



## Mathematics Literacy and *Storytelling*

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**Abstract.** One of the skills needed to thrive in the fourth industrial revolution is complex problem-solving. This skill is closely related to mathematical literacy. Mathematics literacy defined as the ability of an individual to formulate, use and interpret mathematics in various contexts. This skill was one of the important skills in improving Indonesia PISA's (Program for International Student Assessment) rank which was still low so we need a learning approach that can give effect to students' mathematics literacy. Through studying the literature, researchers found that storytelling had an effective influence on students' mathematics literacy skills.

**Keywords:** mathematics literacy, storytelling, literature study

**INTRODUCTION** ~ Indonesia currently facing an era of industrial revolution 4.0 where the way of human activity in the scale, scope, complexity and transformation of previous life experiences change very rapidly. According to Muhammad Yahya, in industrial revolution 4.0 era humans going to live in global uncertainty.

In the article titled "The 10 Skills You Need to Thrive in the Fourth Industrial Revolution" there are ten skills that each person must possess to be successful in the industrial 4.0 era. Complex problem-solving is the ability at the top and it is closely related to mathematical literacy. Mathematical literacy according to the draft assessment framework Program for International Science Assessment (PISA) in 2012 is defined as an individual's ability to formulate, use, and interpret mathematics in various contexts. Unfortunately, from the results of the combined tests of mathematics, science, and reading,

Indonesia occupied rank 64 of the 65 participating countries (OECD, 2013). It shows that the ability of Indonesian students to solve problems that demand the ability to study, give reasons, and communicate effectively, and to solve and interpret problems in various situations is still low.

One effort that can be made by educators to improve students' literacy skill in solving a problem is to innovate mathematics learning and develop learning assessment instruments (Wardono, 2013). According to Ausubel (Ruseffendi, 2006), Mathematics learning worth if uses problem-solving methods, inquiry, and learning methods that can foster creative and critical thinking, so that students can associate and solve problems between math problem, another lesson, or problems related to real life. Storytelling approach considered effective to improve the literacy skills of mathematics as a student-centered, to develop the creativity of



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students, emphasizing the process of constructing knowledge by the students, practicing math literacy skills and connecting mathematics to real-life (As'ari, 2017).

Several definitions for mathematical literacy have been cited in the literature. However, there is an extremely limited number (or lack) of academic texts detailing or quoting verses from the Quran and references from *hadith* related to relevant topics in mathematics. Through studying the literature, this paper makes an effort to gain an insight into mathematics storytelling based on Qur'an and *hadith* to foster mathematics literacy.

### **Mathematics Literacy**

Literacy comes from the Latin word, *littera*, which means understanding the mastery of writing systems and conventions that accompanied. Literacy according to PISA is considered as knowledge and skills for adult life. Literacy is obtained through a lifelong process, taking place not only in schools or through formal education, but also through interactions with friends and the wider community.

Mathematical literacy according to the 2012 PISA Draft Assessment framework means the ability of an individual to formulate, use, and interpret mathematics in various contexts. Including mathematical reasoning and using mathematical concepts, procedures, facts, and tools in helping someone to recognize the role of mathematics in the

world and making the necessary considerations and decisions as citizens.

The word "mathematical literacy" was first mentioned by NCTM (1989) as one of the visions of mathematics education. In this vision mathematical literacy is defined as "*an individual's ability to explore, to conjecture, and to reason logically as well as to use a variety of mathematical methods effectively to solve problems. By becoming literate, their mathematical power should develop*".

The problem faced by the teacher next is how to teach literacy skills math to students? *Principles and Standards for School Mathematics* (NCTM, 2000) recommend using concrete models and physical materials before moving on to more abstract ideas. Goral & Gnadinger (2006) recommend that teachers using storytelling as a catalyst to mathematics instruction is one enjoyable and versatile method to do just this.

### **Storytelling**

*Storytelling* consists of two words, *story* and *telling*. Based on the Dictionary of Indonesia Language / Kamus Besar Bahasa Indonesia, the story is a fairy tale, a speech that describes a process of an incident at length, essays that presents the course of events, the play is embodied in the show (about drama, film and so on). According to Casey (2004), teachers can use storytelling to relate students' informal knowledge and experiences with more formal problem-solving procedures. In particular, when the main characters of



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the story are used to pose a mathematical problem, they can engage student's imagination and creativity and create enthusiasm in the classroom.

In contrast to direct instruction, *storytelling* is considered as an effective approach in learning because the teacher not only transfers their knowledge and student receive it, but there is a knowledge construction process by students. Storytelling is a fun way for children because it is close to the world of children, fairy tales are able to develop imagination, power of thought, wonder, and curiosity of children (Poerwati and Cahaya, 2017).

In the following sections, an example of the mathematics story will be discussed in relation to an understanding of certain verses from the Qur'an and from *hadith*.

### Story In Qur'an And Hadith

The terminology of a story (especially in the Qur'an) can be interpreted as a fragment from the previous people or figures published in the Qur'an. Stories are often used as a medium to convey teachings, and even some surahs predominantly present them, such as Surah Yusuf, Al-Kahfi, Maryam, Al-Anbiya, and Al-Qashash. Every scientific study, in this case about the story in the Qur'an is a *hazanah* that we can take benefit from it if it is good and we can reflect on it again if there is a mistake in it to increase our belief and faith (Khalimuddin, 2014).

Based on Ath-Thahir (2017), the story in Qur'an has several functions including

1. As lessons and advice

"Certainly in the stories of the bygone people there is a lesson for people of understanding. What is being narrated in the Qur'an is no fabrication; it is rather confirmation of the Books that preceded it, and a detailed exposition of everything, and a guidance and mercy for people of faith." (Surah Yusuf: 111)

2. Confirming the hearts of the Prophet and the believers who were with him
3. Tells the way of life of pious people from among the prophets and apostles so that they become an example for believers in living life
4. A warning to unbelievers and seditious people, even to believers, so that they do not commit disobedience, because of the reward is given according to the deeds done  
As entertainment and solace for the hearts of believers

One example of a verse in the Qur'an that can be used as a source of storytelling is the fourth chapter of the Qur'an sets forth some elaborate rules regarding the inheritance of wealth, rules that tended to safeguard the status of women and children (Schwartz, 2014). When a man died, first his debts were to be paid, along with any bequests to "strangers," meaning nonrelatives. The remainder of the estate was then to be divided up among the surviving brothers, sisters, widows, and children according to certain prescribed ratios.



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For example, if a man died leaving two sisters and a wife, each of the 3 women were to receive  $\frac{1}{3}$  of the remainder of the estate after payment of debts and bequests.

According to As'ari (2017) learning based on *story/storytelling* that source coming from Qur'an is a way to develop four thinking skills, namely critical thinking, creative, collaborative, and communicative or 4Cs, in the global era because it uses all of the abilities to think.

### **Storytelling And Mathematics Learning**

Storytelling activities can be designed for learning mathematics with creative planning and management, because basically mathematical concepts and problems can be developed through stories, or what we often know as the story problems. The creativity of the teacher as a facilitator is very necessary because teachers are required to be proficient in storytelling while integrating mathematical concepts into it. Stories need to be organized and improvised so that the goals can be directed to improve children's mathematical abilities.

Storytelling can be applied as an appropriate approach in mathematics learning for children, this research conducted by Campos et al (2015), research shows that children are enthusiastic and have a high interest in drawing and developing e-book comics. Positive progress has been achieved in reading and interpreting the stories proposed. Children's pleasure is indicated

by the concentration of problem-solving given increasing. The relationship between literature and mathematics has a positive impact on how the words in a problem are interpreted because children quickly connect between the stories they read and their respective characters. It shows that storytelling not only can be applied in improving language skills but also effective in developing cognitive abilities including mathematics.

In recent years, Interest in using storytelling in mathematics teaching and learning emerged (Mink & Fraser, 2005; Skoumpourdi & Mpakopoulou, 2011; Szurmak & Thuna, 2013; Lemonidis & Kaiafa, 2019). Integrating storytelling in mathematics teaching develops literacy skills and promotes mathematical language (Wiburne & Napoli, 2008).

Storytelling in mathematics is an approach to creating a safe learning environment where students openly can appreciate, understand and enjoy mathematics (Modi, 2012). Albool's study in 2012 showed that the use of the approach revolves around the teacher's mathematics can improve the ability of students to understand the concept of fractions and solving mathematical problems, so it is able to improve mathematics learning outcomes. Moreover, this approach also increasing student motivation to learn mathematics.

According to Abdussakir & Rosimanidar (2017), mathematics learning can be



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integrated with Qur'an through the following steps

1. *Mathematics from Al-Quran: Developing Mathematics from Al-Quran*

In this integration model, mathematics is studied and developed from the Qur'an. In the classroom, learning begins with studying the verses of the Qur'an related to the topic to be discussed. For example, to discuss the concept of sets can begin by studying Surah Al-Fatihah about human groups, the beginning of Surah al-Baqarah about human groups, Surah An-Nur about animal groups, Surah al-Fathir about groups of angels, or Surah al-Waqiah about human groups.

2. *Mathematics for Al-Quran: Using Mathematics to Implement Al-Quran.*

In this integration model, mathematics is used to carry out God's commands contained in the Qur'an. In teaching practice, mathematics is taught in order to develop intellectual potential as well as the spiritual potential of students (Djauhari, 2008). Mathematical learning is done through problem-solving, cooperative learning, realistic approaches, or *open-ended* approaches that need to be done to develop the cognitive, affective, and psychomotor domains of students.

3. *Mathematics to Explore Al-Quran: Using Mathematics for Revealing the Mathematical Wonders in Al-Quran*

In this integration model, mathematics is used to explore mathematical wonders contained in the Qur'an.

4. *Mathematics to Explain Al-Quran: Using Mathematics for Explaining Al-Qur'an*

In this integration model, mathematics is used to provide explanations in the verses of the Qur'an relating to mathematical calculations or other mathematical aspects. For example, mathematics is used to explain how long the prophet Noah lived with his people or the length of Ashhabul Kahfi slept in a cave. In the 29th surah verse 14, the operation of reducing 1000 *sanah* (referring to the year of Shamsiyah) with 50 *'aam* (referring to the year of Qamariyah) cannot be carried out immediately because of different units, unless one unit is changed to another

5. *Mathematics to Deliver Al-Quran: Using Mathematics to Deliver Al-Quran*

In this integration model, mathematics is used as a means to teach and convey the contents of the Qur'an to students. For example, in explaining the concept of a set using examples of compulsory prayer names, sunnah prayers, names of days or months in Islam, names of prophets, names of angels, names of prophets ulul azmi,



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names of letters in the Qur'an, names of letters of Madaniyah, or the name of the Makkiyah letter. In explaining the relations and functions, using the example of the name of prayer, letter names and the number of verses, or deeds and return.

#### 6. *Mathematics with Al-Quran: Teaches Mathematics with Qur'anic Values*

In this integration model, mathematics is associated with the content of the values of the Qur'an. Mathematics is based on the values of the Qur'an to develop *al-akhlaqul karimah* in order to create students into a *khaira ummah* which is covered by *'amilush shalihah*.

Adopted from previous studies, mathematics learning with the approach revolves around the source of the Quran is divided into three stages include the initial activity, core activities and closing activity.

1. Initial activities, at this stage of learning the teacher begins the learning by conveying the learning objectives to students. The teacher conveys apperception by linking the material that has been learned at the previous meeting and linking it with the material to be learned.
2. Core activities begin with an exploration phase. Then together students open the Qur'an and

the teacher gives a choice verse that can be used as an illustration and related to the material to be studied. Selected verses in the Qur'an are also given an interpretation so that students will easily understand the relationship between selected verses and lessons that can be taken therein. In this stage, the teacher uses the storytelling method, which is one of the methods used by Rasulullah SAW in delivering the minutes by telling stories.

3. Closing activities, at this stage the teacher gives feedback. Feedback is given to students in the form of oral, written, cues in order to strengthen the material provided by the teacher.

### CONCLUSION

At the school level, literacy in mathematics is generally related to problem-solving and or problem posing. Students should be provided with opportunities to experience literacy in doing mathematics and also try to think like a mathematician, which means that students are encouraged to reflect on their own ideas. For this purpose, it is necessary to improve teachers' ability to integrate storytelling within mathematics story because it will develop literacy skills and promotes mathematical language (Wiburne & Napoli, 2008).



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Storytelling is a powerful tool that can bring rich, meaningful and lasting images to student (Goral & Gnadinger, 2006). Furthermore, Using stories is yet another a pedagogical tool to help our students connect to the mathematics they need to learn.

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