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Global Conferences Series:
Sciences and Technology (GCSST), Volume 2, 2019
The 1st International Conference on Education, Sciences and Technology
DOI: https://doi.org/10.32698//tech1315141

The Implementation of TOKIJO as indigenous chemistry knowledge based learning media on chemistry of the element teaching for Senior High School Students

S Purtadi [1,*], **R L P Sari**[1], **D Dina**[1]
[1]Universitas Negeri Yogyakarta

Abstract. This article was aimed to describe the results of the implementation of learning media in the form of characters who combine prominent characteristics of wayang (javaness puppet) characters with chemical and physics properties, use, and abundance of chemical elements. This figure (character) is called TOKIJO (tokoh kimia jowo = javanes chemical figure). TOKIJO which has been developed then socialized to the chemistry teacher association (MGMP) in Temanggung district. This socialization consists of two steps, namely the application of the learning process and explanation to the teacher regarding the use of TOKIJO media in learning. This article emphasizes the implementation of TOKIJO in teaching process by looking at students' responses to the use of TOKIJO in learning. To collect student opinions, a five scale questionnaire was used. The results showed that students considered TOKIJO could improve their understanding on chemistry of the elements. Other results are discussed in this article

1. Introduction

The development of technological and scientific products greatly influences modern life. Therefore an understanding of the facts of science and the connection between technology science and society is very much needed [1]. The ability to understand the facts of science and apply it to life is called scientific literacy. Scientific literacy is the knowledge and understanding of scientific concepts and processes needed in personal and social and cultural decision making, and economic productivity [2]
The dimensions of scientific literacy need to be considered because they relate to decisions about how to undermine lessons and subject matter in the class and how to respond to students individually who demonstrate lack of understanding [3]. The dimensions of scientific literacy are: 1) literacy dimensions, 2) nominal scientific literacy, 3) functional scientific literacy, 4) conceptual and procedural scientific literacy, and 5) multidimensional scientific literacy[3]. The dimensions commonly used in relation to scientific literacy are, a) understanding the nature of the sciences and methods of science and the nature of scientific knowledge, b) understanding key scientific concepts, principles, and theories (science content knowledge), c) understanding of how science and technology are interrelated, d) appreciation and understanding of the influence of science and technology in society, e) communication competencies in the scientific context the ability to read, write, and understand systematic human knowledge, and f) the application of knowledge and skill reasoning in everyday life [4].

Based on this dimension, Shwartz, Ben-Zvi, and Hofstein (2005) [4] develop components of chemical literacy by stating that, someone who is chemically literate understands the basic ideas in chemistry. Chemical literacy has five components [4]. One of these components is chemistry in context.

Understanding chemistry in context will be more meaningful when explaining the context in the lives of students. The context of knowledge that has existed from the time the ancestors were preserved in the form of traditional community knowledge or local knowledge (indigenous knowledge). Social and cultural strength surrounds each individual to form indigenous education [5]. Furthermore, it is explained that humans from prehistoric times can survive because they can learn from examples and experiences to adapt to their lives in the environment. This ability can be maintained from generation to generation in the form of indigenous knowledge (Indigenous knowledge) [6]. Therefore good learning needs to pay attention to this knowledge. The forms of representation of the integration of this knowledge have not been well researched, developed, and inventoried. Existing knowledge is limited to knowledge that spreads from individual to individual. Still need a lot of research about it.

This study develops learning media that link chemical concepts with traditional wisdom, namely Javanese wayan. This media is called TOKIJO. TOKIJO is a general design character that is created by combining the properties of chemical elements with prominent characteristics from puppet world figures to get new figures with elemental names. The process carried out in the study goes through several stages, namely first determining the characteristics of the prominent and visible elements which means they are easy to visualize and typical of each of these elements. These properties can be physical, chemical, abundance in Indonesia, sources, and their use, especially in Javanese society. Second is to analyze the characteristics of a typical, well-known, and prominent puppet characters

The third, synthesizes TOKIJO figures based on the elemental nature and character of puppet characters. There are 30 (thirty) TOKIJO designs that have been completed and assessed. The results of this assessment indicate that the TOKIJO design made is very good and can be used as an attractive medium for studying chemistry. In this TOKIJO, the TOKIJO design is printed in various media, including t-shirts, mugs, key chains and wall clocks.

Fourth is to implement limited learning in schools. Chemistry teachers have not used much local wisdom-based media to teach the context aspects of chemistry. Therefore, this implementation aims to look at students' responses to TOKIJO's media use in learning and provide socialization to High School Chemistry teachers about how to use local wisdom-based learning media to teach contextual chemical literacy. This article discusses students' responses to TOKIJO's media use in learning

2. Results and Discussion

The application of learning using tokijo media was conducted on 30 Temanggung Senior High School 2 students who were randomly selected to take part in this activity. The application of learning is intended to provide concrete examples to the chemistry teacher of the training participants later. Students can easily follow the instructions of all the cooperative model steps that are applied enthusiastically so that no time is wasted. This shows that the speaker has provided communicative direction. This is evident from the results of the questionnaire displayed with the diagram in figure 1

The application was carried out by a short cooperative method type two stay-two modified stray. Modifications are carried out considering the large number of groups and members must learn a lot of material. This method is chosen because the time provided is quite short. This method is carried out with the following steps.

1. Students are grouped into six groups with each group consisting of 5 children

2. Each student takes a different mug with a picture of TOKIJO (chemical character jowo)
3. Each student learns the 'caption' in the mug that connects the characteristics of the elements, the sources in nature, and their uses with the puppet characters associated with TOKIJO (example in figure 2.). this activity is carried out within 3 minutes.

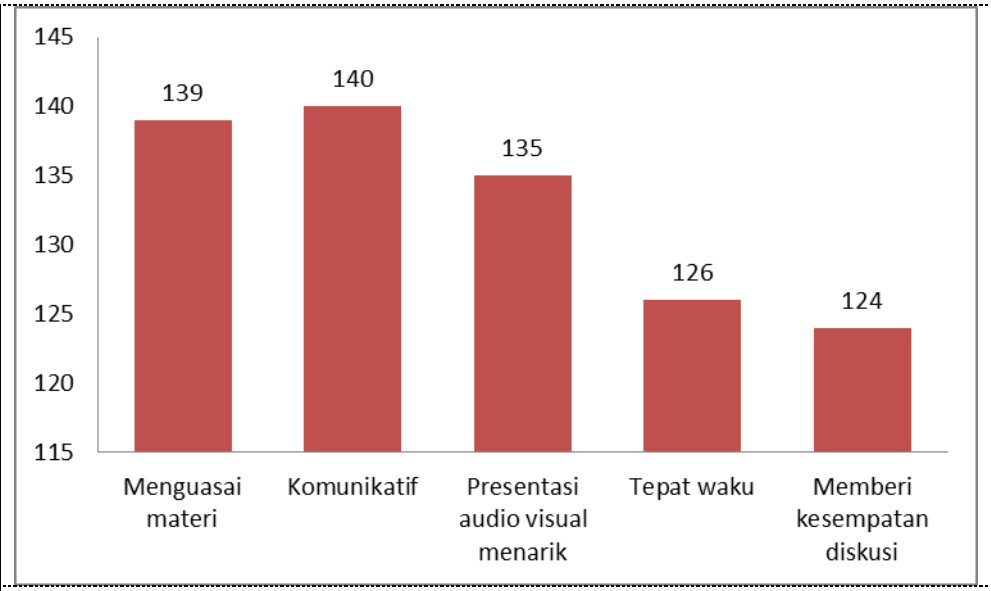

Figure 1. Student Assessment of TOKIJO Instructor

Figure 2. Example of a TOKIJO image in a mug

4. Each student presents TOKIJO that belongs to each of the groups. Each child presents about 2 minutes, so this step takes about 10 minutes
5. Then each group assigns three children to visit three different groups. Assignments are arranged so that no groups are empty or overlapped. Group 1 assigns one child each to groups 2, 3 and 4. Group 2 assigns one child each to groups 3, 4 and 5 and so on
6. Two children who live in groups are tasked to explain all TOKIJO in their groups to each group member who comes. This process was followed by discussion with about 10 minutes later each child returned to his group.

7. Next repeat step 5 by sending three more children to the rest of the group that have not been visited
8. after that, each child returns to his group and explains the results they get from visiting the whole group. Each child is required to explain within 5 minutes per group.
9. The final step is a game to see students' understanding of the chemical elements, abundance, traits, and their association with TOKIJO figures

In the learning process, students look enthusiastic to learn what is in the mug, observe the figure of the character and learn the association with the puppet story. This enthusiasm can be seen in figure 3.

Figure 3. Student enthusiasm when studying with TOKIJO media

The enthusiasm of these students was also indicated by their assessment of the learning methods provided (figure 4). Students assume that the learning method is very interesting and makes students active. For the material passport, the highest score in the material corresponds to chemistry learning, while the material coverage has the lowest value even though it is still in the good category. This means that the material discussed in the learning process takes place appropriately for their learning.

In the last part of the learning game is done, which is to openly open questions to students. Students who can answer questions will receive prizes in the form of TOKIJO products. In this process, students are eager to answer. Students appear confident that he knows the answer. None of the twenty questions related to tokijo were missed by students. This process shows that the use of TOKIJO media has been able to accelerate students' understanding in learning elemental chemistry.

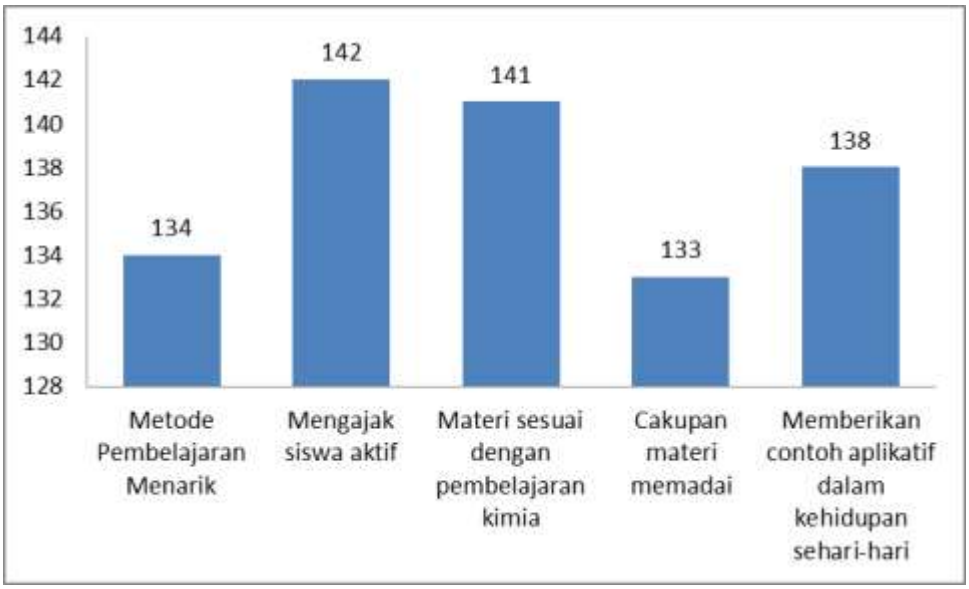

Figure 4. Student Assessment of Learning Methods and Chemical Materials

3. Conclusion

TOKIJO media has been well applied in chemistry learning to teach chemical elements and their abundance. In this application students respond well and assume TOKIJO facilitates their learning process well

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