

The Role of Ethnomathematics in Welcoming the Society 5.0

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Abstract

Efforting reduced the negative effect of the revolution industry, needed to inculcate noble cultural characters in adolescents through implementation ethnomathematics in learning. Through ethnomathematics students not only understand mathematical concepts but also appreciate their cultures more and can take values within them, which impact on the formation of national character. Embedded with the noble cultural character in students will surely cope with the negative impacts of changing the world.

Keywords: role, ethnomathematics, era society 5.0

1. Introduction

Changes in the world are now entering the era of the industrial revolution 4.0 or the fourth world industrial revolution, where information technology has become the basis in human life. As we know, the first generation industrial revolution was marked by the use of steam engines to replace human and animal power. The second generation, through the application of the concept of mass production and the use of electricity. The third generation, marked by the use of automation technology in industrial activities. In the fourth industrial revolution, it became a big leap for the industrial sector, In the fourth industrial revolution, this became a big leap for the industrial sector, using information and communication technology to the fullest. Rapid technological developments, including the existence of social roles that are replaced by the presence of intelligent robots, are considered to be able to degrade human roles. Prime Minister of Japan introduces the 5.0 Society on Monday, January 21, 2019.

In the industrial revolution, 4.0 everything became borderless with unlimited use of computing power and data, because it was influenced by the development of the internet and massive digital technology as the backbone of human and machine movement and

connectivity [1]. Generation in the industrial era 4.0 holds a commitment to increase flexibility in manufacturing, en masse, with better quality and productivity. On the other hand, society 5.0 will make artificial intelligence transform big data collected through the internet in all areas of life into new wisdom, with the hope of increasing human ability to open up opportunities for humans [2].

Rapid changes occur in science and technology. With the development of science and technology, various systems are also experiencing development. Rapid changes experienced by the community due to the rapid development of information technology has many impacts on human life, generally positive and negative [3]. Modernization has affected the life of the nation undeniably. It has an impact on the erosion of the noble cultural values of our nation. It happened because of a lack of application and understanding of the importance of cultural values in society. We can find the erosion of cultural values through current phenomena such as a lot of violence, riots, self-destructive activities, and juvenile delinquency.

It is crucial to teach cultural values, which are the basis of national character. Teaching since childhood can help children better understand, interpret, appreciate, and realize the importance of cultural values in life. Family and community have an essential role in

preserving cultural values. One of the competencies in learning mathematics is the ability to reason. This ability requires the ability to think logically, systematically, and have an honest, disciplined nature in solving problems. Amid the chaos and the multidimensional crisis surrounding the nation, it is better to build alternative solutions based on mathematics learning.

One of the realization of creative and meaningful learning based on the culture in learning is through ethnomathematics. Ethnomathematics is a form of learning approach that links local cultural wisdom in mathematics learning. Learning mathematics through cultural practices is called ethnomathematics. Students will better understand how their culture is related to mathematics, and educators can instill the noble values of national culture that have an impact on character education. With the embedded character of virtuous students will fortify students from the negative impacts of changing world society, both by the industrial revolution 4.0 and society 5.0.

2. Discussion

2.1 Ethnomathematics

D'Ambrosio, a Brazilian mathematician, introduced the term ethnomathematics in 1977. In the language, the prefix "ethnic" is as something comprehensive that refers to the socio-cultural context, including language, jargon, codes of behavior, myths, and symbols. The basic word "mathema" tends to mean to explain, know, understand, and carry out activities such as coding, measuring, clarifying, concluding, and modeling. The suffix "tics" comes from the word *techne* and has the same meaning as a technique [4]. Furthermore, making a bridge between culture and mathematics is an important step to recognize various ways of thinking that can lead to various forms of mathematics [5]. It is a field called ethnomathematics. Culture is the result of human activity, which contains mathematical concepts. Exploration of mathematical concepts in culture is essential.

The term *ethno* describes all the things that make up a group's cultural identity, namely language, codes, values, jargon, beliefs, food and clothing, habits, and physical traits—while mathematics includes a broad view of arithmetic, classifying, sorting, inferring, and modeling. Ethnomathematics serves to express the relationship between culture and mathematics [6].

Ethnomathematics is a study of mathematics that takes into account cultural considerations in which mathematics arises by understanding the reasoning and mathematical systems they use [5]. Ethnomathematics studies in mathematics learning cover all fields: architecture, weaving, sewing, agriculture, relations of humanity, ornamentation, and spiritual and religious practices often in harmony with patterns that occur in nature or enjoining abstract systems of ideas.

Ethnomathematics, namely mathematics that arises and develops in society and is following local culture, is central to the learning process and teaching methods [7]. It opens up the pedagogical potential that takes into consideration students' knowledge gained from learning outside the classroom. Ethnomathematics includes mathematical ideas, thoughts, and practices developed by all cultures [8]. Ethnomathematics as a program that aims to learn how students to understand, understand, articulate, process, and finally use mathematical ideas, concepts, and practices that can solve problems related to their daily activities.

Ethnomathematics uses broad mathematical concepts related to various mathematical activities, including grouping, counting, measuring, designing buildings or tools, playing, determining locations [5]. This statement is in line with Bishop's thought, which states that ethnomathematics has six necessary activities in cultural groups [9]. The six mathematical activities are activities: counting, determining the location, measuring, designing, playing, and explaining.



Fig. 1. Ethnomathematics Object of Borobudur Temple

In Indonesia, there are many cultural sites and traditional traditions of people and ethnic groups. Some of these mathematical objects have been studied and used as objects of ethnomathematics research, including

Prambanan Temple, Borobudur Temple, Yogyakarta Palace, and Cultural traditions of Ki Ageng Wonolelo [10], [11]. Here are some examples of mathematical objects that have been identified based on several studies.



Fig. 2. Ethnomathematics Object of Yogyakarta Palace

We can find several materials, including geometric shapes, tessellations or changes, symmetry and congruence, and angles in Prambanan Temple. On the other hand, we can find mathematics in Borobudur Temple and Kraton Yogyakarta culture. The cultural traditions of Ki Ageng Wonolelo have geometry objects and the volume of geometric shapes .

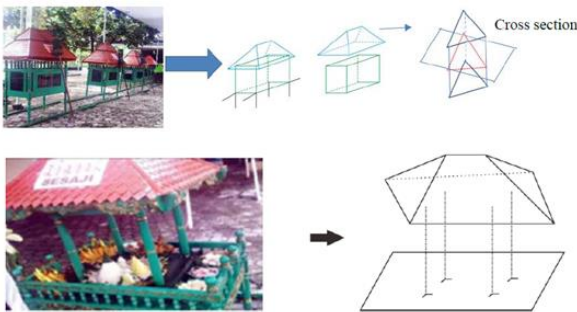


Fig. 3. Ethnomathematics Object in Ki Ageng Wonolelo Cultural Traditions

2.2 Industrial Revolution 4.0

Industry 4.0 Revolution, according to is a real movement towards the development of increasingly sophisticated information and technology. Industry 4.0 is an industry that combines automation technology with cyber technology. It is a trend of automation and data exchange in manufacturing technology. It includes cyber-physical systems, the Internet of Things (IoT), cloud computing, and cognitive computing. Machines will replace humans activities [12]. The innovation that

began with the amount of data on the internet and the use of cloud changed industrial products. Moreover, change the production process and product marketing. Even changing people's lifestyles because of the products of this industrial revolution.

In general, the fourth industrial revolution full of automation, the process of digitalization, and the use of electronic devices with information systems. We can feel the results of the industrial revolution of 4.0. In the previous industrial revolution, it was usually always dominated by European and American countries, which had a greater variety of capital. However, the industrial revolution 4.0 made it possible for each country to develop themselves and improve their abilities internally in all aspects of the field because of the massive exchange of information in the digital age.

2.3 Era Society 5.0

Human-made technology is increasingly developing over time so that developed countries begin to make changes. In recent years Japan has initiated the development of people's lives. At its peak on January 21, 2019, the Japanese PM Office launched a more humanistic roadmap. Japanese innovation emphasized on the use of technological advances. The Japanese government calls it a super-smart society or Society 5.0. Preceded by the era of hunting (Society 1.0), farming (Society 2.0), industry (Society 3.0), and information technology (Society 4.0).

Society 5.0 is a human-centered and technology-based concept developed by Japan. This concept was born as the development of the 4.0 industrial revolution, potentially degrade the role of humans. Society 5.0 balances economic progress by solving social problems through a system that profoundly integrates virtual and physical space.

Through Society 5.0, artificial intelligence will transform big data collected through the internet in all areas of life (the Internet of Things). Of course, it will become new wisdom, to increasing human ability to open opportunities for humanity. This transformation will help humans to live more meaningful lives. This transformation will help humans to live more meaningful lives. In Society 5.0, the need to balance economic achievement with the resolution of social problems.

Innovation in Society 5.0 will reach a forward-looking society that breaks the current stagnation. Communities whose members respect each other and

communities where everyone can lead an active and pleasant life.

In Society 4.0, people will access cloud services (databases) in cyberspace through the internet and search, quote, and analyze information or data. Meanwhile, in Community 5.0, a large amount of information from sensors in physical space is accumulating in cyberspace. In cyberspace, artificial intelligence (AI) can analyze big data, and the results of the analysis are fed back to humans in physical space in various forms. This process brings new value to industry and society in previously impossible ways.

In Industry 4.0, there is a known cyber-physical system (CPS), which is an integration between physical systems, computing, and also network/communication. Society 5.0 is an improvement from CPS to cyber-physical-human systems. Where humans (humans) are not only used as objects (passive elements) but play an active role as a subject (active player) working with physical systems in achieving goals (goals). So the interaction between machines (physical systems) and humans is still needed.

Some people think that Society 5.0 is better because it is considered more humane than Revolution 4.0. Nevertheless, that does not mean Revolution 4.0 cannot compete because basically, the context of the two concepts is almost the same, which is trying to develop technology in a better direction. Sooner or later, this concept will be applied in Indonesia because Indonesia needs better technology to prevent social inequalities and existing economic problems.

2.4 Role of Ethnomatematics in Welcoming the Era society 5.0

The development of the world of education is entering a crucial period. Not only to provide quality and optimal education services. However, it is also a crucial period that will determine the continuation of education itself.

Today, the challenges in education are increasingly sophisticated and require solemn preparation and thinking. After the 4.0 revolution, the idea of society 5.0 has emerged, although to be more humane, we must still be vigilant.

Society 5.0 is a society that can solve various challenges and social problems with the Internet of Things (internet for everything), Artificial Intelligence (artificial intelligence), Big Data (data in large numbers), and robots to improve the quality of human life. This transformation will help humans to live more meaningful lives.

World transformation is very influential on the mindset and patterns of action of society as a whole in various aspects. Psychologically and sociologically, besides affecting the wider community, the communities most easily affected by global phenomena are the younger generation, especially adolescents, wherein this phase adolescents are entering the life of transition from childhood to adolescence, which is still relatively unstable. His emotions, besides that he is also looking for his identity as a teenager. This globalization process indirectly results in the decline of the nation's character in the younger generation who are the nation's assets in the future. We all realize that education is not just a transfer of knowledge (transfer of knowledge) but also a transfer of value. For this reason, the cultivation of national character based on cultural values in education is essential.

In the process of education, cultural education and national character are one of the efforts to prevent the degradation of ethical and moral values among adolescents. Success in building student character helps the success of building the nation. Character education is essential in building national morals and personalities.

Discipline, cooperation, hard work, independent honesty are national characters. We can find these through local cultural values. So the character of the nation lies in local cultural values. Bearing this in mind, the development of national character must begin with the development of local cultural values. Transforming local cultural values is part of the nation's character building [13]. Value transformation is an effort or activity carried out to keep preserving or developing the values contained in the culture so that the culture can answer the complexity of the problems experienced by the community. With this value transformation, the community can know the values that are used as a reference in life so that they can adjust to existing developments without forgetting the fundamental values contained in their local culture.

3. Conclusion

The application of ethnomatematics as one approach to learning mathematics can be used as a forum to develop the nation's character in education. Ethnomatematics which combines mathematics with culture will have a dual function when applied in learning, in addition to making students more comfortable to understand the subject matter, it can also examine the values contained in their culture. Seeing mathematics not only as a

collection of definitions, theorems, or axioms but in mathematics is combined with elements of local culture that affect the mindset of the local community.

Through the ethnomathematics approach, the teacher can study the cultures that are in the student's environment and then examine the values that exist in that culture. The teacher can convey and emphasize the importance of the values of these cultures so students will not only understand mathematics but respect their cultures more and be able to take values within them, which will impact on the formation of the nation's character. The emphasis on cultural values is significant for the teacher to do. The emphasis in question is how students will become accustomed to applying those cultural values.

The teacher must support to develop the nation's character. They have a great responsibility to instill such character education in students. Given the teacher as a facilitator, teachers must be able to assess cultural values, so students can understand the values that exist in their culture. Through this process, it will undoubtedly have an impact both directly and indirectly in shaping the character of students.

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