
DESIGNING LEARNING TRAJECTORY OF SET THROUGH THE INDONESIAN SHADOW PUPPETS AND MAHABHARATA STORIES

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ABSTRACT

Indonesia has many cultures that can be used as a starting point in learning mathematics. Yet, many teachers still use conventional methods to provide explicit mathematical content without connecting with students' culture and daily activities. One of the learning approaches that can solve these problems is Realistic Mathematics Education (RME). This approach uses context as one of its characteristics containing students' culture and their daily activities. On the other hand, Wayang (Indonesian shadow puppets) and Mahabharata stories have the characteristics that can be a context in the learning of set. This research aims to design the Hypothetical Learning Trajectory (HLT) of the set using the RME approach through Wayang and Mahabharata stories, which are familiar with students' culture in Yogyakarta. This HLT will then be tested on students in further research until it becomes the Local Instructional Theory (LIT) on set. Students can study about set by grouping Wayang in Mahabharata stories based on their characters. The research result is the HLT of set through the context of wayang and Mahabharata stories containing learning goals, learning activities, and the conjecture of every activity. This HLT can be a promising solution to overcome students' difficulties in understanding the concept of sets and values in the cultural context to improve the students' character.

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1. INTRODUCTION

In principle, the elements that build mathematical concepts come from several things developed by humans to respond to the surrounding environment, such as seeking explanations, understanding, experiences, and solutions to phenomena or events around them that they experience (Ernest et al., 2016; Freudenthal, 2006; D'Ambrosio, 2007). In addition, mathematics cannot construct itself. Still, it is influenced by historical, environmental, social, and geographical aspects or what we call a culture where humans develop and process their lives (Risdiyanti & Prahmana, 2017; Utami, Sayuti, & Jailani, 2019). As a result, it becomes inflexible and becomes far from culture and everyday life,

where humans develop and process it (Alangui, 2010; Muhtadi et al., 2017). Therefore, mathematics is very close and departs from culture and daily human life, eventually becoming a proper formal education or school form.

The mathematics learning problem is inseparable from the efforts of the West to try to hegemony science to dull the thinking ability of individuals who study mathematics so that it can facilitate and perpetuate colonialism and western influence on other civilizations (D'Ambrosio, 2007; Joseph, 2010). The mathematics form is rigid and far from the origin of the construction of mathematical concepts (Risdiyanti & Prahmana, 2020a). It's causing mathematics learning to be limited to knowledge transfer. Students only accept it without critical and reflective thinking on the knowledge and cannot know its meaning and use in everyday life (D'Ambrosio, 2016). Thus, a learning approach that is close to culture and human activities is needed to solve these problems in learning mathematics.

D'Ambrosio (1985), a mathematician from Brazil, initiated the Ethnomathematics approach as a solution. Ethnomathematics is a way to study and combine ideas, methods, and techniques used and developed by socio-cultural or members of different cultures to learn mathematical concepts (D'Ambrosio, 2016; Rosa & Orey, 2016). It is reflecting on how mathematics was developed based on how mathematics is taught in schools. Ethnomathematics tries to reconstruct mathematics so that it is rooted in different cultures and accommodates other ideas so that students become able to reason critically, democratically and can be tolerant of various ideas and ideas during teaching and learning activities (D'Ambrosio, 2016; Risdiyanti & Prahmana, 2020a). Therefore, ethnomathematics can be used as one of the educational innovations in mathematics learning, aiming to make students love mathematics, be motivated, and increase creativity in mathematics through their culture.

Indonesia is a country with an abundant culture to instill mathematical ideas, methods, and techniques through mathematical modeling (Prahmana et al., 2021). This approach creates opportunities in mathematics learning to use local contexts or cultures that can increase students' critical reasoning and interest by rediscovering mathematics rooted in the culture around students and benefiting from the mathematical concepts it finds. One of the cultures in Java, especially in Central Java, East Java, and the Special Region of Yogyakarta, which has mathematical characteristics, is Wayang. Elements of wayang characters known by the Javanese people have several similarities to identify kind, evil, caste, and several things in them. In addition, there are still many Javanese people who hold Wayang performances at certain events. Mathematical modeling in the context of wayang characters and their stories is expected to teach mathematics. Learning mathematics using the cultural context used in learning mathematics has been documented by some researchers, i.e., the Gadang Minangkabau house for learning the Pythagorean theorem (Rahmawati, 2020), the Soko Tunggal mosque for learning two-dimensional geometry (Putra, Wijayanto, & Widodo, 2020), Megono Gunungan for learning cones (Nursyahidah et al., 2020), Batik cloth motifs for learning reflection (Novrika, Putri, & Hartono, 2016), and Bamboo craft for learning translational (Maryati & Prahmana, 2020).

Ethnomathematics is mathematics that exists from how society uses mathematics to deal with their everyday life (D'Ambrosio, 2007). Ethnomathematics can be part of the Realistic Mathematics Education approach, mainly an authentic context used as a starting point in the learning process (Risdiyanti & Prahmana, 2020a). Therefore, students can understand a mathematical concept from the culture, which implicitly contains mathematical concepts.

Realistic Mathematics Education approach with characteristics of using real context as a starting point in learning can be a place for Ethnomathematics, an authentic context in learning mathematics. Real contexts in RME aim to make it easier for students to understand

and abstract the mathematical concepts learned from non-formal to formal forms (Hadi, 2017; Soedjadi, 2007). In this approach, the teacher acts as a facilitator who accompanies the emergence of students' thinking strategies and not as a source that indoctrinates students' thinking (Hadi, 2017). In this approach, students are more likely to be given the freedom to think critically, be independent, and find the knowledge and mathematical concepts they want to know and learn (Meirisa, Rifandi, & Masniladevi, 2018; Hadi, 2017). Through RME, which uses real contexts such as culture and everyday life, students create a pragmatic view of society, and students who view mathematics as a scary and challenging science to learn and far from civilization and everyday life can be minimized (Risdiyanti, Prahmana, & Shahrill, 2019; Zulkardi, Putri, & Wijaya, 2020). In addition, with the actual context used in RME, students can critically take the meaning of the mathematics they are learning and can feel the benefits to solve the problems they face in students' daily lives (Hadi, 2017; Risdiyanti & Prahmana, 2020a).

Several researchers have documented the students' difficulty in understanding the concept of set, applying the principles, understanding questions, transforming questions, solving problems, including related story questions with students' daily lives (Dwidarti, Mampouw, & Setyadi, 2019; Ratnasari & Setiawan, 2019). At the same time, the concept of a set is a fundamental concept used to understand other materials such as relations and functions (Nurtasari, Jamiah, & Suratman, 2017). If students have difficulty understanding the idea of a set, it won't be easy to understand other related materials. Therefore, it is very urgent to design learning that can be used to understand and make it easier for students to understand this concept.

This study aims to design a learning trajectory of set learning using the RME approach and the Mahabharata Puppet and Storie's context. The use of wayang context is because there are several characterizations in the wayang story, namely protagonist, antagonist, and the tritagonist. The wayang characters are depicted in the visuals of the wayang faces to be easily identified as evil puppets and good puppets. Concerning the set concept, several characters in the Mahabharata story can be seen based on the storyline's learning nature and the method's visualization. This can be used as a starting point in understanding and rediscovering the concept of sets. In addition, wayang is also a culture that contains moral values and a philosophy of life. This is very useful for students to emulate simultaneously for the good character in students (Kasim, 2018).

As a result, a learning trajectory based on a realistic mathematics education approach is required to facilitate students' understanding of sets. Students will study mathematics to solve problems encountered in their daily lives. This learning trajectory is in the form of learning steps that begin with introducing the actual context, then use that context to rediscover mathematical concepts until finally, students can understand the concept in a standard form. Additionally, this outcome will comprehend the relationship between mathematics, culture, and students' daily lives, be familiar with mathematics' applications and encourage students to think critically and meaningfully. This learning trajectory may be an alternative solution for increasing student understanding of the set and preserving Indonesian culture.

2. METHOD

In this study, the researchers designed the alleged set learning trajectory using a Realistic Mathematics Education approach with the context of Wayang and Mahabharata Story. This design is done by analyzing the culture that students are familiar with and then compiling a mathematical abstraction process that can be done using the real context that

exists around the students. Next, the researcher arranges the learning steps along with the conjecture or conjecture of the student's response and the alleged response that the teacher must give to anticipate the answer given by the student. This study is part of design research. The research design is to develop an intervention in teaching and learning activities as a solution to solve educational problems (Plomp, 2013; Gravemeijer & Cobb, 2006). The design research method can answer the problem formulation and achieve the research objectives (Prahmana, 2017; Plomp, 2013). This method allows researchers to study student learning processes. In addition, knowing to what extent the activities that have been designed can support students' understanding of the circle material.

This research is the first phase of design research, namely the preliminary design or research. In the initial design stage, researchers prepare to learn activities through literature review. Researchers obtained information about students' difficulties in learning circles and what activities can support students' understanding of sets from the literature. Before the learning trajectory becomes a local instructional theory, the steps are formulated in advance in the form of alleged learning steps and the alleged responses of students and teachers called the Hypothetical Learning Trajectory.

3. RESULTS AND DISCUSSION

3.1. Results

In this study, the researcher implemented the initial idea of using the context of wayang and Mahabharata stories in group learning by reviewing the literature. After that, the researcher made observations to the Muhammadiyah Magelang Elementary School regarding the context used and ended by designing a Hypothetical Learning Trajectory (HLT). The development of HLT in every learning activity is an essential part of designing student learning activities. The design of learning activities is inseparable from the learning trajectory, which contains a hypothesis plan for learning materials, where the learning trajectory is a concept trajectory that students will pass during the learning process. Furthermore, the learning trajectory, the learning activities, and the context used in the learning of set will become a local instructional theory in the learning process that has been designed (see Figure 1).

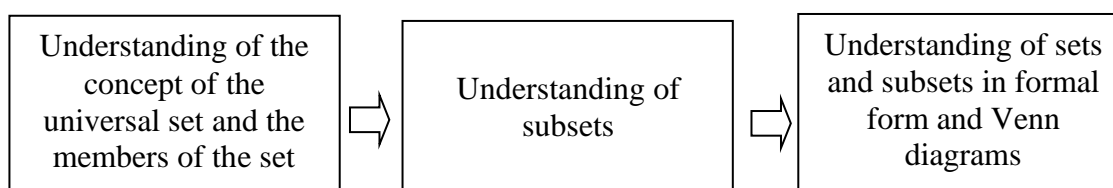


Figure 1. Learning trajectory for set learning

Several activities have been designed based on the hypothesized learning trajectory and students' thought processes. This set of instructional activities has been divided into three activities which were completed in 3 meetings. This research is intended to understand one or more basic concepts of sets in everyday life activities. The relationship between student learning paths, learning activities, and the basic concepts of the set can be seen in Table 1.

Table 1. The relationship between student learning paths, learning activities, and the basic concepts

	Student Learning Paths	Learning Activities	Set Basic Concepts
Activity base on experience (Mode of)	Activity 1 Watching the Mahabarata Wayang Stories by Ki Seno	Watching the Mahabarata Wayang Stories by Ki Seno Identify the characters of Wayang Mahabarata	Universal Set
Laison Activities (Mode for)	Activity 2 Help Ki Seno to compose the Mahabarata Wayang on Kelir Screen	Understanding the pattern of arrangement of the wayang mahabarata on the kelir screen Understanding the difference wayang between of evil and kind characters seen from the seen of the face Classifying wayang based on evil characters Classifying wayang based on kind characters Clasifiying wayang based on pandhawa lima group Clasifiying wayang based on kurawa group	Subset
Formal Knowledge	Activity 3 Write the Set of Mahabarata Wayang	Define the set Define the member of set Write the set-in formal form Define the subset Write the subset in formal from Determine subsets and draw them in the form of a venn diagram Write the experience of learning	Definition and formal form of sets, members of sets and subsets

A set of learning activities as contained in the Hypothetical Learning Trajectory (HLT) in [Table 1](#) consists of 4 activities. The details can be explained as follows.

3.1.1. Activity 1: Watching the Mahabharata Wayang Show by Ki Seno

In this first activity, students watched the Mahabharata wayang show masterminded by Ki Seno. Next, students identify the wayang characters in the Mahabharata story. In this activity, the teacher starts the lesson by distributing student books to the students. Then ask

students about their knowledge and experience about wayang and the Mahabharata story, then ask students to explain what they know or explain their experience. The teacher then asked the students to read the information about the wayang and the Mahabharata story in the student book. Next, the teacher asks students to follow the learning steps in the student book. The teacher asks students to play of a wayang animation video with the Mahabharata story in the student book. The duration of video is 3 minutes. Then, the teacher asks students to identify the wayang characters in the Mahabharata story and write their names in the column provided in the student book. Finally, students are asked to present their work in front of the class for discussion.

Purpose of Activity 1

This first activity aims to find out the students' knowledge and experience regarding the context of the wayang and the Mahabharata story. In addition, to identify the wayang characters in the Mahabharata story, which is actually a clearly defined object, namely the wayang object in the Mahabharata story, with the hope that a 'student language' will appear for the set, namely a collection of objects that have clearly defined properties. As well as appearing 'student language' for members of the set, namely objects or objects that are clearly defined.

Student Book and Conjecture of Activity 1

In this first activity, students are guided by the teacher by using a student book. Student activity begins with getting to know wayang and the Mahabharata story. Then, the students watched the wayang show with the Mahabharata story. After that, students write down the Mahabharata wayang figures in the columns provided in the student books. More details can be seen in [Figure 2](#).



Figure 2. Activity 1 in the student book

The conjecture in the first activity consists of activities, predictions of student responses, and the teacher's responses in response to the responses given by these students. More details can be seen in [Table 2](#).

Table 2. Conjecture of activity 1

No	Activity	Predictions of student responses	Teacher's Responses
1	The teacher asks students about their knowledge and experience about wayang and the Mahabharata story.	Know and/or have experience about wayang and Mahabharata stories Don't know and/or don't have experience with wayang and Mahabharata stories cerita	The teacher asks students to share their knowledge and experiences about wayang and the Mahabharata story. The teacher tells about the wayang and the Mahabharata story, then asks the students to read the information about the Mahabharata wayang and story in the student book.
2	Students write the Mahabharata wayang character	Write all the wayang characters in the Mahabharata story Writing some of the wayang characters in the Mahabharata story	The teacher gives a verbal appreciation of the student's work. The teacher guides the students to be able to write down all the Mahabharata wayang characters.

3.1.2. Activity 2: Compose the Mahabharata Wayang on the Kelir Screen

In this second activity, students arrange wayang characters in the Mahabharata story in wayang colors. The steps for compiling the wayang characters in the Mahabharata story on screen are from the wayang characters that have been identified in the previous activity and have been written in the student's book. Then the wayang characters are separated based on kind and evil characters and based on the groups of wayang pandhawa five and wayang kurawa. Then students arrange the wayangs on the wayang screen with the arrangement pattern as determined in the student book. Finally, students are asked to present their work in front of the class for discussion.

Purpose of Activity 2

The purpose of this second activity is to encourage students to understand and identify wayang characters who have kind and evil characters, as well as five wayang characters and wayang kurawa characters, which are actually a subset of a universal set of Mahabharata wayang figures. The hope is that a 'student language' will appear for subsets, namely sets whose members are included in other sets. And students can write sets and subsets in formal form and Venn diagrams.

Student Book and Conjecture of Activity 2

In this second activity, students are guided by the teacher using student books. This second activity begins with students observing and understanding the pattern of wayang arrangement on the wayang screen. Then the students grouped the Mahabharata wayangs based on their character as seen from their face shape. The students then grouped the kind wayangs and the evil wayangs and the five pandhawa wayangs and the kurawa wayangs.

After that, students arrange the names of the wayangs on the color of the wayangs. More details can be seen in [Figure 3](#) and [Figure 4](#).



Figure 3. Student understanding the pattern of Kelir Wayang and the character wayang base on the fase shape

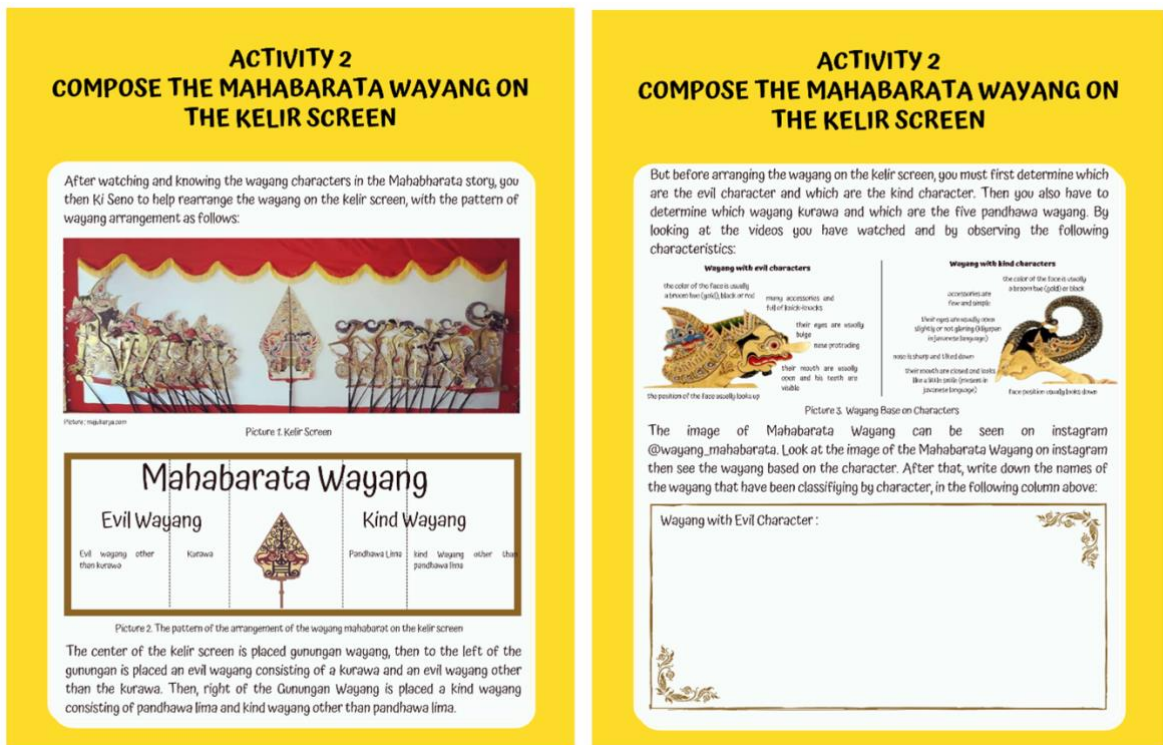


Figure 4. Student classifying Mahabharata Wayang and compose Wayang in Kelir Screen

The conjecture in the second activity consists of activities, predictions of student responses, and the responses that the teacher must give in response to the responses given by these students. More details can be seen in [Table 3](#).

Table 3. Conjecture of activity 2

No	Activity	Predictions of student responses	Teacher's Responses
1	Students observe and understand the pattern of the arrangement of the wayangs on the kelir screen	Students understand the pattern of the arrangement of the wayangs on the screen Students do not understand the pattern of wayang arrangement on the screen	The teacher gives a verbal appreciation for students The teacher helps students to be able to understand the pattern of the arrangement of the wayangs on the screen
2	Students observe the differences in the character of the wayang based on the shape of the face	Students understand the differences in wayang characters based on face shape Students do not understand the differences in the character of the wayang based on the shape of the face	The teacher gives a verbal appreciation for students The teacher helps students to be able to understand the differences in the character of the wayang based on the shape of the face by looking at the different parts of the faces of the evil and kind wayangs
3	Students write the names of the evil wayang characters	Students can write down the names of all the evil characters of Mahabharata wayangs Students have not been able to write the names of all the Mahabharata wayangs with kind character	The teacher gives a verbal appreciation for students The teacher helps students to be able to identify the evil wayang by looking at the characteristics of its face and also the characters in the Mahabharata wayang storyline in the video that has been played.
4	Students write the names of the five pandhawa wayang characters	Students can write the names of the five pandhawa wayangs Students have not been able to write the names of all the five pandhawa wayangs	The teacher gives a verbal appreciation for students The teacher helps students to be able to identify the pandhawa wayang from the Mahabharata wayang storyline on the video that has been played
5	Students write down the names of the Kurawa wayang characters	Students can write wayang kurawa Students have not been able to write the names of all the Kurawa wayangs	The teacher gives a verbal appreciation for students The teacher helps students to be able to identify the wayang kurawa from the storyline of the Mahabharata wayang on the video that has been played

3.1.3. Activity 3: Writing the Set of Mahabharata Wayang

In this activity, students write sets in formal form, including the universal set of wayang characters in the Mahabharata story, subsets, namely the set of kind Mahabharata wayang figures, the evil Mahabharata wayang figures, the five pandhawa wayang figures, the Kurawa wayang figures that have been compiled in wayang color. Students write these sets in the set column in the student book. Finally, students are asked to present their work in front of the class for discussion.

Purpose of Activity 3

This third activity aims to encourage students' understanding in writing or representing sets in a formal form. The hope is that students can represent the universal set and subsets in a formal form.

Student Book and Conjecture of Activity 3

Activity 3 in the student book begins with students defining sets when it is known that the results of grouping wayang characters in the Mahabharata story are called sets. Furthermore, students are given examples of writing sets in formal form, then students write down the results of grouping wayang or wayang sets in formal form. After that, it is known that the five pandhawa wayang sets consisting of yudhistira, bima, arjuna, nakula and sadewa are then called members of the set, students then define the members of the set using students' language.

The image shows two pages from a student book, both with a yellow background. Each page is titled 'ACTIVITY 3 WRITE THE SET OF MAHABARATA WAYANG'. The left page contains two 'Let's Think' sections. 'Let's Think 1' asks for the definition of a set, and 'Let's Think 2' asks for the formal notation of a set. The right page contains two 'Let's Think' sections. 'Let's Think 3' asks for the definition of a member of a set, and 'Let's Think 4' asks for the definition of a subset. Each section is followed by a large, empty rectangular box with decorative corners for student input.

**ACTIVITY 3
WRITE THE SET OF MAHABARATA WAYANG**

Let's Think 1
In mathematics, there are things called universal sets, members of sets, and subsets. If the grouped wayang are a set, for example the Mahabharata Wayang group, the Pandhawa Lima Wayang group, the Kurawa Wayang group. So, in your opinion, what is the definition of set? Write your opinion in the column below!

Let's Think 2
If the set in mathematics is written as $A = \{a, b, c, d, e, \dots\}$, A is the name of the set and a, b, c, d , etc. are members of the set. Try to write the set of wayang that has been grouped in activity 2, in the column below!

**ACTIVITY 3
WRITE THE SET OF MAHABARATA WAYANG**

Let's Think 3
If, Yudhistira, Bhima, Arjuna, Nakula, Sadewa are members of the set of the Pandawa Lima. So, what do you think is the definition of a member of the set? Write your opinion in the column below!

Let's Think 4
If, all members of the Pandhawa Lima set are also found in the members of the Kind Wayang set. Then, called pandhawa lima set is a subset of Kind Wayang set. So what do you think is the definition of the subset? Write your opinion in the column below!

Figure 5. Student define set, members of set and subset

Then, students define subsets when it is known that all the members of the five wayang pandhawa set are also in the wayang set with kind character. Then, given an example of writing subsets and how to describe them in the form of a Venn diagram. Students then find other subsets of the results of grouping wayang then written in a formal form and drawn in the form of a Venn diagram. Finally, students reflect on their learning experiences using the context of wayang and Mahabharata stories, especially learning experiences other than mathematical concepts. The illustration can be seen in Figure 5 and Figure 6.

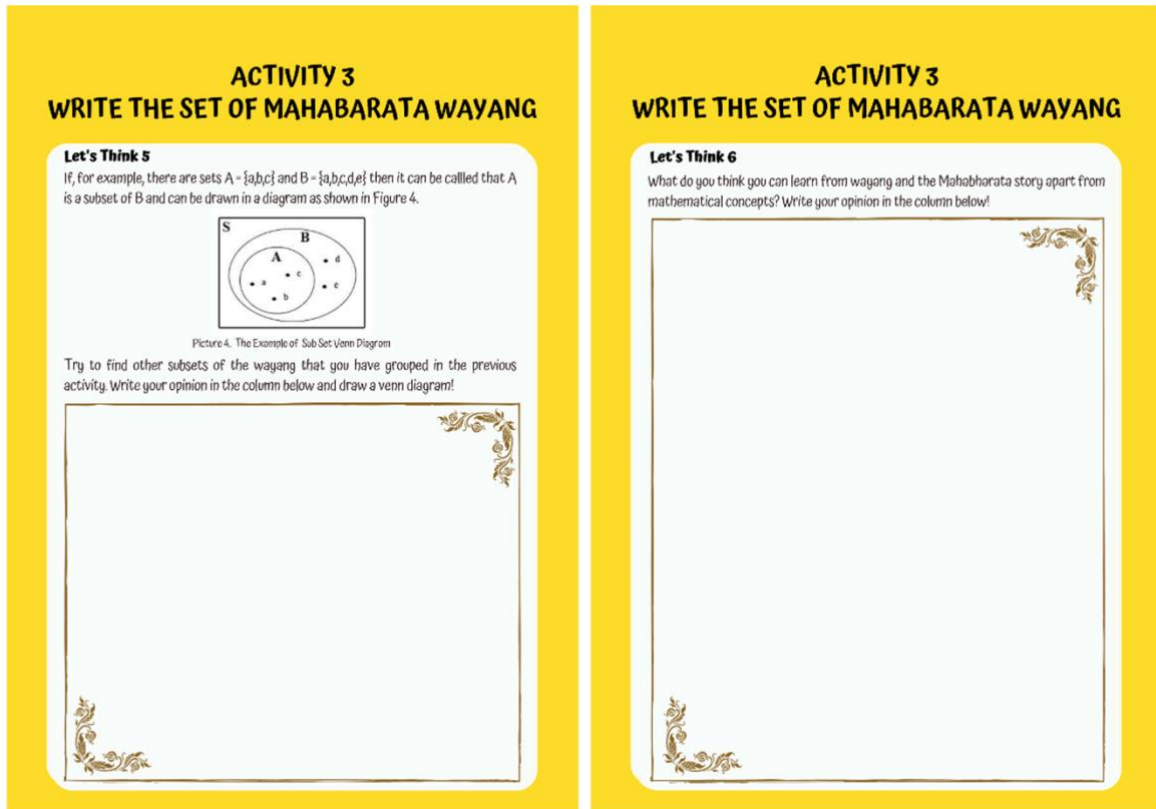


Figure 6. Student write set and subset in the formal form

The conjecture in the third activity consists of activities, predictions of student responses, and the responses that the teacher must give in response to the responses given by these students. The details can be seen in Table 4.

Table 4. Conjecture of activity 3

No	Activity	Predictions of student responses	Teacher's Responses
1	Let's Think 1 Students define 'set'	Students can define that a set as a clearly defined collection of objects, in their own language Students have not been able to define a set	The teacher gives a verbal appreciation for students The teacher explores students' difficulties which cause students not to be able to define sets. Then the teacher ignites the creativity of students' thinking by inviting students to reflect on the activities that have been done previously.

No	Activity	Predictions of student responses	Teacher's Responses
2	Let's Think 2 Students write the set- in formal form	Students can write sets in formal form Students have not been able to write sets in formal form	The teacher gives a verbal appreciation for students The teacher explores students' difficulties which cause students to not be able to write sets in formal form. Then the teacher ignites the critical and creativity of students' thinking by giving examples, and then students are asked to try themselves in writing the "set" in formal form.
3	Let's Think 3 Students define 'set members'	Students can define that a member of a set as an object that is clearly defined, in their language Students have not been able to define the members of the set	The teacher gives a verbal appreciation for students The teacher explores students' difficulties that cause students not to be able to define members. Then the teacher ignites the critical and creativity of students' thinking by inviting students to reflect on the activities that have been done previously.
4	Let's Think 4 Students define "subsets"	Students can define that a subset is a set whose members include members of other sets, with their language Students have not been able to define subsets	The teacher gives a verbal appreciation for students The teacher explores students' difficulties that cause students not to be able to define subsets. Then the teacher ignites the critical and creativity of students' thinking by inviting students to reflect on the activities that have been done previously.
5	Let's Think 5 Students describe subsets in the form of a Venn diagram	Students can describe subsets in the form of a Venn diagram Students have not been able to describe subsets in the form of Venn diagrams	The teacher gives a verbal appreciation for students The teacher explores students' difficulties which cause students to not be able to draw subsets in the form of Venn diagrams. Then the teacher ignites the critical and creativity of students' thinking by giving examples, and then students are asked to try themselves in writing the set-in formal form.

No	Activity	Predictions of student responses	Teacher's Responses
6	Let's Think 6 Students explain learning experiences obtained from the context of wayang and Mahabharata stories in addition to mathematical concepts	Students can explain the social, moral, or cultural values contained in the wayang and Mahabharata stories according to their learning experience Students cannot explain learning experiences other than mathematical concepts, especially sets	The teacher gives a verbal appreciation for students The teacher triggers students' critical and creative thinking by giving examples. Then students are asked to try their own writing the set-in formal form.

3.2. Discussion

The learning design of this set uses an ethnomathematics context, namely Wayang and Mahabharata stories and the Realistics Mathematics Education (RME) approach. The context of the Wayang and the Mahabharata story was used in the design of this study because the context is close to Javanese culture, which is the culture of students, and also close to students' daily lives (Risdiyanti & Prahmana, 2020a; D'Ambrosio, 2016). Furthermore, in some performances, such as at celebrations or government cultural events, Wayang and Mahabharata stories are often presented to entertain and educate the public (Lim, 2017; Sabunga et al., 2014). Seeing the problems in mathematics education where mathematics lessons are often considered a frightening specter and many students do not understand mathematical concepts because, in schools, they tend to be taught practical formulas without being explained in detail about the concept of sets and their use in everyday life. In comparison, mathematics is a human activity and must be related to culture and human daily live (Freudenthal, 2016). Therefore, cultural contexts such as wayang and Mahabharata stories are urgent to use in the learning process (Risdiyanti & Prahmana, 2020b).

The RME approach is also effectively used as an approach in this design because RME has the characteristics of using a real context as a starting point in learning (Hadi, 2017; Prahmana et al., 2020). In addition, RME effectively encourages students' activeness and creative thinking skills because RME has characteristics, namely, learning is carried out with the student center or more active students. The teacher is only a facilitator and can bring up student thinking strategies where the strategy arises from critical thinking skills and creative students (Hadi, 2017; Gravemeijer, 1994; Sembiring, Hadi, & Dolk, 2008). The activity in the set learning design using the context of Wayang and the Mahabharata story begins with students watching an animation of a wayang show with the Mahabharata story masterminded by Ki Seno. This activity is carried out based on the learning activities using the RME approach (Hadi, 2017; Prahmana, Zulkardi, & Hartono, 2012; Sembiring et al., 2008). The first activity starts from the mode for the activity to introduce context in an abstract form, namely by how students watching the Mahabharata wayang then identify all the wayang characters in the story. This activity still uses the concrete form of this context. In addition to introducing context, students are asked to create a universal set through an

actual context in this first activity, namely Wayang. Then enter the second activity, namely connecting or "mode for," where students classify the Wayangs based on their characters and based on their groups. After that, they compile the results of the classification on the wayang colors. Finally, the formal knowledge activity defines the universal set, members of the set, and subsets and can write it down formally. In this last activity, students could not use the context of the Wayang and the Mahabharata story again. When students have been able to write sets in standard form and are separated from context, it means that abstracting process of the concept of the set is successful (Hadi, 2017; Gravemeijer, 1994). The details can be seen from the iceberg illustration in Figure 7.

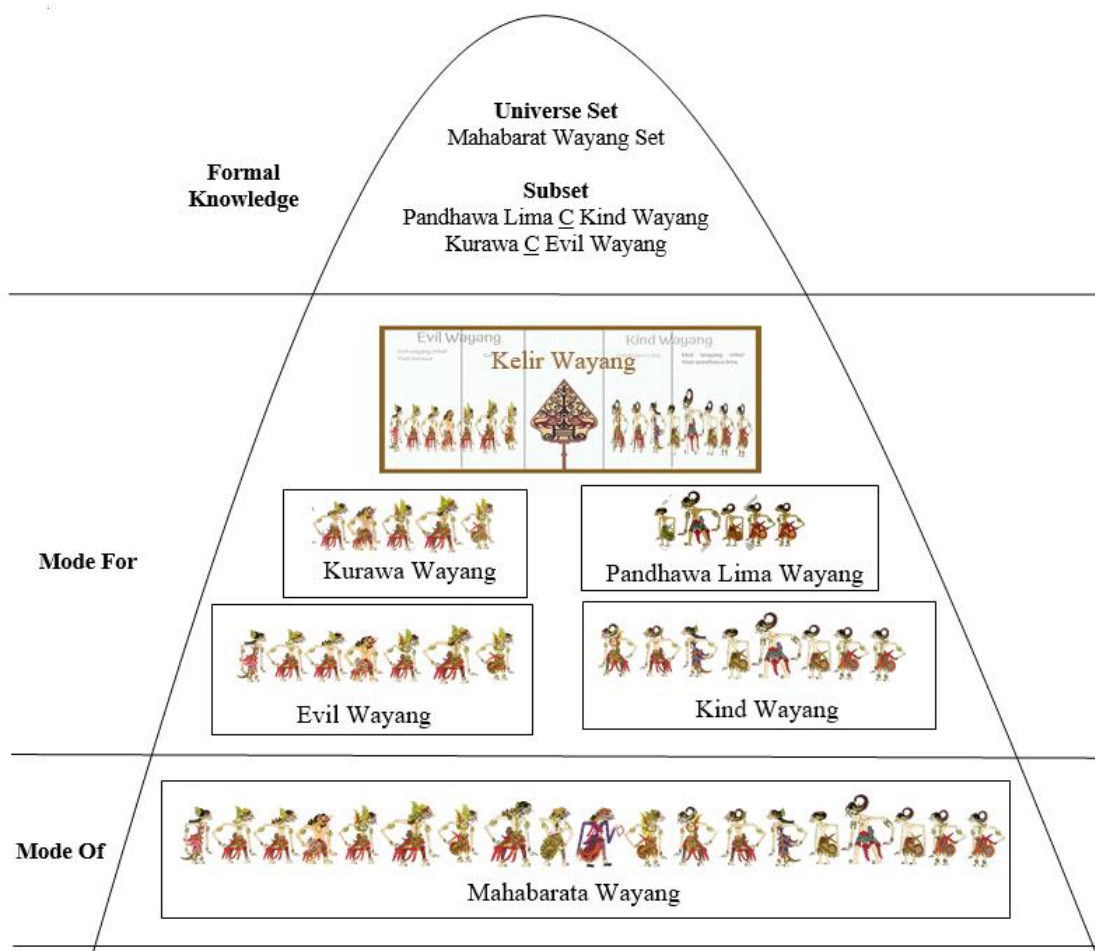


Figure 7. The iceberg of learning design of set using Wayang and Mahabharata story

The trajectory of the set learning design using Wayang and Mahabharata stories, as can be seen in the iceberg in Figure 7, are adjusted to the student learning flow contained in the mathematics learning curriculum made by the Indonesian Ministry of Education and Culture as well as the sequence of achievement of the competency standards included in the education curriculum in Indonesia (As'ari et al., 2017). The curriculum states that students understand the concept of the universal set, then set members, then subsets and write them informal form. In addition, some of the questions regarding activity three are adjusted to indicators of critical thinking skills, namely the ability to identify and justify concepts or the ability to provide mastery of ideas, the ability to generalize, the ability to analyze algorithms (Hendriana, Rohaeti, & Sumarmo, 2017; Joyner & Reys, 2000; Komariyah & Laili, 2018). In addition, it is also adjusted to indicators of creative ability, namely fluency, flexibility,

originality, and elaboration (Amidi & Zahid, 2017; Hendriana et al., 2017; Joyner & Reys, 2000).

This research has an additional reference in mathematics education to complement previous studies using the ethnomathematical context and RME approach in learning mathematics. For example, the story of the Wayang Barathayudha War and the Uno Stacko to learn number patterns (Risdiyanti & Prahmana, 2020b), traditional Indonesian games in learning number operations (Prahmana et al., 2012), playing one house in learning number operations (Nasrullah & Zulkardi, 2011), Patok Lele in measuring learning (Wijaya, 2008), the traditional Indonesian game Kubuk Manuk as a stimulated starting point to understand the knowledge of social arithmetic concepts (Risdiyanti et al., 2019), and the Gasing game in measuring learning time (Jaelani, Putri, & Hartono, 2013), and several mathematical activities in estimating, measuring, and making patterns using Sundanese culture (Muhtadi et al., 2017). Therefore, this study takes the role of adding context studies to be used as a starting point for learning mathematics.

4. CONCLUSION

The local contexts such as culture can use to understand the concept of sets. This study succeeded in designing the learning trajectory of the set using the RME approach with the context of Wayang and Mahabharata stories. The learning trajectory consists of three activities, namely watching the Mahabharata Wayang stories by Ki Seno, helping Ki Seno compose the Mahabharata Wayang on Kelir Screen, and writing the set of Mahabharata Wayang. This design allows students to rediscover the concept of sets from real and abstract contexts. It will make students understand mathematical concepts easily because it is fun for them, and most importantly, culture relates to activities in their daily lives. This research can play a role in developing the learning trajectory of the set using Wayang and Mahabharata stories as local learning contexts. It is also a basis to implement it in teaching experiments and analyze the result using retrospective analysis to construct the local instructional theory on set for further research.

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