



Ethnomathematics Comics of Al-Akbar Mosque Surabaya to Improve Numeracy and Literacy in Reading and Writing

Dian Kusmaharti; Pana Pramulia; Via Yustitia

Universitas PGRI Adi Buana Surabaya, Indonesia

<http://dx.doi.org/10.18415/ijmmu.v10i11.5118>

Abstract

The numeracy and reading and writing literacy of elementary school students in Indonesia is still not satisfactory. Need the existence of innovative teaching materials that suit students' cognitive levels, increasing interest in reading, and accommodate students' numeracy and literacy skills. Culture in the form of the Al-Akbar Mosque building in Surabaya can be used as a student learning resource with the hope that learning will be more meaningful for students. Ethnomatematics comics can used as an alternative learning media to improve numeracy and reading literacy write. The purpose of this research is to describe the comic development process ethnomathematics of al-akbar mosque and knowing the validity of ethnomathematics comics. The research method uses Borg and research and development methods Gall. The research subjects were fifth grade students at Bahrul Ulum Elementary School, Surabaya. This research uses a type of development research or commonly known as Research and Development (R&D). Using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). However, it is limited to the Analysis, Design and Development stage. Data collection methods use questionnaires and documentation. Development research instruments used to assess the feasibility of interaktif digital modules are in the form of product feasibility questionnaires. Data analysis techniques use descriptive data analysis techniques for product processing and quantitative analysis to determine product feasibility. The results of this research are products of development results through three stages, namely Analysis (needs analysis, student analysis, content analysis), Design (the stage used to create an Ethnomatematics comics and Development in the form of product development results. Ethnomathematics comic at the Al Akbar Mosque in Surabaya has achieved 83.93% feasibility in the feasible category. Feasibility is obtained from the results of an assessment by 2 expert validators media and material experts, as well as 2 practitioners. So it can be concluded that ethnomathematics comics are suitable for use in learning and are expected to become reference learning resources by educators to improve literacy and numeracy for elementary school students.

Keywords: *Ethnomatematics; Al-Akbar Mosque*

Introduction

The numeracy and literacy skills of elementary school students in Indonesia still leave much to be desired. There is a pressing need for innovative teaching materials that align with students' cognitive

abilities, foster a stronger reading interest, and accommodate their numeracy and literacy levels. Cultural assets, such as the Al-Akbar Mosque in Surabaya, can serve as valuable learning resources for students, aiming to imbue learning with greater significance. An alternative medium for instruction, ethnomathematics comics, holds promise in enhancing both numeracy and literacy in reading and writing.

Numeracy and literacy skills stand as pivotal proficiencies for elementary school students to acquire (Yustiti & Juniarso, 2020). These competencies form the bedrock upon which children build problem-solving skills for life and effective communication within society (Grover & Pea, 2018). Regrettably, the reality reflects less than satisfactory numeracy and literacy skills among elementary students in Indonesia. According to a 2019 survey conducted by the Program for International Student Assessment (PISA) and published by the Organization for Economic Co-operation and Development (OECD), Indonesia ranked 62nd out of 70 countries, positioning it among the 10 countries with the lowest literacy rates (Alamin, dkk, 2022).

Numeracy encompasses the practical application of fundamental mathematical principles and processes within everyday contexts (Kusmaharti & Yustitia, 2022). Within numeracy-literacy, four aspects are examined: numbers, geometry & measurement, algebra, and data & uncertainty. At SD Bahrul Ulum Surabaya, numeracy skills for fifth-grade students primarily fall within the “less proficient” category, accounting for 66.98% of students. The “sufficiently proficient” category ranks second at 27.36%, while the “very less proficient” category constitutes 3.77%. The “proficient” category registers at 1.89%.

Literacy skills in reading and writing encompass the ability to locate information, comprehend informational and literary texts, evaluate text presentations, and critically engage with textual content (Fang, 2023). The literacy skills of students at SD Bahrul Ulum Surabaya fall within the “sufficiently proficient” range, with an average score of 56.03. The test results are promising, with 35.85% of students falling within the “good” category and 5.66% achieving an “excellent” rating. Approximately 42.45% of students are classified as “sufficiently proficient,” 15.09% are categorized as “less proficient,” and 0.94% exhibit “very less proficient” skills.

One of the factors that influence students’ numeracy and literacy skills is the teaching activities carried out by teachers in the classroom (Yustitia, dkk, 2021). Teachers need to develop lessons using teaching materials that facilitate numeracy and literacy skills. The preliminary analysis conducted at SD Bahrul Ulum Surabaya indicates that teachers have not yet developed their self-made teaching materials. Additionally, geometry is considered a challenging subject by the majority of students, especially when presented in the form of story problems. Thus, there is a pressing need for innovative teaching materials that are aligned with students’ cognitive levels, stimulate reading interest, and cater to numeracy and literacy skills. One effective approach to address this is by creating educational comics. Comics are a popular genre among students, characterized by engaging storylines, vibrant illustrations, and a touch of humor (Akcanca, 2020). Utilizing comics motivates students to complete tasks and encourages critical thinking as they analyze both the narrative and the visual content.

In the fast-paced era of technology and information, there is a concern about the potential erosion of cultural values. Mathematics, however, can serve as a means to preserve and pass down cultural traditions. Culture intertwined with mathematical concepts is often referred to as ethnomathematics, where cultural elements and the surroundings can be leveraged as valuable learning resources for students (Verner, dkk, 2019). This approach is aimed at making the learning experience more meaningful for them. An example of such cultural integration is the Al-Akbar Mosque in Surabaya, which is close to SD Bahrul Ulum.

The Al-Akbar Mosque exhibits geometric forms that lend themselves to analysis within the realm of mathematics education. Geometry, as one of the branches of mathematics, carries abstract properties.

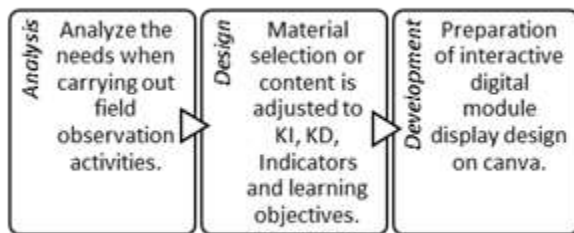
The educational approach to mathematical concepts in geometry can be rooted in local wisdom (Ana, 2016). This research holds significance for educators as it aids in crafting a comprehensive learning resource and knowledge repository for geometry topics at the elementary level. This is anticipated to simplify the process of delivering geometry content and enhance teaching experiences for educators.

Given the aforementioned considerations, an ethnomathematics comic centered around the Al-Akbar Mosque in Surabaya was developed for geometry lessons within the context of elementary schools.

Methods

The researcher in this study employed the research-and-development (R&D) method. The research subjects were fifth-grade students at SD Bahrul Ulum Surabaya. Research and development (R&D) using the ADDIE development model. In Setyosari, (2020) the ADDIE model consists of several stages of learning design, namely Analysis (analysis), Design (design), Development (development), Implementation (implementation) and Evaluation (evaluation), but in this research the development stage is limited to the development stage due to limited research time.

The research procedure for the development of the interactive digital module only comes to three stages more details can be seen in the following figure:



Result

Based on the data obtained, the Al Akbar National Mosque (Surabaya Grand Mosque) is the largest mosque after the Istiqlal Mosque. This mosque is located in Pagesangan Village, Jambangan District, Surabaya and is directly parallel to the Surabaya-Gempol Toll Road. From the results of these observations, the researchers found that in the architecture of the Al-Akbar National Mosque there are mathematical concepts in its architecture, such as a cone-shaped dome and a pyramid, the pillars of the mosque are tubular. In addition, in the experience of researchers not only found spatial shapes but also flat shapes such as squares, circles, rectangles, rhombuses and octagons. From this research experience, researchers were encouraged to conduct further research. Researchers think of making the Al-Akbar National Mosque used as teaching material for geometry material that can combine culture and also material in mathematics. Before discussing the geometric shapes at the Surabaya Al-Akbar Mosque and ethnomathematics, it is necessary to know the physical form of the Surabaya Al-Akbar Mosque.

Physically, the building area and facilities in the Al-Akbar Mosque in Surabaya are 18,816 square meters, the length of the Al-Akbar Mosque is 147 meters while the width of the mosque is 128 meters. Surabaya Al Akbar Mosque has 1 large dome, 4 small pyramid-shaped domes and has 1 tower. The uniqueness of the shape of the dome of the Al-Akbar Mosque lies in its egg-like shape. The dome of the Al-Akbar Mosque uses a space frame system, namely using a triangular structure that is connected from steel. On the main stretch (diameter) measuring 54 x 54 m then a dome is formed on top of the frame. The

dome is also made with 1.5 layers which has a height of about 27 meters. This mosque has several characteristics of large mosques in Indonesia, namely having a large entrance and having the largest mihrab in Indonesia.

Judging from the structure of the shape of the Surabaya Al-Akbar National Mosque, many geometric concepts are found in it. This is supported by observation activities that have been carried out, where geometric elements in the form of flat shapes and spatial shapes are found in every structure of the Al-Akbar Mosque in Surabaya. From the results of the exploration that has been carried out, the Al-Akbar Mosque in Surabaya is used as a medium to learn about the history and mathematics of the mosque. These conditions can be used as a new mathematics learning medium. In accordance with the concept of ethnomathematics presented by Pradhan (2017) that in any culture you can find ideas about mathematical concepts contained within it. Culture in this case is the Al-Akbar Mosque in Surabaya which is an example of mathematical results applied to local community groups (Lee, 2022).

Based on the observations made, namely that the Al-Akbar Mosque in Surabaya has several elements of mathematical geometry. These elements are flat shapes in the form of squares, rectangles, circles, octagons, rhombuses and also semicircles. To wake up space there are pyramids, blocks, cubes, tubes, balls and also cones. Of the various forms that have been found in the building of the Al-Akbar Mosque in Surabaya, it is also necessary to know about the concept of symmetry in the building of the Al-Akbar Mosque in Surabaya. There is a flat shape at the Al-Akbar Mosque in Surabaya, which has a flat shape with folding and rotating symmetry. Holm (2020) in their journal explained that folding symmetry is the number of folds that occur in a shape that can make the shape split into two equal sizes. At the Al-Akbar Mosque in Surabaya, the buildings have folding symmetry, including the floor of the mosque, the mosque charter, the shape of the dome from the inside, calligraphy, the shape of the mosque's dome motif, and others. While the concept of rotational symmetry is that if a plane is rotated less than a full circle it will occupy the same position, at the Al-Akbar Mosque in Surabaya the concept of rotational symmetry can also be found in one of the fence holes, urban farming walls, the outer floors of the mosque and others. According to a study of ethnomathematics concepts mentioned by D'Ambrosio (in Arboleda, 2023) ethnomathematics depicts the cultural identity of a group. In this case the Surabaya Al-Akbar Mosque can be interpreted as a culture originating from East Java, a form of expression from groups or surrounding communities which are classified in the form of mathematical structures. Therefore, ethnomathematics can provide insight that mathematics comes from a culture. Mathematics is closely related to culture. The discovery of mathematical elements in the Al-Akbar Mosque in Surabaya is also in accordance with the opinion of Rosa & Orey (2011), namely ethnomathematics objects are objects of a culture that contain mathematical and mathematical modeling, these objects can be in the form of traditional dances, traditional clothing, or all other activities.

The results of this study are to describe the stages of development of the ADDIE model, but are limited to the Analysis, Design and Development stages. At the stage of needs analysis Lack of variation in the use of teaching materials used in learning. At SD Bahrul Ulum, they conduct virtual face-to-face learning once a week because they get complaints from parents. Student was given the task of completing a learning module consisting of several materials and collected representatives of parents in the space provided. So that makes learning seem less meaningful.

At the stage of the analysis students according to Ashraf (2020) there is a lack of interest of students in mathematics learning, because mathematics is one of the subjects that students consider difficult. Because students complete tasks in one lesson, it makes it difficult for students to understand concepts, formulas and solve problems in mathematics learning. At the content analysis stage, namely using mathematics subjects, the material is geometry class IV / semester2. Researchers refocused indicators and learning objectives in accordance with core competencies and basic competencies in the annual mathematics program of SD Bahrul Ulum.

At the product design stage the researcher determines the contents and materials to be used in the ethnomathematics comic. Design development is carried out according to the initial design that has been determined at the stage previously. The explanation at this stage is as follows on the cover of the ethnomathematics comic there is a title and background that depicts the essence of the ethnomathematics comic story. The home page is made as attractive as possible perhaps by bringing up four main characters so that students feel interested in opening the story and read this ethnomathematics comic.



Figure 1. Comic Cover Display

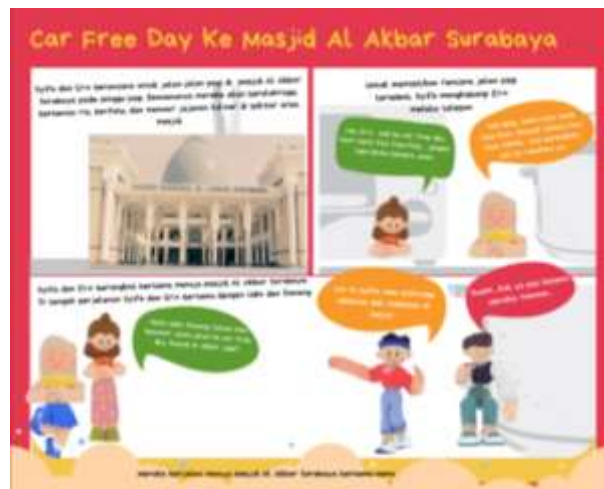


Figure 2. Example of comic display

Ethnomathematics comic at the Al Akbar Mosque in Surabaya has achieved 83.93% feasibility in the feasible category. Feasibility is obtained from the results of an assessment by 2 expert validators media and material experts, as well as 2 practitioners. So it can be concluded that ethnomathematics comics are suitable for use in learning and are expected to become reference learning resources by educators to improve literacy and numeracy for elementary school students.

Conclusion

The results of this research are products of development results through three stages, namely Analysis (needs analysis, student analysis, content analysis / material), Design (the stage used to create an Ethnomatematics comics and Development in the form of product development results. Ethnomatematics comic at the Al Akbar Mosque in Surabaya has achieved 83.93% feasibility in the feasible category. Feasibility is obtained from the results of an assessment by 2 expert validators media and material experts, as well as 2 practitioners. So it can be concluded that ethnomatematics comics are suitable for use in learning and are expected to become reference learning resources by educators to improve literacy and numeracy for elementary school students.

Reference

- Akcanca, N. (2020). An alternative teaching tool in science education: Educational comics. *International Online Journal of Education and Teaching*, 7(4), 1550-1570.
- Alamin, R. Y., Zulaikha, E., & Gunarta, I. K. (2022, December). Board Game as Financial Literacy Education Media for Indonesian High School Students. In 2022 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM) (pp. 0022-0026). IEEE.
- Ana, M. K. S. (2016). Eksplorasi Etnomatematika Bentuk Bangunan Masjid Al-Akbar Surabaya Pada Materi Geometri Di Sekolah Dasar. *JPGSD*.
- Arboleda, L. C. (2023). Ubiratan D'Ambrosio as Historian of Mathematics and Science. In *Ubiratan D'Ambrosio and Mathematics Education: Trajectory, Legacy and Future* (pp. 71-82). Cham: Springer International Publishing.
- Ashraf, A. L. A. M. (2020). Challenges and possibilities in teaching and learning of calculus: A case study of India. *Journal for the Education of Gifted Young Scientists*, 8(1), 407-433.
- Fang, Z. (2023). *Demystifying academic reading: A disciplinary literacy approach to reading across content areas*. Taylor & Francis.
- Grover, S., & Pea, R. (2018). Computational thinking: A competency whose time has come. *Computer science education: Perspectives on teaching and learning in school*, 19(1), 19-38.
- Holm, L. (2020). DALI and the persistence of protein shape. *Protein Science*, 29(1), 128-140.
- Kusmaharti, D., & Yustitia, V. (2022). Self Regulated Learning Calon Guru Sekolah Dasar Dalam Menyelesaikan Masalah Numerasi: Studi Deskriptif. *Union: Jurnal Ilmiah Pendidikan Matematika*, 10(3), 395-404.
- Lee-Niinioja, H. S. (2022). The continuity of pre-Islamic motifs in Javanese mosque ornamentation, Indonesia. *The Continuity of Pre-Islamic Motifs in Javanese Mosque Ornamentation, Indonesia*, 1-296.
- Pradhan, J. B. (2017). Mathematical ideas in Chundara culture: Unfolding a Nepalese teaching and learning system. *Ethnomatematics and its diverse approaches for mathematics education*, 125-152.

- Verner, I., Massarwe, K., & Bshouty, D. (2019). Development of competencies for teaching geometry through an ethnomathematical approach. *The Journal of Mathematical Behavior*, 56, 100708.
- Yustitia, V., & Juniarso, T. (2020). Literasi Matematika Mahasiswa Dengan Gaya Belajar Visual. *Malih Peddas (Majalah Ilmiah Pendidikan Dasar)*, 9 (2), 100–109.
- Yustitia, V., & Siswono, T. Y. E. Abadi. (2021). The effect of mathematics self-efficacy on numeracy skills of prospective elementary school teachers. *Cypriot Journal of Educational Sciences*, 16(6), 3405-3417.

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).