figures with mathematics. One of them is that the teacher can tell about the scientist AL-Khwarizmi in finding the concept of decimal algebra, zero, and etc to students.

Al-Khwarizmi has the full name Ibn Musa al-Khwarizmi from Persia. Al-Khwarizmi is the earliest Islamic scientist to develop number theory in mathematics (Muhtar, 2014). Al-Khwarizmi's thought in the field of mathematics is to create techniques for solving problems which can be shown in mathematical form, namely algebra. According to Putri, Al-Khwarizmi's contribution to the field of mathematics in his discovery is that he can solve simple to complex problems with algebraic concepts. Al-Khwarizmi has intelligences so he joined the Dar al-Hukama institution. One of Al-Khwarizmi's famous works in mathematics is *Hisab Al Jabr Wa'I Muqabalah* (Science of Equations). Algebra has a very important role in solving problems in everyday life. This is what makes Al-Khwarizmi called the father of Al-Khwarizmi (Putri, 2019: 67-72). The contribution of Al-Khwarizmi in developing mathematics is finding decimal or tenth and zero (Huda & Mutia, 2014: 188).

The discovery of Al-Khwarizmi's thought is included in the mathematical teaching material learned in elementary school. Cultivating character in mathematical learning requires an appropriate concept to develop the potential of students who exist in themselves. The integration of character in mathematical learning leads to internalization in daily behavior through the learning process from the planning, implementation, and assessment stage (Khamidah, 2014: 244-249). The character of students can be developed especially based on the results of Al-Khwarizmi's thought on mathematics, namely by integrating characters in mathematics subject and can emerge in the learning process or teaching material (Rudyanto & Retnoningtyas, 2018: 41). The purpose of learning mathematics is to educate students, have the power of reason, personality, and good character. Mathematics has characteristics that require students to have critical, analytical, systematic skill, think logically, creatively, and innovatively and focus on mastering concepts and algorithms in addition to problem solving (Rudyanto & Retnoningtyas, 2018: 38).

The stages which can be carried out in character building are planting, growing, developing, and strengthening. At the planting stage, there are several things that can be done such as introducing students to concrete examples of good and bad things, teachers explaining bad and good consequences, students being monitored by parents, the community and teachers, and if students make a mistake, it will be corrected or notified in an appropriate way. While at the growth stage, what has been carried out at the planting stage is still monitored, reminded and guided, students should not be insulted or criticized so that they can develop and grow well in their hearts. In the third stage, development through concrete activities, students are given the trust to play role, discussion, assignment, group work, and etc and internalize the character in each learning activity. The last stage is stabilization which can be done such as students being given the opportunity or freedom to actualize themselves in contextual activities, motivating students to participate actively, being responsible for all things, both verbal, attitude, and deed (Annisah, 2016: 56).

Characters which can be developed in the mathematical learning process are hard work, discipline, curiosity, honest, creative, independent, communicative, and responsible (Maryati & Priatna, 2017: 338). This is in line with the opinion (Annisah, 2016: 57), learning mathematics can be grouped into characters which can be developed such as religious, responsible, confident, communicative, independent, curious, innovative, creative, critical, logical thinking, hard work, honest and disciplined. Meanwhile, according to (Khamidah, 2014: 248), character values which are able to be developed in students are the value of tolerance or respect for the results of one's thought by applying and using them in everyday life. This is in line with the results of research conducted by (Rudyanto & Retnoningtyas, 2018: 40), the characters in mathematical learning both in the teaching process by the teacher and the material presented to students such as the values of love, friendship, justice, honesty. This character can be conveyed optimally if the teacher understands it well. According to (Kristanti, 2019: 84), the characters in mathematical learning include discipline values, religious values, democratic values, tolerance values, character values like reading, and responsibility values.

Based on the results of the research above, it can be obtained data that the contributions of Al-Khwarizmi scientist in the field of mathematics can be seen, namely Arabic number, algorithm, the discovery of the number zero notation, the notation of placement of numbers with base 10, modern algebraic concept, the use of irrational number, algebraic letter, and the value of the root of a number. The Al-Khwarizmi scientist finds that it is not easy and it take a great struggle and enthusiasm to solve a problem. The values contained in the thinking of Al-Khwarizmi scientists are religious values, honesty, discipline, hard work, creative, independent, responsible, fair, confident, innovative, creative, democratic, communicative, fond of reading, critical thinking, logical thinking, curiosity, tolerance, compassion, and friendship.

Based on Al-Khwarizmi's thought on mathematics which has contributed a lot in everyday life, regarding his discovery of new methods of numerical calculation, solving techniques to recognize problems can be shown in mathematical form or what is called algebra and the creation of the Arabic number system. The results of his thought in the field of mathematics are summarized in *Al-Kitāb al-mukhtaṣar fī isāb al-jabr wa-l-muqābala or Liber algebrae et almucabala*. From Al-Khwarizmi's thoughts, we can be grateful that without Al-Khwarizmi's contribution in this life, we cannot know what Al-Jabar is (Mohamed, 2004). Problem solving in learning mathematics can be solved with several models, methods or ways such as the teacher directing students to be grateful to Allah SWT for what we receive. Patterns, concepts, rules which exist in mathematics, and their benefits for everyday life can foster the greatness of Allah SWT.

The next thing which can be developed and instilled in mathematical learning is being honest. This character can be formed by deductive mathematical proof activities in which someone will believe if there is strong evidence. Based on the results of Al-Khwarizmi's thought about subtraction and addition, it becomes a staple in mathematics. In this regard, a teacher not only teaches the concepts of addition and subtraction but also develops the value of honesty to students which is applied in the real life of students, for example by giving examples when buying snacks or calculating the amount of pocket money, and others. Al-Khwarizmi find the value of the number symbol *phi* ( $\pi$ ) which is applied to the formula for the area of a circle, the circumference of a circle, the volume of a cylinder, and etc. In mathematics, students learn mathematical concepts and mathematical symbols which cannot be changed. Through learning mathematics, students are given the opportunity to be orderly in their work and make good habits, always pay attention to the rules, formulas, mathematical concepts, and patterns. Thus, the value of the character of discipline can be formed in students.

The value which can be contained in mathematical learning is hard work. Students are required to be thorough and diligent in mathematical learning. When solving problems, there are times when you are wrong in calculating, using formulas and etc. Remarkably, students must not be discouraged, must be patient, and examine what is wrong with their work. Al-Khwarizmi is a mathematical scientist who pursues almost all of his work and produces a great work in the field of mathematics which is used as a scientific foundation, namely algebra, astronomy, and other fields that he is engaged in (Muhtar, 2014: 86). Like the scientist Al-Khwarizmi in solving, a problem needs to think critically by always doing experiments. Thus, we can imitate his attitude in everyday life. The process of learning mathematics is usually done by giving problems in the form of story questions or problem solving so that students are required to be able to solve these problems independently by thinking critically, logically, and able to determine the appropriate way. The way of completion of each student is also different, there are those who complete the long way and some who complete the short way. If students are accustomed to solving math problems, they will come up with creative ideas that can help in everyday life.

Al-Khwarizmi scientist has a high curiosity by observing and analyzing to produce various works and discoveries which are very valuable in the field of mathematics, namely problem solving techniques shown in mathematical form or called algebra. Values which can be developed in the mathematical learning process are when students are able to answer or solve mathematical problems. Students understand the problem, looking for what information is already known, and what it is information to look for. The process of finding this information from mathematical problems to its completion is a process of inculcating the value of curiosity. In the mathematical learning process, students are given mathematical problems that demand to find appropriate solutions without depending on others. Independent values can be formed in students when they think about the belief that they can solve the problem they face by finding or thinking about the right way to solve the problem.

Mathematics can grow communicative values because the language used is still in the form of symbols so that students are required to be able to solve mathematical problems by communicating well so that the information conveyed to others can be understood with their own abilities. Discipline in thinking becomes a habit which is formed in studying mathematics giving birth to an attitude of responsibility towards obligation that should be carried out both responsibilities to oneself or to others and to God. When students can solve mathematical problems independently and the teacher gives students the opportunity to present their work in front of the class, the teacher gives appreciation for what they do. This will indirectly raise self-confidence in students.

The teacher in instilling democratic character values is by giving students the opportunity to conclude learning outcomes and make decisions. Al-Khwarizmi also give an example from his findings by presenting and pouring it into a book. The next value which can be developed in learning mathematics is the value of liking to read. In learning mathematics, students must be careful and must read the problems provided by the teacher carefully in order to understand what is being asked in the problem. Al-Khwarizmi also provides an example by contributing to translating Greek and Hindu texts to analyze and develop the idea of zero as a number (Muhtar, 2014: 83). In mathematical learning, students are taught to solve a problem which must be solved by counting and using formulas but the method used by each student is different but the results obtained are the same. Thus indirectly, students are practicing the character values of tolerance for each other and respecting the way that is applied in their respective lives. The material taught in mathematical learning is integrated with real world

condition or contextual with everyday life for example when there is a problem about fractions where an object must be divided equally with others. Based on this indirectly, students are practicing the values of love and friendship.

Based on the analysis above, it can be said that the thought of the Al-Khwarizmi scientist is very helpful and makes it easier to solve problems faced in everyday life. Al-Khwarizmi's thought turns out to contain a lot of character values which need to be instilled in mathematical learning, especially in elementary school (SD/MI).

## CONCLUSION

Al-Khwarizmi is a prominent Islamic scientist who contributed his thought in the field of mathematics, namely finding the 0 number (zero), algebra, logarithm, geometry and etc. The results of his thought on mathematics are very helpful in everyday life. Mathematics is a subject which is learned in elementary school (SD/MI) which has a role in developing the character of students. Characters which can be developed are religious value, discipline value, honest value, hard work value, critical thinking value, logical, creative and innovative value, curiosity value, communicative value, independent value, responsibility value, self-confidence value, democratic value, the value of reading, and the value of fairness, compassion, and friendship. To deepen research on the study of Al-Khwarizmi's thought, more in-depth research is needed.

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