Digital Zoo Exploration Learning: A Review of Integration Roblox with Challenge based on STEM Context Learning on Mathematical Literacy Skills

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Abstract. Mastering mathematical literacy skills is a must for students to face challenges in the era of society 4.0. However, the PISA results show that mathematical literacy skills in Indonesia are still low. Roblox game media is an alternative solution to overcome this problem. The challenge based on STEM context learning can provide learning meaningfulness to students. The learning innovation of Roblox zoo exploration integrated with challenge based on STEM context learning is an alternative way to develop math literacy skills in a science context. The purpose of this research is to describe the effect of Roblox integration on challenge based on STEM context learning on mathematical literacy skills through a literature review. The literature review was carried out by analyzing the results of relevant research. The facts show the integration of Roblox stimulates students to explore the STEM context of the digital world presented so that it can encourage the development of mathematical literacy skills. Challenges based on STEM context learning guides students to develop their mathematical literacy skills. Roblox games integrated with challenges based on STEM context learning will provide learning meaningfulness for students. The results of the literature study show the Roblox game that integrated with challenge based on STEM context learning can have a positive impact on students' mathematical literacy skills.

BACKGROUND

The 4.0 revolution era is an era that has changed human life in several sectors. The education sector is a sector that has experienced many changes in the 4.0 revolution era [1]. This is a challenge for a learner to face the changes that occur. In order to face these challenges, students need to master the basic skills of mathematical reasoning to be able to model a problem in real life into a simpler form, known as mathematical literacy skill [2]. Mathematical literacy is an ability to reason mathematically, including formulating, employing, and interpreting mathematical concepts to solve various problems in real life [3]. A person is said to master mathematical literacy if he is able to apply his knowledge to real world problems [4].

One of the benchmarks that can be used for students' mathematical literacy skills is the Programme for International Student Assessment (PISA) published by the Organization for Economic Co-operation and Development, OECD [5]. Based on the results of PISA in the last three publications, it shows the mathematical literacy skills of Indonesian students at 386 with an average world score of 490 in PISA 2015, 379 with an average world score of 489 in PISA 2018, and 366 with an average world score of 472 in PISA 2022 [6], in other words, in each year Indonesia's mathematical literacy skills are always below the world average. This data also shows a decrease in the math literacy scores of students in Indonesia in the last 10 years.

A learning innovation that is oriented towards mathematical literacy skills is one way to improve the mastery of mathematical literacy skills [7]. Innovations such as interactive games in mathematics learning can provide a positive learning experience and encourage students' mathematical abilities [8]. The use of interactive games in the form of digital exploration worlds such as Roblox can well train students' mathematical literacy skills to apply mathematical concepts in everyday life [9]. So, the integration of Roblox interactive games can be an alternative solution to enhance students' mathematical literacy skills.

The innovation of learning media such as interactive games in the classroom is inseparable from the application of the right learning model in it [10]. One of the learning models that can be used is the Challenge Based Learning (CBL) learning model. The CBL learning model can provide learning experiences for students in constructing their knowledge through a meaningful and relevant learning process with real-world contextual problems [11]. Contextual learning and relevant to real-world problems in a learning model can improve students' numeracy literacy [12]. CBL modeled learning integrated with Science, Technology, Engineering, and Mathematics (STEM) nuances can present contextual problems in the form of Challenge based on STEM Learning [13].

The implementation of STEM-based learning is able to facilitate students in mastering mathematical skills on contextual problems [14]. STEM-based learning encourages student sensitivity to real-world problems so as to improve mastery of mathematical literacy skills [15]. Zoo exploration activities are one of the learning activities that have many activities related to science, suggesting an "ecology" of sites vary-ing in degree with regards to science and STEM learning in general [16]. STEM learning in zoo exploration activities provides a variety of science contextual problems that can be raised to improve math literacy skills [17]. Although zoo exploration learning has several challenges such as expensive costs and weather factors, the innovation of digital zoo exploration learning in Roblox media is an alternative solution that is expected to be able to improve math literacy skills.

Based on the background above, this research will focus on an in-depth study of learning innovations to improve students' mathematical literacy skills. The study conducted aims to find out how the role of Roblox integration with Challenge based on STEM Learning on students' mathematical literacy skills.

RESEARCH METHODS

The method used in this study is Literature Review (LR), by collecting literature or research that is relevant to the topic being reviewed. In order to filter the existing literature, researchers set criteria in finding related articles. Literature collection in this method comes from several sources such as research journals, articles, or national and international proceedings within the last five years so as to obtain the latest information. The keywords used to search for relevant literature are Roblox, Challenge Based Learning, STEM Context, and mathematical literacy skills. The type of data used in the theoretical study is secondary data in the form of results or conclusions from the literature reviewed.

In this literature, the literature is analyzed through three steps, namely: (1) Organization, (2) Synthesis, and (3) Identification. The organizing stage is carried out by collecting and compiling the literature to be analyzed. The synthesis stage is carried out by organizing the data obtained in the previous stage so that it becomes a summary that has a connection with each other. The identification stage is carried out by identifying the data obtained according to the keywords in the literature so as to achieve the objectives of this study. This study focuses on the role of Roblox integration with Challenge based on STEM Learning on students' mathematical literacy skills.

RESULTS AND DISCUSSIONS

The organizing stage is carried out by collecting literature which is then analyzed by making an exploration framework that contains the author's name, year of publication, title, research results, and research conclusions. In addition, literature exploration was carried out regarding the type of research, procedures, research samples, and other matters related to research methods in the literature. The results of this exploration will then be analyzed to achieve the objectives of this research.

The synthesis stage is carried out to form an identification of each literature which is then assembled into a summary that is connected to each other. The results of the analysis of literatures relevant to the research statement are described in the following sub-chapters.

Mathematical Literacy Skills

Mathematical literacy skills are needed for a learner to deal with changes that occur in the education sector [2]. Mathematical literacy is defined as an ability to reason mathematically, including formulating, employing, and interpreting mathematical concepts to solve various problems in real life [6]. Mathematical literacy skills are needed

by someone in learning to formulate, use and interpret mathematical concepts through reasoning processes, applying concepts in contextual problem at various situations [18]. Mathematical literacy skills can be a general and basic competency in mathematical problem-solving competency [19].

FIGURE 1. Mathematical Literacy Skill Framework

There are three indicators of mathematical literacy skills as shown in Fig 1. The indicators of mathematical literacy are as follows: (1) Formulate is creating a mathematical structure based on a contextual problem; (2) Employ is solving a mathematical problem that has been formulated by applying mathematical concepts, facts, procedures, and reasoning; and (3) Interprate & Evaluate is reflecting the solution to a mathematical problem into the context of a real

life problem [11]. In simple terms, the indicators of mathematical literacy skills can be interpreted as: (1) students can model the forms of contextual problems into mathematical problems; (2) students can solve mathematical problems from modeling that has been made based on previously acquired knowledge; and (3) students can draw conclusions from the solutions made and reapply them to contextual problems in the real world.

Roblox

Roblox is a free multiplayer online content/game platform that allows students to explore the digital world that offers various interactive features in learning [20]. The creation of digital world and interactive features in Roblox media is created using Roblox Studio developer software so that it can be adjusted to the learning needs required [21]. The digital world developed in Roblox Studio can be customized to be compatible with several platforms including mobile, apple, computer, and even virtual reality [22]. Thus, this provides an opportunity for educators to develop an interactive game for students based on contextual problems to improve their mathematical literacy skills.

As an interactive game, Roblox allows students to interact, interact socially, collaborate, and explore through avatars that they control in the game in analyzing the contextual problems provided [23]. Roblox interactive games also provide opportunities for students to be more involved in the learning process to provide meaningful learning for each student [24]. The integration of Roblox into learning in the form of a virtual world exploration world is effective in training mastery of mathematical literacy skills in applying mathematical concepts in the real world [9]. Preview of the Roblox zoo game is attached in Fig 2.

FIGURE 2. Roblox Zoo Game Preview from Zoo Tycoon Server

Challenge Based Learning (CBL)

The Challenge Based Learning (CBL) learning model is a learning model that focuses on contextual problems in the real world by combining the concepts of project-based learning and problem-based learning [25]. In CBL learning, students are able to apply their thinking in the real world, helping them find ways to present and solve mathematical problems in collaborative learning [26]. Thus, CBL learning helps students to master the ability to model problems, complete modeling forms, and convey solutions to these problems to the real world.
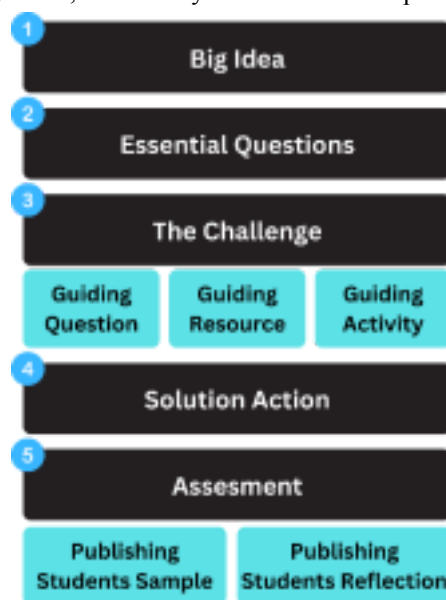
FIGURE 3. Roblox Zoo Game Preview from Zoo Tycoon Server

Figure 3 shows the five steps in the CBL model. The implementation of CBL learning begins with students being given a big idea and raising essential questions that are interrelated with contextual problems so that students can proceed to the challenge stage; In compiling a solution design for the given challenge, students will be guided using Guiding Activities, Guiding Resources, and Guiding Questions to provide instructions on how to solve the given contextual challenge; Furthermore, students will develop and apply the solution to the real world. Furthermore, students develop solutions to be implemented for real challenges; The final stage of CBL-modeled learning, students carry out assessments by presenting solutions that have been found to be published Publishing and reflection on the learning that has been passed Reflection [27].

CBL learning model has a positive impact on students' mathematical literacy skills. Students in learning with the CBL learning model have better mathematical literacy skills compared to using conventional learning in solving a contextual problem [28]. Thus, CBL learning media is able to train students' mastery of mathematical literacy skills

to face changes in the 4.0 era.

STEM Context

STEM Context is a combination of STEM learning and real-world contextual problems. STEM is defined as "an approach that refers to combinations of two or four components of science, namely Science, Technology, Engineering, and Mathematics (STEM) is an approach formed based on a combination of several disciplines, namely science, technology, engineering, and mathematics" [29]. Then, what is meant by real-world contextual problems refers to a learning concept that directs students to connect mathematical concepts with mathematical problems with more realistic, focused, and systematic solutions [30]. By focusing on integrating several pillars of science in contextual challenges, STEM Context learning is an effort that can improve students' mathematical literacy skills [31].

Integration Roblox with Challenge based on STEM Context Learning on Mathematical Literacy Skills

At the identification stage, the merging stage is carried out and produces a digital zoo exploration innovation design framework integrated with Roblox that answers the research objectives. At this stage, the implementation of the innovation is compiled in an integrated manner in the implementation of mathematics learning.

One of the designs that can be applied to train students' mastery of mathematical literacy through the integration of Roblox with Challenge based on STEM Context Learning on Mathematical Literacy Skills is in the material on function relations, with learning outcome "Peserta didik dapat memahami relasi dan fungsi (domain, kodomain, range) dan menyajikannya dalam bentuk diagram panah, tabel, himpunan pasangan berurutan, dan grafik." based on Kurikulum Merdeka, in the field of mathematics combined with classification material in the field of biology. Learning design using integration of Roblox with Challenge based on STEM Context Learning on Mathematical Literacy Skills can be seen in Table 1. Figure 4 shows several illustrations regarding (a) the basic ideas in the exploration activities regarding taxonomy in the digital zoo, (b) questions that arouse students' curiosity to explore the digital zoo to answer them, and (c) the form of challenges that will be given to students to complete in groups.

TABLE 1. Integration Roblox with Challenge based on STEM Context Learning on Mathematical Literacy Skills. **Stages of the CBL-STEM Context Model Description**

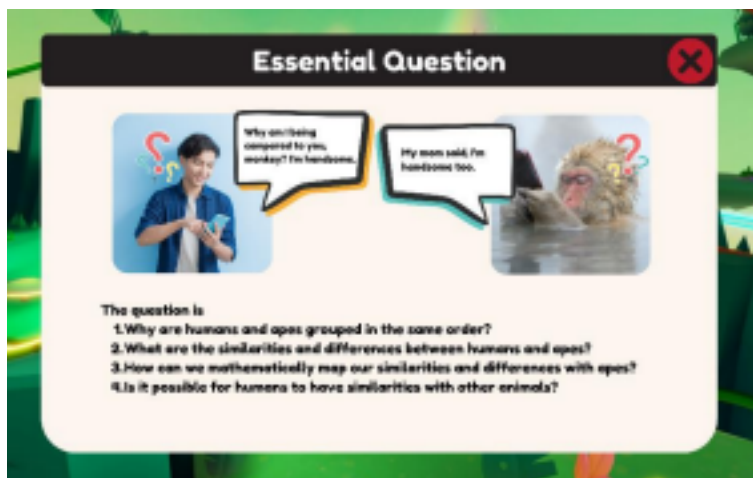| Stages of the CBL-STEM Context Model	Description
Big Idea	In the waiting area, students are given big ideas related to the application of STEM in taxonomy problem. Students are given directions before entering the exploration area in groups. There is a 3D simulation in the replica world regarding the use of STEM in taxonomy activities.
Essential Question	Students are given or given important questions that are relevant to STEM and its application in the biology and mathematics.
The Challenge	Guiding Resources Students read materials scattered at some important points at the Zoo. Guiding Questions Students solve contextual problems packaged in the form of puzzles to open access to more difficult levels. Guiding Activity Students read the guide located in the puzzle area at the zoo to help find solutions to puzzles and become a guide in completing the main challenge.
Solution and Action	In groups, students present solutions to contextual challenges to the wider community via social media platforms.
Assessment	Publishing Students Sample Every student works on the questions. Publishing Students Reflection Every student carries out an evaluation through

reflection.

(a)

(b)

(c)

FIGURE 4. Big idea of exploration activity (a); Essential question of that related to taxonomy in the digital

zoo (b); The challenges that will be given to students to complete in groups (c)

Table 1 explains the stages of the STEM-Context-based CBL learning model carried out in learning using Roblox Zoo. Learning begins by providing students with a big idea regarding facts about human and ape taxonomy as an introduction to relations and functions in mathematics, an illustration of the big idea display is attached in Fig.4. (a). However, to make it easier for students to digest the big idea delivered, the teacher can convey several provocative questions to students as attached in Fig.4. (b). After that, all students in the class are grouped into several groups to complete contextual challenges that are expected to help them understand the modeling and application of mathematics in the real world as attracted in Fig.4. (c). All UI in Fig.4, can be accessed by students and teachers via Roblox. Other components in Table 1, such as guide resources, guide questions, guide activities, and assessments can be adjusted to the same material and adjusted to learning outcomes with the applicable curriculum.

CONCLUSION

Based on the results and discussion, it can be concluded that the digital zoo exploration activity on Roblox integrated into challenge-based STEM learning can be an innovative solution to improve students' mathematical literacy skills. This learning provides an opportunity for students to be actively involved in the learning process so as to provide a meaningful experience in learning that is integrated with STEM Context. Not only that, the application of STEM Context to CBL-modeled learning facilitates students in mastering the skills needed in the era of the 4.0 revolution, namely mathematical literacy skills. Thus, further research is needed regarding the development of learning media that integrates Roblox into challenge-based STEM learning in the form of digital zoo exploration activities to improve mathematical literacy skills.

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