Artikel di submit tanggal 30 November 2019

Published by:

Journal on Mathematics Education

(P-ISSN: 2087-8885 | E-ISSN: 2407-0610)

Scopus Indexed

#10225 Summary

SUMMARY REVIEW EDITING

Submission

Authors	Irma Risdiyanti, Rully Charitas Indra Prahmana
Title	THE LEARNING TRAJECTORY OF NUMBER PATTERN LEARNING USING BARATHAYUDHA WAR STORIES AND UNO STACKO
Original file	10225-24697-1-SM.DOCX 2019-11-30
Supp. files	None
Submitter	Rully Charitas Indra Prahmana
Date submitted	November 30, 2019 - 09:08 AM
Section	Articles
Editor	Kaye Stacey
Abstract Views	753

Status

Status	Published Vol 11, No 1 (2020)
Initiated	2020-01-11
Last modified	2020-11-21

Submission Metadata

Authors

Name	Irma Risdiyanti
Affiliation	Universitas Ahmad Dahlan, Yogyakarta
Country	Indonesia
Bio Statement	—
Name	Rully Charitas Indra Prahmana
URL	https://www.scopus.com/authid/detail.uri?authorId=57192302745
Affiliation	(SCOPUS ID: 57192302745), Universitas Ahmad Dahlan, Yogyakarta
Country	Indonesia
Bio Statement	—

Principal contact for editorial correspondence.

Title and Abstract

Title: THE LEARNING TRAJECTORY OF NUMBER PATTERN LEARNING USING BARATHAYUDHA WAR STORIES AND UNO STACKO

Abstract: In recent years, several researchers have tried to use stories and games as a starting point for learning mathematics. This is allegedly able to increase students' mathematical abilities and make learning mathematics more enjoyable. Therefore, this research is aimed to design a mathematics learning trajectory in pattern number using *Barathayudha* War Stories and Uno Stacko games as a starting point or context in the learning process with the Indonesian Realistic Mathematics Education (IRME) approach. The research method used is a design research that contains three stages, preliminary design, teaching experiment, and retrospective analysis. The result of this research is the learning trajectory design of number pattern learning using *Barathayudha* war stories and Uno Stacko. The design consists of four activities, which is a detective of *Barathayudha* war; rebuilt *Abimayu* fortress at the battlefield of *Kurusetra*; find the unique secret number code of *Abimayu* fortress; and built another fort using number pattern. The results showed *Barathayudha* war stories and Uno Stacko can stimulate students to understand their knowledge of pattern number concept which is the stages in the learning trajectory of student have an essential role in understanding the concept.

Indexing

Keywords: Learning Trajectory, Number Pattern, Barathayudha War Stories, Uno Stacko, Design Research

Language: en

Supporting Agencies

Agencies: —

References

References:

Arisetyawan, A., Suryadi, D., Herman, T., & Rahmat, C. (2014). Study of Ethnomathematics: A lesson from the Baduy Culture. International Journal of Education and Research, 2(10), 681-688.

Arsaythamby, V., & Zubainur, C. M. (2014). How a realistic mathematics educational approach affect students' activities in primary schools?. Procedia-Social and Behavioral Sciences, 159, 309-313. https://doi.org/10.1016/j.sbspro.2014.12.378.

Bakker, A. (2004). Design research in statistics education-On symbolizing and computer tools. Unpublished Ph.D. Thesis. Utrecht: The Freudenthal Institute.

Freudenthal, H. (1991). Revisiting Mathematics Education: China Lectures. Dordrecht: Kluwer Academic Publishers.

Gravemeijer, K. (1994). Educational development and developmental research in mathematics education. Journal for Research in Mathematics Education, 25(5), 443-471. https://doi.org/10.2307/749485.

Gravemeijer, K., & Cobb, P. (2006). Design research from a learning design perspective. In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.), Educational Design Research (pp. 17-51). London: Routledge.
Grigoryan, L. K., Lebedeva, N., & Breugelmans, S. M. (2018). A cross-cultural study of the mediating role of implicit theories of innovativeness in the relationship between values and attitudes toward innovation. Journal of cross-cultural psychology, 49(2), 336-352. https://doi.org/10.1177/0022022116656399.
Hatley, B. (2005). Theater, politics, and Javanese "Tradition": Yogyakarta's Sultan onstage. In H. Antl?v and J. Hellman (Eds.), The Java that Never Was: Academic Theories and Political Practices (pp. 67-96). M?nster: Die Deutsche Bibliothek.
Irawan, A., & Kencanawaty, G. (2017). Implementation of Realistic Mathematics-based Etnomathematics Learning [in Bahasa]. Journal of Medives, 1(2), 74-81.
Jaelani, A., Putri, R. I. I., & Hartono, Y. (2013). Students' strategies of measuring time using traditional gasing game in third grade of primary school. Journal on Mathematics Education, 4(1), 29-40. https://doi.org/10.22342/jme.4.1.560.29-40.
Kamaliyah, Zulkardi, & Darmawijoyo. (2013). Developing the sixth level of PISA-like mathematics problems for secondary school students. Journal on Mathematics Education, 4(1), 9-28. https://doi.org/10.22342/jme.4.1.559.9-28.
Lestariningsih, Putri, R. I. I., & Darmawijoyo. (2012). The legend of Kemaro Island for supporting students in learning average. Journal on Mathematics Education, 3(2), 165-174. https://doi.org/10.22342/jme.3.2.1932.165-174.
Muhtadi, D., Sukirwan, Warsito, & Prahmana, R.C.I. (2017). Sundanese ethnomathematics: mathematical activities in estimating, measuring, and making patterns. Journal on Mathematics Education, 8(2), 185-198. https://doi.org/10.22342/jme.8.2.4055.185-198.
Nasrullah & Zulkardi. (2011). Building Counting by Traditional Game a Mathematics Program for Young Children. Journal on Mathematics Education 2(1), 41-54. https://doi.org/10.22342/jme.2.1.781.41-54.
Nurhasanah, F., Kusumah, Y. S., & Sabandar, J. (2017). Concept of triangle: Examples of mathematical abstraction in two different contexts. International Journal on Emerging Mathematics Education, 1(1), 53-70. http://dx.doi.org/10.12928/ijeme.v1i1.5782.
Prahmana, R. C. I. (2017). Design Research (Theory and its implementation: An Introduction) [in Bahasa]. Jakarta: Rajawali Pers.
Prahmana, R. C. I., Zulkardi, & Hartono, Y. (2012). Learning multiplication using Indonesian traditional game in third grade. Journal on Mathematics Education, 3(2), 115-132. https://doi.org/10.22342/jme.3.2.1931.115-132.
Priyatni, E. T. (2016). Contradictory transformation of Amba novel: Critical response with intertextuality approach. Journal of Nusantara Studies, 1(1), 46-59. https://doi.org/10.24200/jonus.vol1iss1pp46-59.
Radovic, D., Black, L., Williams, J., & Salas, C. E. (2018). Towards conceptual coherence in the research on mathematics learner identity: a systematic review of the literature. Educational Studies in Mathematics, 99(1), 21-42. https://doi.org/10.1007/s10649-018-9819-2.
Revina, S. (2018). Influence of culture on the adaptation of realistic mathematics education in Indonesia. Unpublished Ph.D. Thesis. Hongkong: The University of Hong Kong.
Revina, S., & Leung, F. K. S. (2019). How the same flowers grow in different Soils? The implementation of realistic mathematics education in Utrecht and Jakarta classrooms. International Journal of Science and Mathematics Education, 17(3), 565-589. https://doi.org/10.1007/s10763-018-9883-1.
Risdiyanti, I., & Prahmana, R. C. I. (2018). Etnomathematics: Exploration of Javaness traditional games. Journal of Medives, 2(1), 1-11.
Risdiyanti, I., Prahmana, R. C. I., & Shahrill, M. (2019). The learning trajectory of social arithmetic using an Indonesian traditional game. Elementary Education Online, 18(4), 2094-2108. https://doi.org/10.17051/ilkonline.2019.639439.
Sembiring, R. K., Hadi, S., & Dolk, M. (2008). Reforming mathematics learning in Indonesian classrooms through RME. ZDM-Journal on Mathematics Education, 40(6), 927-939. https://doi.org/10.1007/s11858-008-0125-9.
Sembiring, R. K., Hoogland, K., & Dolk, M. (2010). A Decade of PMRI in Indonesia. Utrecht: APS International.
Simonson. (2006). Design-based research: Applications for distance education. Quarterly Review of Distance Education, 7(1), vii-viii.
Soedjadi, R. (2007). Dasar-dasar pendidikan matematika realistik Indonesia. Jurnal Pendidikan Matematika, 1(2), 1-10. https://doi.org/10.22342/jpm.1.2.807.
Stacey, K. (2011). The PISA view of mathematical literacy in Indonesia. Journal on Mathematics Education, 2(2), 95-126. https://doi.org/10.22342/jme.2.2.746.95-126.
Subijanto. (2015). The policy of local excellence-based education programs in state senior high school 2 Pekalongan [in Bahasa]. Jurnal Pendidikan dan Kebudayaan, 21(2).115-134.
Suparjo. (2011). On land (wealth) distribution: A cultural approach to justice in Indonesia. Indonesia Law Review, 1(3), 334-347. http://dx.doi.org/10.15742/ilrev.v1n3.60.
Susetya, W. (2007). Bharatayuda: Teaching, symbols, philosophies and their meanings for daily life [in Bahasa]. Yogyakarta: Kreasi Wacana.
Tanujaya, B., Prahmana, R. C. I, & Mumu, J. (2017). Mathematics instruction, problems, challenges, and opportunities: A case study in Manokwari Regency, Indonesia. World Transactions on Engineering and Technology Education, 15(3), 287-291.
Triyani, S., Putri, R. I. I., & Darmawijoyo. (2012). Supporting student's ability in understanding least common multiple (LCM) concept using storytelling. Journal on Mathematics Education, 3(2), 151-164. https://doi.org/10.22342/jme.3.2.572.151-164.
Uge, S., Neolaka, A., & Yasin, M. (2019). Development of social studies learning model based on local wisdom in improving students' knowledge and social attitude. International Journal of Instruction, 12(3), 375-388. . https://doi.org/10.29333/iji.2019.12323a.
Wahyudi, T., Zulkardi, & Darmawijoyo. (2016). Developing of TIMSS type reasoning questions using the Lampung cultural context [in Bahasa]. Jurnal Didaktik Matematika, 3(1), 1-14. https://doi.org/10.24815/jdm.v3i1.4300.
Wijaya, A. (2008). Design research in mathematics education: Indonesian traditional games as means to support second graders' learning of linear measurement. Thesis. Utrecht: Utrecht University.

Journal on Mathematics Education
Doctoral Program on Mathematics Education
Faculty of Teacher Training and Education, Universitas Sriwijaya
Kampus FKIP Bukit Besar
Jl. Srijaya Negara, Bukit Besar
Palembang - 30139
email: jme@unsri.ac.id

p-ISSN: 2087-8885 | e-ISSN: 2407-0610

KEYWORDS

Addition Asian Games Curriculum Design Research Design research Ethnomathematics Geometry Integers Mathematical Literacy Mental models Metacognition Metaphors Microworlds PISA PMRI Realistic Mathematics Education Subtraction design research learning trajectory mathematical proof multiplication

Blind Review Artikel yang di submit pada tanggal 30 November 2019 dengan judul awal

“The Learning Trajectory of Number Pattern Learning Using Barathayudha War Stories and Uno Stacko”

ISSN 2087-8885
E-ISSN 2407-0610

Journal on Mathematics Education
Volume xx, No. x, January xxxx, pp. x-xx

THE LEARNING TRAJECTORY OF NUMBER PATTERN LEARNING USING BARATHAYUDHA WAR STORIES AND UNO STACKO

Abstract

This research is aimed to design a mathematics learning trajectory in pattern number using Barathayudha War Stories and Uno Stacko games as a starting point or context in the learning process with the Indonesian Realistic Mathematics Education (IRME) approach. The method used is a design research that contains three stages, that is preliminary design, teaching experiment, and retrospective analysis. The result of this research is the design learning trajectory of number pattern learning using Barathayudha war stories and Uno Stacko. The design consists of four activities, which is a detective of Barathayudha war; rebuilt Abimayu fortress at the battlefield of Kurusetra; find the unique secret number code of Abimayu fortress; built another fort using number pattern. The results showed Barathayudha war stories, and Uno Stacko can stimulate students to understand their knowledge of pattern number concept, and the stages in the learning trajectory of student have an essential role in understanding the concept.

Keywords: Learning Trajectory, Number Pattern, Barathayudha War Stories, Uno Stacko, Design Research

Abstrak

Penelitian ini bertujuan untuk mendesain lintasan belajar matematika pada materi pola bilangan menggunakan cerita peperangan Barathayudha dan permainan Uno Stacko sebagai titik awal atau konteks dalam proses pembelajaran menggunakan pendekatan Pendidikan Matematika Realistik Indonesia (PMRI). Metode yang digunakan dalam penelitian ini adalah penelitian desain yang terdiri dari 3 tahapan, yaitu desain pendahuluan, percobaan pengajaran, dan analisis retrospektif. Hasil dari penelitian ini merupakan desain lintasan belajar pada pembelajaran pola bilangan menggunakan cerita peperangan Barathayudha dan permainan Uno Stacko. Desain ini terdiri dari 4 aktivitas, yaitu seorang detektif dari perang Barathayudha, membangun kembali benteng Abimayu di medan perang Kurusetra; menemukan kode nomor rahasia unik dari benteng Abimayu; membangun benteng lain menggunakan pola angka. Hasil penelitian menunjukkan bahwa kisah peperangan Barathayudha dan Uno Stacko dapat merangsang siswa untuk menumbuhkan pemahaman siswa tentang konsep pola bilangan dan seluruh tahapan dalam lintasan belajar yang dilalui siswa memiliki peran penting dalam penanaman konsep tersebut.

Kata kunci: lintasan belajar, pola bilangan, Cerita Peperangan Barathayudha, Uno Stacko, Penelitian Desain

How to Cite: .(2016). The learning trajectory of number pattern learning using Barathayudha war stories and Uno Stacko. *Journal on Mathematics Education, 11*(1), xx-xx.

The development and application of the mathematics concept daily problems are part of a learning process (Tanujaya, Prahmana, & Mumu, 2017). Freudhental (1991) explained that mathematics is a human activity and must be related to daily life. However, in reality, the mathematics in schools tend to be taught using practical formulas and most often, not seamlessly associated with everyday life and culture, as should be experienced by the students (Stacey, 2011; Arisetyawan, Suryadi, Herman, & Rahmat, 2014; Nurhasanah, Kusumah, & Sabandar, 2017). The society, including the teachers, generally does not regard mathematics to be related to culture, and the learning of mathematics in the classroom can also be regarded with almost having no relation to culture. In fact, culture is part of a student's life that may guide the way a student learns and regard mathematics (Stacey, 2011; Revina, 2018; Revina & Leung, 2019). It may significantly influence the student's ability to solve mathematics projects that relate to daily life. The results of the Programme for International Student Assessment

(PISA) for Indonesia showed that the students' abilities to solve and interpret problems in various situations are still considered at a level, which is low (Kamaliyah, Zulkardi, & Darmawijoyo, 2013).

Subsequently, Irawan and Kencanawaty (2017) and Sembiring, Hoogland, and Dolk (2010) suggested that appropriate strategies and learning methods are needed to develop students' thinking ability that orientate towards technical skills and the reformation of mathematics education based on problem-solving in the daily life. The learning method suggested is the *Pendidikan Matematika Realistik Indonesia* (PMRI), which is an adaptation of the Realistic Mathematics Education (RME). The PMRI is aligned with the Indonesian culture, geography and the ability of Indonesian society in general (Soedjadi, 2007; Sembiring, Hadi, & Dolk, 2008; Arsaythamby & Zubainur, 2014).

Wahyudi, Zulkardi, and Darmawijoyo (2016) and Subijanto (2015) explained that one of the contexts that can be used in PMRI is a culture that is applied to realistic mathematics learning and modified according to the local context where the school is located. Consequently, it may result in engaging, contextual knowledge if it is to be taught in schools as it may increase the students' ability to solve a problem that has a relation to their daily life. Also, the cultural context can be a solution to the lost aesthetic value and character of a student due to the influence of modernization (Prahmana, 2017; Grigoryan, Lebedeva, & Breugelmans, 2018; Uge, Neolaka, & Yasin, 2019)

Professional teachers, as the product of reform in education, must have higher education qualifications and be able to innovate in teaching and learning (Prahmana, Zulkardi, & Hartono, 2012; Risdiyanti & Prahmana, 2018). So, every prospective teacher should be prepared to become a professional teacher to equip himself through higher education and knowledge of the learning and teaching process. In Yogyakarta, there is a study club called the Yogyakarta Mathematics Study Club (YMSC) consisting of several mathematical mathematics education graduates who are engaged in innovating mathematics learning as a way to improve the qualifications and innovative learning abilities for graduates of mathematics education in Yogyakarta.

The culture product is fun as it contained concepts of mathematics for learning purposes and aspects of moral values (Radovic, Black, Williams, & Salas, 2018; Risdiyanti, Prahmana, & Shahrill, 2019). The design of the number pattern learning using Barathayudha war stories and Uno Stacko is expected to be innovative in terms of learning mathematics so that the concept will be easy for students to understand thus enabling them to solve any daily-related problems. This context was chosen mainly because of its familiarity with the participants from the perspectives of culture as well as their daily life. Furthermore, this design is expected to cultivate and develop the cultural values that may influence a student's character.

METHOD

This research uses design research as a research method. Design research was chosen in this research because this method is a systematic and flexible method to improve the quality of learning in the classroom by collaborating between researchers and teachers to develop a learning design (Gravemeijer, 1994). The development of learning design is carried out in three, which are preliminary

design, design experiment, and analysis retrospective (Bakker, 2004; Gravemeijer & Cobb, 2006; Simonson, 2006; Prahmana, 2017).

The preliminary design aims to form a Hypothetical Learning Trajectory (HLT), which is then refined in the design experiment stage (Prahmana, 2017). The activities carried out in this stage are collaborating with the teacher to conduct a literature review of the concept of number patterns, realistic mathematics education, and contexts that can be used in learning number patterns. Also, I analyzed the concept of number patterns in the mathematics education curriculum in Indonesia. Then the results of the literature study and curriculum analysis were used as a basis for designing learning trajectories and developing conjectures to become HLT. In this case, theory aims as guidelines that will improve in each learning activity, so it is flexible and can be revised during the experimental design stage.

In the design experiment stage, the learning trajectory that has been designed at the preliminary design stage is then implemented in the learning process (Prahmana, 2017). The purpose of this implementation is to explore and observe the strategies and thoughts of students. There are two cycles in this stage; the first cycle is a pilot experiment that aims to evaluate and improve the learning trajectory that has been designed. The second cycle is a teaching experiment that seeks to implement a learning trajectory that is evaluated and revised in the pilot experiment of the design experiment stage.

The last stage is retrospective analysis, all data collected in the design experiment stage are analyzed by comparing conjecture and HLT with the results of the application of the learning trajectory that has been carried out in the design experiment stage (Gravemeijer & Cobb, 2006). From the results of the analysis will obtain a trajectory description of number pattern learning using Uno Stacko games.

RESULT AND DISCUSSION

The results of this study obtained a trajectory description of the number pattern learning using the Barathayuda war story and Uno Stacko. The learning activities consist of four activities. Activities 1 is to be a detective of Barathayudha war. Activities 2 is to rebuild Abimayu Fortress at Battlefield of Kurusetra. Activities 3 is to find the unique secret number code of Abimayu fortress. Lastly, activity 4 is to build another fortress using the number pattern. Students can understand the concept of number patterns using the Barathayudha war story and Uno Stacko. It viewed from the results of the final evaluation and the positive responses of students.

Regarding this learning can be seen from the comments, students feel more comfortable understanding the number pattern using this context. The results of this study indicated that the learning design of number patterns using Barathayudha War Story and Uno Stacko has very important to be the starting point and can increase student motivation in the learning process. In detail, the researcher discusses the results of this study as follows.

Activity 1: Be a detective of Barathayudha War

Learning activities begin with the teacher describing the Barathayuda war, which is a civil war between Kurawa and Pandhawa in *Pewayangan* Stories. The student will be told the original story, for,

in the end, it will be slightly modified to fit the material to be learned. Barathayuda's story was chosen as the starting point because this learning was carried out in Java, which was very thick with the *Pewayangan* stories culture. So, it would create a new stigma for students who had felt that actually, mathematics was far from their lives to think that mathematics existed and became part of their culture.

In this activity, it told that at once upon a time. There was a civil war between Kurawa and Pandhawa. In the *Pewayangan* story, Kurawa and Pandhawa have the same father named Prabu Pandhu, but from different mother. Before dying, Prabu Pandhu handed over the authority of the state to purify Pandhawa, because he was considered capable of managing and leading wisely. Kurawa did not accept his father's decision and always tried to seize the power of Pandhawa (Susetya, 2007). Finally, one day, a civil war took place on a battlefield, namely Kurusetra. The Hindus believe that Kurusetra existed on this earth precisely in India, but no one had succeeded in proving the truth.

At the time of the war, Abimayu, one of the members of Pandhawa made a triangular fortress of rock arranged in a unique arrangement of numbers, consisting of the results of repetitive number operations. According to archeologists, there ways to prove whether the war really happened and took place in Kurusetra, India are by breaking the secret code used Abimayu to compile the fort. Based on historical records, it is known that the fortress was composed of 30 pieces of stone, consisting of 8 levels, the most basic of which had eight bricks, and the top is one brick. Until now, no one has been able to crack the secret code.

After the story is complete, the teacher provokes the students' interest in breaking the secret code. The teacher invites students to be a detective looking for truth. They seem to be in Kurusetra, India and found the ruins of the fort there, but did not know whether the debris was a fortress built by Abimayu as in the *Pewayangan* story. Therefore, students formed a group of 4 to 5 people who acted as a detective team. The team did research by collecting debris that was suspected of being Abimayu's fortress and then rebuilt and solved its secret code. In this study, the fortress debris is illustrated using Uno Stacko sticks. As a result, at this stage, the students were enthusiastic about listening to the *Pewayangan* story and were interested in deciphering the secret code of Abimayu fortress which was actually a pattern number.

Activity 2: Rebuilt Abimayu fortress at battlefield of Kurusetra

In this activity students who have collected fortress debris that is suspected to be the fortress of Abimayu, then they try to compile the fort with the arrangement as recorded in history that the Abimayu fortress is triangular in shape, arranged uniquely, consisting of the results of repetitive number operations, organized of 30 pieces of stone that from 8 levels, the bottom is composed of 8 pieces of stone. The top is arranged for one stone. At this stage, students need creativity and critical thinking because students must expect a form of the fort that they have never seen, and they rebuild that fort only based on the clues given. As a result, students managed to make a fortress with an arrangement that formed a triangle with eight levels and the provision of each level, creating a number pattern. The students' activities of rebuilt the Abimayu's fortress can be seen in Figure 1.

Figure 1. Students rebuilt Abimayu Fortrees at Battlefield Kurusetra

Activity 3: Find the unique secret number code of Abimayu fortress

In the third activity, students are given a student worksheet, which will serve to help students find the secret code of the Abimayu fortress arrangement. The student worksheet consists of columns that will be filled with the number of stones arranged in each level. Then students look for the relationship of the number operation of the number of rocks arranged on each level. It is done to test whether the structure that students make has been the same as the one recorded in history, and to prove the truth of the ruins of the fortress in Kurusetra, India is the landscape of Abimayu in the puppet story. At this stage, students then look for formulas from the number pattern that has been found. The activity in the third stage is essential to do as a bridge to understanding the concept of number patterns from the formal level to the informal level.

Figure 2. Students find the Unique Secret Number Code of Abimayu Fortress

Activity 4: Built another fortress using number pattern

In this fourth activity, students make a fortress with a pattern according to the number pattern they want as this stage, students' understanding has been on understanding the informal level. Students have understood the concept of number patterns and can make these patterns without using the help of Uno Stacko sticks and can visualize the number pattern in the form of a fort made using Uno stick.

Figure 3. Students built another fortress using number pattern

All activities could change the stigma of students and society that mathematics that is felt far from daily life exists and becomes part of the culture of the community. This study was able to take on the role of developing the learning trajectory of number pattern learning using Barathayudha war stories and Uno Staco as the local context of education. In addition, a few of researchers have documented the results of their research related to the implementation of daily activities of students in the learning process of mathematics, such as pictorial pat games in learning number operations (Prahmana, Zulkardi, & Hartono, 2012), playing one house in learning number operations (Nasrullah & Zulkardi, 2011), *Patok Lele* stakes in learning measurements (Wijaya, 2008), Kubuk Manuk Indonesian traditional game as stimulated starting point to understand the knowledge of the social arithmetic concept (Risdayanti, Prahmana, & Shahrill, 2019), and top games in time learning (Jaelani, Putri, & Hartono, 2013). Therefore this study takes a role to add to the study of contexts that can be used as a starting point for learning mathematics.

CONCLUSION

The learning of number pattern, the learning trajectory can be practiced using local contexts such as culture or other things easily found in the daily activities of the students. The students were able to understand the concept of mathematics easily since it is fun for them and importantly, the game is relatable to activities in their daily life.

REFERENCES

Arisetyawan, A., Suryadi, D., Herman, T., & Rahmat, C. (2014). Study of Ethnomathematics: A lesson from the Baduy Culture. *International Journal of Education and Research, 2*(10), 681-688.

Arsaythamby, V., & Zubainur, C. M. (2014). How a realistic mathematics educational approach affect

students' activities in primary schools?. *Procedia-Social and Behavioral Sciences, 159*, 309-313. https://doi.org/10.1016/j.sbspro.2014.12.378.

Bakker, A. (2004). Design research in statistics education-On symbolizing and computer tools. *Unpublished Ph.D. Thesis*. Utrecht: The Freudenthal Institute.

Freudenthal, H. (1991). *Revisiting Mathematics Education: China Lectures*. Dordrecht: Kluwer Academic Publishers.

Gravemeijer, K. (1994). Educational development and developmental research in mathematics education. *Journal for Research in Mathematics Education, 25*(5), 443-471. https://doi.org/10.2307/749485.

Gravemeijer, K., & Cobb, P. (2006). Design research from a learning design perspective. In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.), *Educational Design Research* (pp. 17-51). London: Routledge.

Grigoryan, L. K., Lebedeva, N., & Breugelmans, S. M. (2018). A cross-cultural study of the mediating role of implicit theories of innovativeness in the relationship between values and attitudes toward innovation. *Journal of cross-cultural psychology*, *49*(2), 336-352. https://doi.org/10.1177/0022022116656399.

Irawan, A., & Kencanawaty, G. (2017). Implementation of Realistic Mathematics-based Etnomathematics Learning [in Bahasa]. *Journal of Medives, 1*(2), 74-81.

Jaelani, A., Putri, R. I. I., & Hartono, Y. (2013). Students' strategies of measuring time using traditional gasing game in third grade of primary school. *Journal on Mathematics Education, 4*(1), 29-40. https://doi.org/10.22342/jme.4.1.560.29-40.

Kamaliyah, Zulkardi, & Darmawijoyo. (2013). Developing the sixth level of PISA-like mathematics problems for secondary school students. *Journal on Mathematics Education*, *4*(1), 9-28. https://doi.org/10.22342/jme.4.1.559.9-28.

Nasrullah & Zulkardi. (2011). Building Counting by Traditional Game a Mathematics Program for Young Children. *Journal on Mathematics Education 2*(1), 41-54. https://doi.org/10.22342/jme.2.1.781.41-54.

Nurhasanah, F., Kusumah, Y. S., & Sabandar, J. (2017). Concept of triangle: Examples of mathematical abstraction in two different contexts. *International Journal on Emerging Mathematics Education, 1*(1), 53-70. http://dx.doi.org/10.12928/ijeme.v1i1.5782.

Prahmana, R. C. I. (2017). *Design Research (Theory and its implementation: An Introduction)* [in Bahasa]. Jakarta: Rajawali Pers.

Prahmana, R. C. I., Zulkardi, & Hartono, Y. (2012). Learning multiplication using Indonesian traditional game in third grade. *Journal on Mathematics Education*, *3*(2), 115-132. https://doi.org/10.22342/jme.3.2.1931.115-132.

Radovic, D., Black, L., Williams, J., & Salas, C. E. (2018). Towards conceptual coherence in the research on mathematics learner identity: a systematic review of the literature. *Educational Studies in Mathematics, 99*(1), 21-42. https://doi.org/10.1007/s10649-018-9819-2.

Revina, S. (2018). Influence of culture on the adaptation of realistic mathematics education in Indonesia. *Unpublished Ph.D. Thesis*. Hongkong: The University of Hong Kong.

Revina, S., & Leung, F. K. S. (2019). How the same flowers grow in different Soils? The implementation of realistic mathematics education in Utrecht and Jakarta classrooms.

International Journal of Science and Mathematics Education, 17(3), 565-589. https://doi.org/10.1007/s10763-018-9883-1.

Risdiyanti, I., & Prahmana, R. C. I. (2018). Etnomathematics: Exploration of Javaness traditional games. *Journal of Medives, 2*(1), 1-11.

Risdiyanti, I., Prahmana, R. C. I., & Shahrill, M. (2019). The learning trajectory of social arithmetic using an Indonesian traditional game. *Elementary Education Online, 18*(4), 2094-2108. https://doi.org/10.17051/ilkonline.2019.639439.

Sembiring, R. K., Hadi, S., & Dolk, M. (2008). Reforming mathematics learning in Indonesian classrooms through RME. *ZDM-Journal on Mathematics Education, 40*(6), 927-939. https://doi.org/10.1007/s11858-008-0125-9.

Sembiring, R. K., Hoogland, K., & Dolk, M. (2010). A Decade of PMRI in Indonesia. Utrecht: APS International.

Simonson. (2006). Design-based research: Applications for distance education. *Quarterly Review of Distance Education, 7*(1), vii-viii.

Soedjadi, R. (2007). Dasar-dasar pendidikan matematika realistik Indonesia. *Jurnal Pendidikan Matematika, 1*(2), 1-10. https://doi.org/10.22342/jpm.1.2.807.

Stacey, K. (2011). The PISA view of mathematical literacy in Indonesia. *Journal on Mathematics Education, 2*(2), 95-126. https://doi.org/10.22342/jme.2.2.746.95-126.

Subijanto. (2015). The policy of local excellence-based education programs in state senior high school 2 Pekalongan [in Bahasa]. *Jurnal Pendidikan dan Kebudayaan, 21*(2),115-134.

Susetya, W. (2007). *Bharatayuda: Teaching, symbols, philosophies and their meanings for daily life [in Bahasa]*. Yogyakarta: Kreasi Wacana.

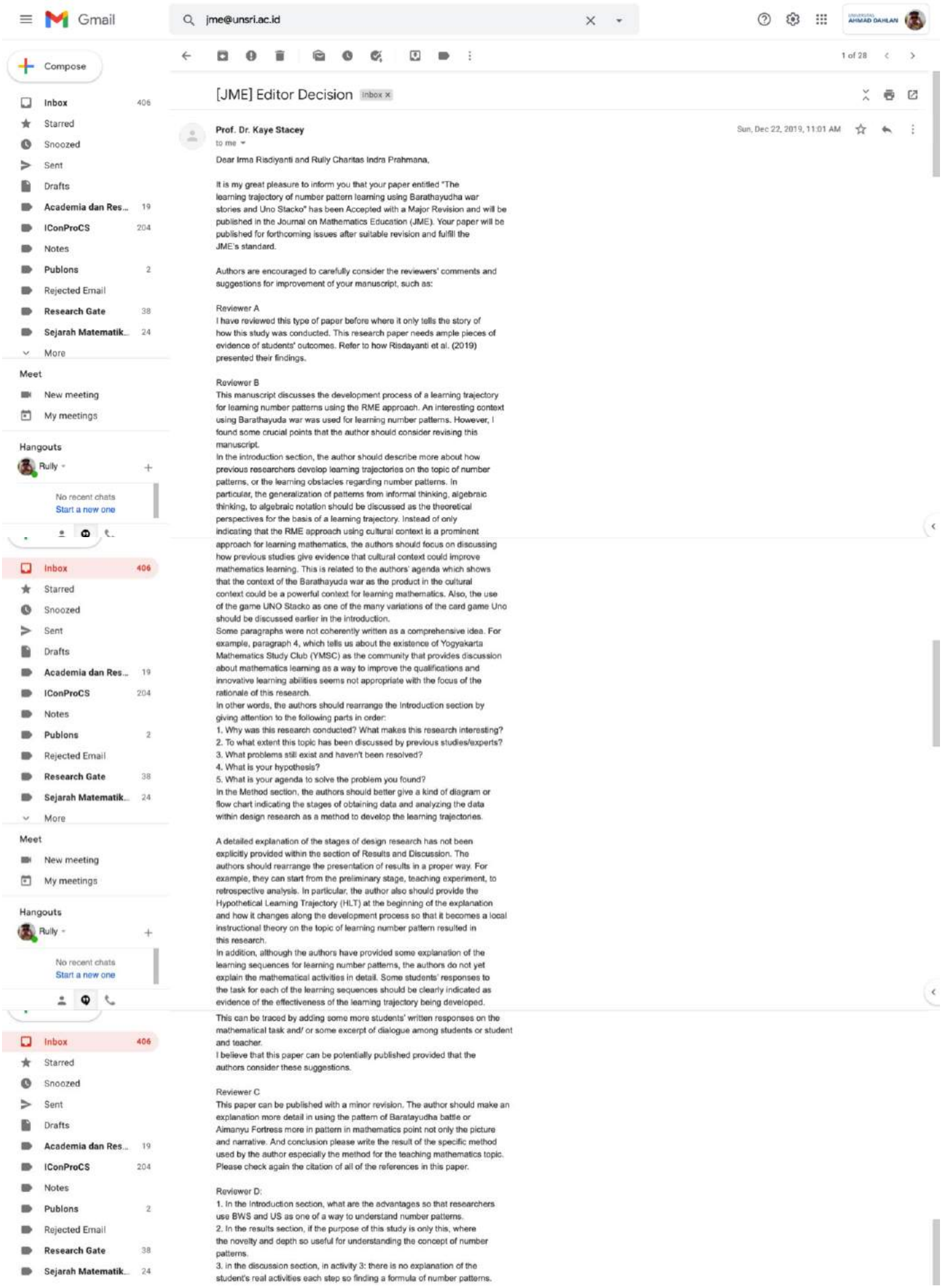
Tanujaya, B., Prahmana, R. C. I, & Mumu, J. (2017). Mathematics instruction, problems, challenges, and opportunities: A case study in Manokwari Regency, Indonesia. *World Transactions on Engineering and Technology Education, 15*(3), 287-291.

Uge, S., Neolaka, A., & Yasin, M. (2019). Development of social studies learning model based on local wisdom in improving students' knowledge and social attitude. *International Journal of Instruction, 12*(3), 375-388. . https://doi.org/10.29333/iji.2019.12323a.

Wahyudi, T., Zulkardi, & Darmawijoyo. (2016). Developing of TIMSS type reasoning questions using the Lampung cultural context [in Bahasa]. *Jurnal Didaktik Matematika, 3*(1), 1-14. https://doi.org/10.24815/jdm.v3i1.4300.

Wijaya, A. (2008). Design research in mathematics education: Indonesian traditional games as means to support second graders' learning of linear measurement. *Thesis*. Utrecht: Utrecht University.

Keputusan diterima dengan revisi pada pada tanggal 22 Desember 2019



Gmail

jme@unsri.ac.id

Compose

Inbox 406
Starred
Snoozed
Sent
Drafts
Academia dan Res... 19
IConProCS 204
Notes
Publons 2
Rejected Email
Research Gate 38
Sejarah Matematik... 24
More

Meet
New meeting
My meetings

Hangouts
Rully
No recent chats
Start a new one

1 of 28

[JME] Editor Decision Inbox ×

Prof. Dr. Kaye Stacey Sun, Dec 22, 2019, 11:01 AM
to me

Dear Irma Risdiyanti and Rully Charitas Indra Prahmana,

It is my great pleasure to inform you that your paper entitled "The learning trajectory of number pattern learning using Barathayudha war stories and Uno Stacko" has been Accepted with a Major Revision and will be published in the Journal on Mathematics Education (JME). Your paper will be published for forthcoming issues after suitable revision and fulfill the JME's standard.

Authors are encouraged to carefully consider the reviewers' comments and suggestions for improvement of your manuscript, such as:

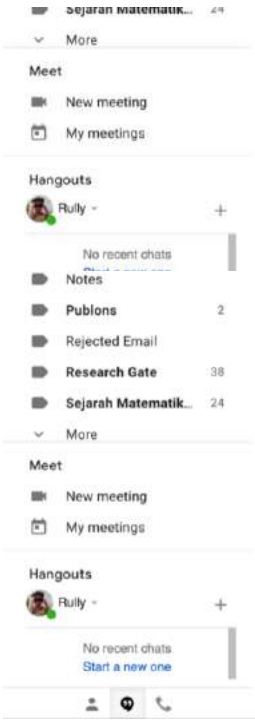
Reviewer A
I have reviewed this type of paper before where it only tells the story of how this study was conducted. This research paper needs ample pieces of evidence of students' outcomes. Refer to how Risdayanti et al. (2019) presented their findings.

Reviewer B
This manuscript discusses the development process of a learning trajectory for learning number patterns using the RME approach. An interesting context using Barathayuda war was used for learning number patterns. However, I found some crucial points that the author should consider revising this manuscript.
In the introduction section, the author should describe more about how previous researchers develop learning trajectories on the topic of number patterns, or the learning obstacles regarding number patterns. In particular, the generalization of patterns from informal thinking, algebraic thinking, to algebraic notation should be discussed as the theoretical perspectives for the basis of a learning trajectory. Instead of only indicating that the RME approach using cultural context is a prominent approach for learning mathematics, the authors should focus on discussing how previous studies give evidence that cultural context could improve mathematics learning. This is related to the authors' agenda which shows that the context of the Barathayuda war as the product in the cultural context could be a powerful context for learning mathematics. Also, the use of the game UNO Stacko as one of the many variations of the card game Uno should be discussed earlier in the introduction.
Some paragraphs were not coherently written as a comprehensive idea. For example, paragraph 4, which tells us about the existence of Yogyakarta Mathematics Study Club (YMSC) as the community that provides discussion about mathematics learning as a way to improve the qualifications and innovative learning abilities seems not appropriate with the focus of the rationale of this research.
In other words, the authors should rearrange the Introduction section by giving attention to the following parts in order:
1. Why was this research conducted? What makes this research interesting?
2. To what extent this topic has been discussed by previous studies/experts?
3. What problems still exist and haven't been resolved?
4. What is your hypothesis?
5. What is your agenda to solve the problem you found?
In the Method section, the authors should better give a kind of diagram or flow chart indicating the stages of obtaining data and analyzing the data within design research as a method to develop the learning trajectories.

A detailed explanation of the stages of design research has not been explicitly provided within the section of Results and Discussion. The authors should rearrange the presentation of results in a proper way. For example, they can start from the preliminary stage, teaching experiment, to retrospective analysis. In particular, the author also should provide the Hypothetical Learning Trajectory (HLT) at the beginning of the explanation and how it changes along the development process so that it becomes a local instructional theory on the topic of learning number pattern resulted in this research.
In addition, although the authors have provided some explanation of the learning sequences for learning number patterns, the authors do not yet explain the mathematical activities in detail. Some students' responses to the task for each of the learning sequences should be clearly indicated as evidence of the effectiveness of the learning trajectory being developed. This can be traced by adding some more students' written responses on the mathematical task and/ or some excerpt of dialogue among students or student and teacher.
I believe that this paper can be potentially published provided that the authors consider these suggestions.

Reviewer C
This paper can be published with a minor revision. The author should make an explanation more detail in using the pattern of Baratayudha battle or Almanyu Fortress more in pattern in mathematics point not only the picture and narrative. And conclusion please write the result of the specific method used by the author especially the method for the teaching mathematics topic. Please check again the citation of all of the references in this paper.

Reviewer D:
1. In the introduction section, what are the advantages so that researchers use BWS and US as one of a way to understand number patterns.
2. In the results section, if the purpose of this study is only this, where the novelty and depth so useful for understanding the concept of number patterns.
3. in the discussion section, in activity 3: there is no explanation of the student's real activities each step so finding a formula of number patterns.



4. in the conclusion section:
- In the introduction, one of the effects of this study was started on the character of students, but in conclusion, there was no result;
- which indicators in result and discussion explain "the students were able to understand the concept of mathematics easily

For more details, please check the reviewers' comment file in your account. Furthermore, the author must make sure all references have DOI and follow this guideline to ensure that your final file is complete and in the correct format (https://bit.ly/33GvXT3) for preparing their paper strictly. You can follow the paper that already published in JME. Lastly, the recapitulation of the contents of the revised article and the similarity check result file must be attached as a supplementary file in the revision submission process.

Please submit the final revised paper along with your Copyright Transfer Agreement to email: jme@unsri.ac.id or via your JME OJS Account as an Author Version. The revised manuscript should be submitted by 30 December 2019; if you anticipate that you will be unable to meet this deadline, please notify the Editorial Office. Should you have any questions, please do not hesitate to contact us.

Thank you very much for your cooperation. I do really appreciate it.

Kind regards,

Prof. Dr. Kaye Stacey
(SCOPUS ID: 7003572015), University of Melbourne, Australia

IMPORTANT:
"Please revise and give a comment in the attached file and it is not permitted to send a new file, other than the revised results of the attached file"

Journal on Mathematics Education (p:2087-8885 e:2407-0610)
http://ejournal.unsri.ac.id/index.php/jme

Hasil review dari 4 reviewer dengan 1 diantaranya memberikan catatan pada artikel nya secara langsung, yaitu Reviewer D

[Paper ID: 10225]

ISSN 2087-8885
E-ISSN 2407-0610

Journal on Mathematics Education
Volume xx, No. x, January xxxx, pp. x-xx

THE LEARNING TRAJECTORY OF NUMBER PATTERN LEARNING USING BARATHAYUDHA WAR STORIES AND UNO STACKO

Abstract

This research is aimed to design a mathematics learning trajectory in pattern number using Barathayudha War Stories and Uno Stacko games as a starting point or context in the learning process with the Indonesian Realistic Mathematics Education (IRME) approach. The method used is a design research that contains three stages, that is preliminary design, teaching experiment, and retrospective analysis. The result of this research is the design learning trajectory of number pattern learning using Barathayudha war stories and Uno Stacko. The design consists of four activities, which is a detective of Barathayudha war; rebuilt Abimayu fortress at the battlefield of Kurusetra; find the unique secret number code of Abimayu fortress; built another fort using number pattern. The results showed Barathayudha war stories, and Uno Stacko can stimulate students to understand their knowledge of pattern number concept, and the stages in the learning trajectory of student have an essential role in understanding the concept.

Keywords: Learning Trajectory, Number Pattern, Barathayudha War Stories, Uno Stacko, Design Research

Abstrak

Penelitian ini bertujuan untuk mendesain lintasan belajar matematika pada materi pola bilangan menggunakan cerita peperangan Barathayudha dan permainan Uno Stacko sebagai titik awal atau konteks dalam proses pembelajaran menggunakan pendekatan Pendidikan Matematika Realistik Indonesia (PMRI). Metode yang digunakan dalam penelitian ini adalah penelitian desain yang terdiri dari 3 tahapan, yaitu desain pendahuluan, percobaan pengajaran, dan analisis retrospektif. Hasil dari penelitian ini merupakan desain lintasan belajar pada pembelajaran pola bilangan menggunakan cerita peperangan Barathayudha dan permainan Uno Stacko. Desain ini terdiri dari 4 aktivitas, yaitu seorang detektif dari perang Barathayudha, membangun kembali benteng Abimayu di medan perang Kurusetra; menemukan kode nomor rahasia unik dari benteng Abimayu; membangun benteng lain menggunakan pola angka. Hasil penelitian menunjukkan bahwa kisah peperangan Barathayudha dan Uno Stacko dapat merangsang siswa untuk menumbuhkan pemahaman siswa tentang konsep pola bilangan dan seluruh tahapan dalam lintasan belajar yang dilalui siswa memiliki peran penting dalam penanaman konsep tersebut.

Kata kunci: lintasan belajar, pola bilangan, Cerita Peperangan Barathayudha, Uno Stacko, Penelitian Desain

How to Cite: .(2016). The learning trajectory of number pattern learning using Barathayudha war stories and Uno Stacko. *Journal on Mathematics Education, 11*(1), xx-xx.

The development and application of the mathematics concept daily problems are part of a learning process (Tanujaya, Prahmana, & Mumu, 2017). Freudhental (1991) explained that mathematics is a human activity and must be related to daily life. However, in reality, the mathematics in schools tend to be taught using practical formulas and most often, not seamlessly associated with everyday life and culture, as should be experienced by the students (Stacey, 2011; Arisetyawan, Suryadi, Herman, & Rahmat, 2014; Nurhasanah, Kusumah, & Sabandar, 2017). The society, including the teachers, generally does not regard mathematics to be related to culture, and the learning of mathematics in the classroom can also be regarded with almost having no relation to culture. In fact, culture is part of a student's life that may guide the way a student learns and regard mathematics (Stacey, 2011; Revina, 2018; Revina & Leung, 2019). It may significantly influence the student's ability to solve mathematics projects that relate to daily life. The results of the Programme for International Student Assessment

(PISA) for Indonesia showed that the students' abilities to solve and interpret problems in various situations are still considered at a level, which is low (Kamaliyah, Zulkardi, & Darmawijoyo, 2013).

Subsequently, Irawan and Kencanawaty (2017) and Sembiring, Hoogland, and Dolk (2010) suggested that appropriate strategies and learning methods are needed to develop students' thinking ability that orientate towards technical skills and the reformation of mathematics education based on problem-solving in the daily life. The learning method suggested is the *Pendidikan Matematika Realistik Indonesia* (PMRI), which is an adaptation of the Realistic Mathematics Education (RME). The PMRI is aligned with the Indonesian culture, geography and the ability of Indonesian society in general (Soedjadi, 2007; Sembiring, Hadi, & Dolk, 2008; Arsaythamby & Zubainur, 2014).

Wahyudi, Zulkardi, and Darmawijoyo (2016) and Subijanto (2015) explained that one of the contexts that can be used in PMRI is a culture that is applied to realistic mathematics learning and modified according to the local context where the school is located. Consequently, it may result in engaging, contextual knowledge if it is to be taught in schools as it may increase the students' ability to solve a problem that has a relation to their daily life. Also, the cultural context can be a solution to the lost aesthetic value and character of a student due to the influence of modernization (Prahmana, 2017; Grigoryan, Lebedeva, & Breugelmans, 2018; Uge, Neolaka, & Yasin, 2019)

Professional teachers, as the product of reform in education, must have higher education qualifications and be able to innovate in teaching and learning (Prahmana, Zulkardi, & Hartono, 2012; Risdiyanti & Prahmana, 2018). So, every prospective teacher should be prepared to become a professional teacher to equip himself through higher education and knowledge of the learning and teaching process. In Yogyakarta, there is a study club called the Yogyakarta Mathematics Study Club (YMSC) consisting of several mathematical mathematics education graduates who are engaged in innovating mathematics learning as a way to improve the qualifications and innovative learning abilities for graduates of mathematics education in Yogyakarta.

Commented [HH1]: what are the advantages so that researchers use BWS and US as one of a way to understand number patterns

The culture product is fun as it contained concepts of mathematics for learning purposes and aspects of moral values (Radovic, Black, Williams, & Salas, 2018; Risdiyanti, Prahmana, & Shahrill, 2019). The design of the number pattern learning using Barathayudha war stories and Uno Stacko is expected to be innovative in terms of learning mathematics so that the concept will be easy for students to understand thus enabling them to solve any daily-related problems. This context was chosen mainly because of its familiarity with the participants from the perspectives of culture as well as their daily life. Furthermore, this design is expected to cultivate and develop the cultural values that may influence a student's character.

METHOD

This research uses design research as a research method. Design research was chosen in this research because this method is a systematic and flexible method to improve the quality of learning in the classroom by collaborating between researchers and teachers to develop a learning design (Gravemeijer, 1994). The development of learning design is carried out in three, which are preliminary

design, design experiment, and analysis retrospective (Bakker, 2004; Gravemeijer & Cobb, 2006; Simonson, 2006; Prahmana, 2017).

The preliminary design aims to form a Hypothetical Learning Trajectory (HLT), which is then refined in the design experiment stage (Prahmana, 2017). The activities carried out in this stage are collaborating with the teacher to conduct a literature review of the concept of number patterns, realistic mathematics education, and contexts that can be used in learning number patterns. Also, I analyzed the concept of number patterns in the mathematics education curriculum in Indonesia. Then the results of the literature study and curriculum analysis were used as a basis for designing learning trajectories and developing conjectures to become HLT. In this case, theory aims as guidelines that will improve in each learning activity, so it is flexible and can be revised during the experimental design stage.

In the design experiment stage, the learning trajectory that has been designed at the preliminary design stage is then implemented in the learning process (Prahmana, 2017). The purpose of this implementation is to explore and observe the strategies and thoughts of students. There are two cycles in this stage; the first cycle is a pilot experiment that aims to evaluate and improve the learning trajectory that has been designed. The second cycle is a teaching experiment that seeks to implement a learning trajectory that is evaluated and revised in the pilot experiment of the design experiment stage.

The last stage is retrospective analysis, all data collected in the design experiment stage are analyzed by comparing conjecture and HLT with the results of the application of the learning trajectory that has been carried out in the design experiment stage (Gravemeijer & Cobb, 2006). From the results of the analysis will obtain a trajectory description of number pattern learning using Uno Stacko games.

RESULT AND DISCUSSION

The results of this study obtained a trajectory description of the number pattern learning using the Barathayuda war story and Uno Stacko. The learning activities consist of four activities. Activities 1 is to be a detective of Barathayudha war. Activities 2 is to rebuild Abimayu Fortress at Battlefield of Kurusetra. Activities 3 is to find the unique secret number code of Abimayu fortress. Lastly, activity 4 is to build another fortress using the number pattern. Students can understand the concept of number patterns using the Barathayudha war story and Uno Stacko. It viewed from the results of the final Regarding this learning can be seen from the comments, students feel more comfortable understanding the number pattern using this context. The results of evaluation and the positive responses of students.

Commented [HH2]: if the purpose of this study is only this, where the novelty and depth so useful for understanding the concept of number patterns

this study indicated that the learning design of number patterns using Barathayudha War Story and Uno Stacko has very important to be the starting point and can increase student motivation in the learning process. In detail, the researcher discusses the results of this study as follows.

Activity 1: Be a detective of Barathayudha War

Learning activities begin with the teacher describing the Barathayuda war, which is a civil war between Kurawa and Pandhawa in *Pewayangan* Stories. The student will be told the original story, for, in the end, it will be slightly modified to fit the material to be learned. Barathayuda's story was chosen

as the starting point because this learning was carried out in Java, which was very thick with the *Pewayangan* stories culture. So, it would create a new stigma for students who had felt that actually, mathematics was far from their lives to think that mathematics existed and became part of their culture.

In this activity, it told that at once upon a time. There was a civil war between Kurawa and Pandhawa. In the *Pewayangan* story, Kurawa and Pandhawa have the same father named Prabu Pandhu, but from different mother. Before dying, Prabu Pandhu handed over the authority of the state to purify Pandhawa, because he was considered capable of managing and leading wisely. Kurawa did not accept his father's decision and always tried to seize the power of Pandhawa (Susetya, 2007). Finally, one day, a civil war took place on a battlefield, namely Kurusetra. The Hindus believe that Kurusetra existed on this earth precisely in India, but no one had succeeded in proving the truth.

At the time of the war, Abimayu, one of the members of Pandhawa made a triangular fortress of rock arranged in a unique arrangement of numbers, consisting of the results of repetitive number operations. According to archeologists, there ways to prove whether the war really happened and took place in Kurusetra, India are by breaking the secret code used Abimayu to compile the fort. Based on historical records, it is known that the fortress was composed of 30 pieces of stone, consisting of 8 levels, the most basic of which had eight bricks, and the top is one brick. Until now, no one has been able to crack the secret code.

After the story is complete, the teacher provokes the students' interest in breaking the secret code. The teacher invites students to be a detective looking for truth. They seem to be in Kurusetra, India and found the ruins of the fort there, but did not know whether the debris was a fortress built by Abimayu as in the *Pewayangan* story. Therefore, students formed a group of 4 to 5 people who acted as a detective team. The team did research by collecting debris that was suspected of being Abimayu's fortress and then rebuilt and solved its secret code. In this study, the fortress debris is illustrated using Uno Stacko sticks. As a result, at this stage, the students were enthusiastic about listening to the *Pewayangan* story and were interested in deciphering the secret code of Abimayu fortress which was actually a pattern number.

Activity 2: Rebuilt Abimayu fortress at battlefield of Kurusetra

In this activity students who have collected fortress debris that is suspected to be the fortress of Abimayu, then they try to compile the fort with the arrangement as recorded in history that the Abimayu fortress is triangular in shape, arranged uniquely, consisting of the results of repetitive number operations, organized of 30 pieces of stone that from 8 levels, the bottom is composed of 8 pieces of stone. The top is arranged for one stone. At this stage, students need creativity and critical thinking because students must expect a form of the fort that they have never seen, and they rebuild that fort only based on the clues given. As a result, students managed to make a fortress with an arrangement that formed a triangle with eight levels and the provision of each level, creating a number pattern. The students' activities of rebuilt the Abimayu's fortress can be seen in Figure 1.


Figure 1. Students rebuilt Abimayu Fortrees at Battlefield Kurusetra

Activity 3: Find the unique secret number code of Abimayu fortress

In the third activity, students are given a student worksheet, which will serve to help students find the secret code of the Abimayu fortress arrangement. The student worksheet consists of columns that will be filled with the number of stones arranged in each level. Then students look for the relationship of the number operation of the number of rocks arranged on each level. It is done to test whether the structure that students make has been the same as the one recorded in history, and to prove the truth of the ruins of the fortress in Kurusetra, India is the landscape of Abimayu in the puppet story. At this stage, students then look for formulas from the number pattern that has been found. The activity in the third stage is essential to do as a bridge to understanding the concept of number patterns from the formal level to the informal level.

Commented [HH3]: in activity 3: there is no explanation of the student's real activities each step so finding a formula of number patterns



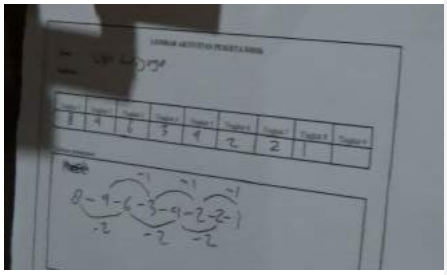



Figure 2. Students find the Unique Secret Number Code of Abimayu Fortress

Activity 4: Built another fortress using number pattern

In this fourth activity, students make a fortress with a pattern according to the number pattern they want as this stage, students' understanding has been on understanding the informal level. Students have understood the concept of number patterns and can make these patterns without using the help of Uno Stacko sticks and can visualize the number pattern in the form of a fort made using Uno stick.

Figure 3. Students built another fortress using number pattern

All activities could change the stigma of students and society that mathematics that is felt far from daily life exists and becomes part of the culture of the community. This study was able to take on the role of developing the learning trajectory of number pattern learning using Barathayudha war stories and Uno Staco as the local context of education. In addition, a few of researchers have documented the results of their research related to the implementation of daily activities of students in the learning process of mathematics, such as pictorial pat games in learning number operations (Prahmana, Zulkardi, & Hartono, 2012), playing one house in learning number operations (Nasrullah & Zulkardi, 2011), *Patok Lele* stakes in learning measurements (Wijaya, 2008), Kubuk Manuk Indonesian traditional game as stimulated starting point to understand the knowledge of the social arithmetic concept (Risdayanti, Prahmana, & Shahrill, 2019), and top games in time learning (Jaelani, Putri, & Hartono, 2013). Therefore this study takes a role to add to the study of contexts that can be used as a starting point for learning mathematics.

CONCLUSION

The learning of number pattern, the learning trajectory can be practiced using local contexts such as culture or other things easily found in the daily activities of the students. The students were able to understand the concept of mathematics easily since it is fun for them and importantly, the game is relatable to activities in their daily life.

Commented [HH4]: - In the introduction, one of effect of this study was stated on the character of students, but in conclusion there was no result
- which indicators in result and discussion explain "the studentds were able to understand the concept of mathematics easily.

REFERENCES

Arisetyawan, A., Suryadi, D., Herman, T., & Rahmat, C. (2014). Study of Ethnomathematics: A lesson from the Baduy Culture. *International Journal of Education and Research, 2*(10), 681-688.

Arsaythamby, V., & Zubainur, C. M. (2014). How a realistic mathematics educational approach affect

students' activities in primary schools?. *Procedia-Social and Behavioral Sciences, 159*, 309-313. https://doi.org/10.1016/j.sbspro.2014.12.378.

Bakker, A. (2004). Design research in statistics education-On symbolizing and computer tools. *Unpublished Ph.D. Thesis*. Utrecht: The Freudenthal Institute.

Freudenthal, H. (1991). *Revisiting Mathematics Education: China Lectures*. Dordrecht: Kluwer Academic Publishers.

Gravemeijer, K. (1994). Educational development and developmental research in mathematics education. *Journal for Research in Mathematics Education, 25*(5), 443-471. https://doi.org/10.2307/749485.

Gravemeijer, K., & Cobb, P. (2006). Design research from a learning design perspective. In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.), *Educational Design Research* (pp. 17-51). London: Routledge.

Grigoryan, L. K., Lebedeva, N., & Breugelmans, S. M. (2018). A cross-cultural study of the mediating role of implicit theories of innovativeness in the relationship between values and attitudes toward innovation. *Journal of cross-cultural psychology, 49*(2), 336-352. https://doi.org/10.1177/0022022116656399.

Irawan, A., & Kencanawaty, G. (2017). Implementation of Realistic Mathematics-based Etnomathematics Learning [in Bahasa]. *Journal of Medives, 1*(2), 74-81.

Jaelani, A., Putri, R. I. I., & Hartono, Y. (2013). Students' strategies of measuring time using traditional gasing game in third grade of primary school. *Journal on Mathematics Education, 4*(1), 29-40. https://doi.org/10.22342/jme.4.1.560.29-40.

Kamaliyah, Zulkardi, & Darmawijoyo. (2013). Developing the sixth level of PISA-like mathematics problems for secondary school students. *Journal on Mathematics Education, 4*(1), 9-28. https://doi.org/10.22342/jme.4.1.559.9-28.

Nasrullah & Zulkardi. (2011). Building Counting by Traditional Game a Mathematics Program for Young Children. *Journal on Mathematics Education 2*(1), 41-54. https://doi.org/10.22342/jme.2.1.781.41-54.

Nurhasanah, F., Kusumah, Y. S., & Sabandar, J. (2017). Concept of triangle: Examples of mathematical abstraction in two different contexts. *International Journal on Emerging Mathematics Education, 1*(1), 53-70. http://dx.doi.org/10.12928/ijeme.v1i1.5782.

Prahmana, R. C. I. (2017). *Design Research (Theory and its implementation: An Introduction)* [in Bahasa]. Jakarta: Rajawali Pers.

Prahmana, R. C. I., Zulkardi, & Hartono, Y. (2012). Learning multiplication using Indonesian traditional game in third grade. *Journal on Mathematics Education*, *3*(2), 115-132. https://doi.org/10.22342/jme.3.2.1931.115-132.

Radovic, D., Black, L., Williams, J., & Salas, C. E. (2018). Towards conceptual coherence in the research on mathematics learner identity: a systematic review of the literature. *Educational Studies in Mathematics, 99*(1), 21-42. https://doi.org/10.1007/s10649-018-9819-2.

Revina, S. (2018). Influence of culture on the adaptation of realistic mathematics education in Indonesia. *Unpublished Ph.D. Thesis*. Hongkong: The University of Hong Kong.

Revina, S., & Leung, F. K. S. (2019). How the same flowers grow in different Soils? The implementation of realistic mathematics education in Utrecht and Jakarta classrooms.

International Journal of Science and Mathematics Education, *17*(3), 565-589. https://doi.org/10.1007/s10763-018-9883-1.

Risdiyanti, I., & Prahmana, R. C. I. (2018). Etnomathematics: Exploration of Javaness traditional games. *Journal of Medives, 2*(1), 1-11.

Risdiyanti, I., Prahmana, R. C. I., & Shahrill, M. (2019). The learning trajectory of social arithmetic using an Indonesian traditional game. *Elementary Education Online*, *18*(4), 2094-2108. https://doi.org/10.17051/ilkonline.2019.639439.

Sembiring, R. K., Hadi, S., & Dolk, M. (2008). Reforming mathematics learning in Indonesian classrooms through RME. *ZDM-Journal on Mathematics Education, 40*(6), 927-939. https://doi.org/10.1007/s11858-008-0125-9.

Sembiring, R. K., Hoogland, K., & Dolk, M. (2010). A Decade of PMRI in Indonesia. Utrecht: APS International.

Simonson. (2006). Design-based research: Applications for distance education. *Quarterly Review of Distance Education, 7*(1), vii-viii.

Soedjadi, R. (2007). Dasar-dasar pendidikan matematika realistik Indonesia. *Jurnal Pendidikan Matematika, 1*(2), 1-10. https://doi.org/10.22342/jpm.1.2.807.

Stacey, K. (2011). The PISA view of mathematical literacy in Indonesia. *Journal on Mathematics Education, 2*(2), 95-126. https://doi.org/10.22342/jme.2.2.746.95-126.

Subijanto. (2015). The policy of local excellence-based education programs in state senior high school 2 Pekalongan [in Bahasa]. *Jurnal Pendidikan dan Kebudayaan, 21*(2),115-134.

Susetya, W. (2007). *Bharatayuda: Teaching, symbols, philosophies and their meanings for daily life [in Bahasa]*. Yogyakarta: Kreasi Wacana.

Tanujaya, B., Prahmana, R. C. I, & Mumu, J. (2017). Mathematics instruction, problems, challenges, and opportunities: A case study in Manokwari Regency, Indonesia. *World Transactions on Engineering and Technology Education, 15*(3), 287-291.

Uge, S., Neolaka, A., & Yasin, M. (2019). Development of social studies learning model based on local wisdom in improving students' knowledge and social attitude. *International Journal of Instruction, 12*(3), 375-388. . https://doi.org/10.29333/iji.2019.12323a.

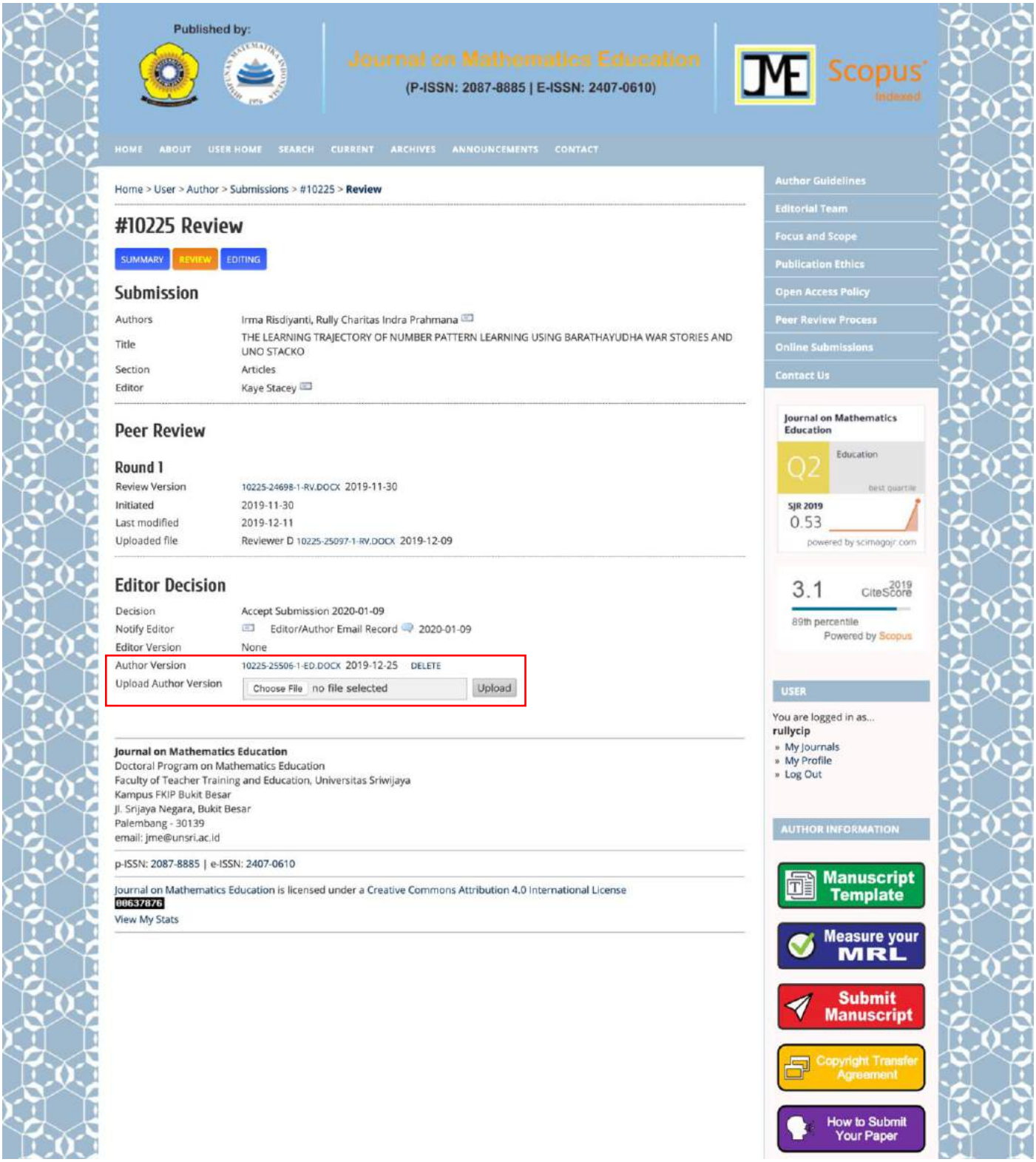
Wahyudi, T., Zulkardi, & Darmawijoyo. (2016). Developing of TIMSS type reasoning questions using the Lampung cultural context [in Bahasa]. *Jurnal Didaktik Matematika, 3*(1), 1-14. https://doi.org/10.24815/jdm.v3i1.4300.

Wijaya, A. (2008). Design research in mathematics education: Indonesian traditional games as means to support second graders' learning of linear measurement. *Thesis*. Utrecht: Utrecht University.

PEMBELAJARAN POLA BILANGAN DENGAN MENGGUNAKAN CERITERA PERANG BARATHAYUDHA DAN UNO STACKO

Pengembangan dan penerapan masalah sehari-hari konsep matematika adalah bagian dari proses pembelajaran (Tanujaya, Prahmana, & Mumu, 2017). Freudhental (1991) menjelaskan bahwa matematika adalah aktivitas manusia dan harus berkaitan dengan kehidupan sehari-hari. Namun, pada kenyataannya, matematika di sekolah cenderung diajarkan menggunakan rumus praktis dan paling sering, tidak terkait dengan kehidupan sehari-hari dan budaya, seperti yang seharusnya dialami oleh siswa (Stacey, 2011; Arisetyawan, Suryadi, Herman, & Rahmat, 2014; Nurhasanah, Kusumah, & Sabandar, 2017). Masyarakat, termasuk para guru, umumnya tidak menganggap matematika berhubungan dengan budaya, dan pembelajaran matematika di kelas juga dapat dianggap dengan hampir tidak memiliki hubungan dengan budaya. Faktanya, budaya adalah bagian dari kehidupan siswa yang dapat memandu cara siswa belajar dan menganggap matematika (Stacey, 2011; Revina, 2018; Revina & Leung, 2019). Ini dapat secara signifikan mempengaruhi kemampuan siswa untuk menyelesaikan proyek matematika yang berhubungan dengan kehidupan sehari-hari. Hasil Program untuk Penilaian Siswa Internasional (PISA) untuk Indonesia menunjukkan bahwa kemampuan siswa untuk memecahkan dan menafsirkan masalah dalam berbagai situasi masih dianggap pada tingkat yang rendah (Kamaliyah, Zulkardi, & Darmawijoyo, 2013).

Hasil revisi di kirim pada tanggal 25 Desember 2019 dengan perubahan signifikan pada konten isi



Paper hasil revisi dengan judul,

“The Learning Trajectory of Number Pattern Learning using Barathayudha War Stories and Uno Stacko”

[Paper ID: 10225]

ISSN 2087-8885
E-ISSN 2407-0610

Journal on Mathematics Education
Volume xx, No. x, January xxxx, pp. x-xx

THE LEARNING TRAJECTORY OF NUMBER PATTERN LEARNING USING BARATHAYUDHA WAR STORIES AND UNO STACKO

Abstract

This research is aimed to design a mathematics learning trajectory in pattern number using Barathayudha War Stories and Uno Stacko games as a starting point or context in the learning process with the Indonesian Realistic Mathematics Education (IRME) approach. The method used is a design research that contains three stages, that is preliminary design, teaching experiment, and retrospective analysis. The result of this research is the design learning trajectory of number pattern learning using Barathayudha war stories and Uno Stacko. The design consists of four activities, which is a detective of Barathayudha war; rebuilt Abimayu fortress at the battlefield of Kurusetra; find the unique secret number code of Abimayu fortress; built another fort using number pattern. The results showed Barathayudha war stories, and Uno Stacko can stimulate students to understand their knowledge of pattern number concept, and the stages in the learning trajectory of student have an essential role in understanding the concept.

Keywords: Learning Trajectory, Number Pattern, Barathayudha War Stories, Uno Stacko, Design Research

Abstrak

Penelitian ini bertujuan untuk mendesain lintasan belajar matematika pada materi pola bilangan menggunakan cerita peperangan Barathayudha dan permainan Uno Stacko sebagai titik awal atau konteks dalam proses pembelajaran menggunakan pendekatan Pendidikan Matematika Realistik Indonesia (PMRI). Metode yang digunakan dalam penelitian ini adalah penelitian desain yang terdiri dari 3 tahapan, yaitu desain pendahuluan, percobaan pengajaran, dan analisis retrospektif. Hasil dari penelitian ini merupakan desain lintasan belajar pada pembelajaran pola bilangan menggunakan cerita peperangan Barathayudha dan permainan Uno Stacko. Desain ini terdiri dari 4 aktivitas, yaitu seorang detektif dari perang Barathayudha, membangun kembali benteng Abimayu di medan perang Kurusetra; menemukan kode nomor rahasia unik dari benteng Abimayu; membangun benteng lain menggunakan pola angka. Hasil penelitian menunjukkan bahwa kisah peperangan Barathayudha dan Uno Stacko dapat merangsang siswa untuk menumbuhkan pemahaman siswa tentang konsep pola bilangan dan seluruh tahapan dalam lintasan belajar yang dilalui siswa memiliki peran penting dalam penanaman konsep tersebut.

Kata kunci: lintasan belajar, pola bilangan, Cerita Peperangan Barathayudha, Uno Stacko, Penelitian Desain

How to Cite: .(2016). The learning trajectory of number pattern learning using Barathayudha war stories and Uno Stacko. *Journal on Mathematics Education, 11*(1), xx-xx.

The development and application of the mathematics concept daily problems are part of a learning process (Tanujaya, Prahmana, & Mumu, 2017). Freudhental (1991) explained that mathematics is a human activity and must be related to daily life. However, in reality, the mathematics in schools tend to be taught using practical formulas and most often, not seamlessly associated with everyday life and culture, as should be experienced by the students (Stacey, 2011; Arisetyawan, Suryadi, Herman, & Rahmat, 2014; Nurhasanah, Kusumah, & Sabandar, 2017). The society, including the teachers, generally does not regard mathematics to be related to culture, and the learning of mathematics in the classroom can also be regarded with almost having no relation to culture. In fact, culture is part of a student's life that may guide the way a student learns and regard mathematics (Stacey, 2011; Revina, 2018; Revina & Leung, 2019). It may significantly influence the student's ability to solve mathematics projects that relate to daily life. The results of the Programme for International Student Assessment

(PISA) for Indonesia showed that the students' abilities to solve and interpret problems in various situations are still considered at a level, which is low (Kamaliyah, Zulkardi, & Darmawijoyo, 2013).

Subsequently, Irawan and Kencanawaty (2017) and Sembiring, Hoogland, and Dolk (2010) suggested that appropriate strategies and learning methods are needed to develop students' thinking ability that orientate towards technical skills and the reformation of mathematics education based on problem-solving in the daily life. The learning method suggested is the *Pendidikan Matematika Realistik Indonesia* (PMRI), which is an adaptation of the Realistic Mathematics Education (RME). The PMRI is aligned with the Indonesian culture, geography and the ability of Indonesian society in general (Soedjadi, 2007; Sembiring, Hadi, & Dolk, 2008; Arsaythamby & Zubainur, 2014).

Wahyudi, Zulkardi, and Darmawijoyo (2016) and Subijanto (2015) explained that one of the contexts that can be used in PMRI is a culture that is applied to realistic mathematics learning and modified according to the local context where the school is located. Consequently, it may result in engaging, contextual knowledge if it is to be taught in schools as it may increase the students' ability to solve a problem that has a relation to their daily life. Also, the cultural context can be a solution to the lost aesthetic value and character of a student due to the influence of modernization (Prahmana, 2017; Grigoryan, Lebedeva, & Breugelmans, 2018; Uge, Neolaka, & Yasin, 2019)

Professional teachers, as the product of reform in education, must have higher education qualifications and be able to innovate in teaching and learning (Prahmana, Zulkardi, & Hartono, 2012; Risdiyanti & Prahmana, 2018). So, every prospective teacher should be prepared to become a professional teacher to equip himself through higher education and knowledge of the learning and teaching process. In Yogyakarta, there is a study club called the Yogyakarta Mathematics Study Club (YMSC) consisting of several mathematical mathematics education graduates who are engaged in innovating mathematics learning as a way to improve the qualifications and innovative learning abilities for graduates of mathematics education in Yogyakarta.

The culture product is fun as it contained concepts of mathematics for learning purposes and aspects of moral values (Radovic, Black, Williams, & Salas, 2018; Risdiyanti, Prahmana, & Shahrill, 2019). The design of the number pattern learning using Barathayudha war stories and Uno Stacko is expected to be innovative in terms of learning mathematics so that the concept will be easy for students to understand thus enabling them to solve any daily-related problems. This context was chosen mainly because of its familiarity with the participants from the perspectives of culture as well as their daily life. Furthermore, this design is expected to cultivate and develop the cultural values that may influence a student's character.

METHOD

This research uses design research as a research method. Design research was chosen in this research because this method is a systematic and flexible method to improve the quality of learning in the classroom by collaborating between researchers and teachers to develop a learning design (Gravemeijer, 1994). The development of learning design is carried out in three, which are preliminary

design, design experiment, and analysis retrospective (Bakker, 2004; Gravemeijer & Cobb, 2006; Simonson, 2006; Prahmana, 2017).

The preliminary design aims to form a Hypothetical Learning Trajectory (HLT), which is then refined in the design experiment stage (Prahmana, 2017). The activities carried out in this stage are collaborating with the teacher to conduct a literature review of the concept of number patterns, realistic mathematics education, and contexts that can be used in learning number patterns. Also, I analyzed the concept of number patterns in the mathematics education curriculum in Indonesia. Then the results of the literature study and curriculum analysis were used as a basis for designing learning trajectories and developing conjectures to become HLT. In this case, theory aims as guidelines that will improve in each learning activity, so it is flexible and can be revised during the experimental design stage.

In the design experiment stage, the learning trajectory that has been designed at the preliminary design stage is then implemented in the learning process (Prahmana, 2017). The purpose of this implementation is to explore and observe the strategies and thoughts of students. There are two cycles in this stage; the first cycle is a pilot experiment that aims to evaluate and improve the learning trajectory that has been designed. The second cycle is a teaching experiment that seeks to implement a learning trajectory that is evaluated and revised in the pilot experiment of the design experiment stage.

The last stage is retrospective analysis, all data collected in the design experiment stage are analyzed by comparing conjecture and HLT with the results of the application of the learning trajectory that has been carried out in the design experiment stage (Gravemeijer & Cobb, 2006). From the results of the analysis will obtain a trajectory description of number pattern learning using Uno Stacko games.

RESULT AND DISCUSSION

The results of this study obtained a trajectory description of the number pattern learning using the Barathayuda war story and Uno Stacko. The learning activities consist of four activities. Activities 1 is to be a detective of Barathayudha war. Activities 2 is to rebuild Abimayu Fortress at Battlefield of Kurusetra. Activities 3 is to find the unique secret number code of Abimayu fortress. Lastly, activity 4 is to build another fortress using the number pattern. Students can understand the concept of number patterns using the Barathayudha war story and Uno Stacko. It viewed from the results of the final evaluation and the positive responses of students.

Regarding this learning can be seen from the comments, students feel more comfortable understanding the number pattern using this context. The results of this study indicated that the learning design of number patterns using Barathayudha War Story and Uno Stacko has very important to be the starting point and can increase student motivation in the learning process. In detail, the researcher discusses the results of this study as follows.

Activity 1: Be a detective of Barathayudha War

Learning activities begin with the teacher describing the Barathayuda war, which is a civil war between Kurawa and Pandhawa in *Pewayangan* Stories. The student will be told the original story, for,

in the end, it will be slightly modified to fit the material to be learned. Barathayuda's story was chosen as the starting point because this learning was carried out in Java, which was very thick with the *Pewayangan* stories culture. So, it would create a new stigma for students who had felt that actually, mathematics was far from their lives to think that mathematics existed and became part of their culture.

In this activity, it told that at once upon a time. There was a civil war between Kurawa and Pandhawa. In the *Pewayangan* story, Kurawa and Pandhawa have the same father named Prabu Pandhu, but from different mother. Before dying, Prabu Pandhu handed over the authority of the state to purify Pandhawa, because he was considered capable of managing and leading wisely. Kurawa did not accept his father's decision and always tried to seize the power of Pandhawa (Susetya, 2007). Finally, one day, a civil war took place on a battlefield, namely Kurusetra. The Hindus believe that Kurusetra existed on this earth precisely in India, but no one had succeeded in proving the truth.

At the time of the war, Abimayu, one of the members of Pandhawa made a triangular fortress of rock arranged in a unique arrangement of numbers, consisting of the results of repetitive number operations. According to archeologists, there ways to prove whether the war really happened and took place in Kurusetra, India are by breaking the secret code used Abimayu to compile the fort. Based on historical records, it is known that the fortress was composed of 30 pieces of stone, consisting of 8 levels, the most basic of which had eight bricks, and the top is one brick. Until now, no one has been able to crack the secret code.

After the story is complete, the teacher provokes the students' interest in breaking the secret code. The teacher invites students to be a detective looking for truth. They seem to be in Kurusetra, India and found the ruins of the fort there, but did not know whether the debris was a fortress built by Abimayu as in the *Pewayangan* story. Therefore, students formed a group of 4 to 5 people who acted as a detective team. The team did research by collecting debris that was suspected of being Abimayu's fortress and then rebuilt and solved its secret code. In this study, the fortress debris is illustrated using Uno Stacko sticks. As a result, at this stage, the students were enthusiastic about listening to the *Pewayangan* story and were interested in deciphering the secret code of Abimayu fortress which was actually a pattern number.

Activity 2: Rebuilt Abimayu fortress at battlefield of Kurusetra

In this activity students who have collected fortress debris that is suspected to be the fortress of Abimayu, then they try to compile the fort with the arrangement as recorded in history that the Abimayu fortress is triangular in shape, arranged uniquely, consisting of the results of repetitive number operations, organized of 30 pieces of stone that from 8 levels, the bottom is composed of 8 pieces of stone. The top is arranged for one stone. At this stage, students need creativity and critical thinking because students must expect a form of the fort that they have never seen, and they rebuild that fort only based on the clues given. As a result, students managed to make a fortress with an arrangement that formed a triangle with eight levels and the provision of each level, creating a number pattern. The students' activities of rebuilt the Abimayu's fortress can be seen in Figure 1.

Figure 1. Students rebuilt Abimayu Fortrees at Battlefield Kurusetra

Activity 3: Find the unique secret number code of Abimayu fortress

In the third activity, students are given a student worksheet, which will serve to help students find the secret code of the Abimayu fortress arrangement. The student worksheet consists of columns that will be filled with the number of stones arranged in each level. Then students look for the relationship of the number operation of the number of rocks arranged on each level. It is done to test whether the structure that students make has been the same as the one recorded in history, and to prove the truth of the ruins of the fortress in Kurusetra, India is the landscape of Abimayu in the puppet story. At this stage, students then look for formulas from the number pattern that has been found. The activity in the third stage is essential to do as a bridge to understanding the concept of number patterns from the formal level to the informal level.

Figure 2. Students find the Unique Secret Number Code of Abimayu Fortress

Activity 4: Built another fortress using number pattern

In this fourth activity, students make a fortress with a pattern according to the number pattern they want as this stage, students' understanding has been on understanding the informal level. Students have understood the concept of number patterns and can make these patterns without using the help of Uno Stacko sticks and can visualize the number pattern in the form of a fort made using Uno stick.

Figure 3. Students built another fortress using number pattern

All activities could change the stigma of students and society that mathematics that is felt far from daily life exists and becomes part of the culture of the community. This study was able to take on the role of developing the learning trajectory of number pattern learning using Barathayudha war stories and Uno Staco as the local context of education. In addition, a few of researchers have documented the results of their research related to the implementation of daily activities of students in the learning process of mathematics, such as pictorial pat games in learning number operations (Prahmana, Zulkardi, & Hartono, 2012), playing one house in learning number operations (Nasrullah & Zulkardi, 2011), *Patok Lele* stakes in learning measurements (Wijaya, 2008), Kubuk Manuk Indonesian traditional game as stimulated starting point to understand the knowledge of the social arithmetic concept (Risdayanti, Prahmana, & Shahrill, 2019), and top games in time learning (Jaelani, Putri, & Hartono, 2013). Therefore this study takes a role to add to the study of contexts that can be used as a starting point for learning mathematics.

CONCLUSION

The learning of number pattern, the learning trajectory can be practiced using local contexts such as culture or other things easily found in the daily activities of the students. The students were able to understand the concept of mathematics easily since it is fun for them and importantly, the game is relatable to activities in their daily life.

REFERENCES

Arisetyawan, A., Suryadi, D., Herman, T., & Rahmat, C. (2014). Study of Ethnomathematics: A lesson from the Baduy Culture. *International Journal of Education and Research, 2*(10), 681-688.

Arsaythamby, V., & Zubainur, C. M. (2014). How a realistic mathematics educational approach affect

students' activities in primary schools?. *Procedia-Social and Behavioral Sciences, 159*, 309-313. https://doi.org/10.1016/j.sbspro.2014.12.378.

Bakker, A. (2004). Design research in statistics education-On symbolizing and computer tools. *Unpublished Ph.D. Thesis*. Utrecht: The Freudenthal Institute.

Freudenthal, H. (1991). *Revisiting Mathematics Education: China Lectures*. Dordrecht: Kluwer Academic Publishers.

Gravemeijer, K. (1994). Educational development and developmental research in mathematics education. *Journal for Research in Mathematics Education, 25*(5), 443-471. https://doi.org/10.2307/749485.

Gravemeijer, K., & Cobb, P. (2006). Design research from a learning design perspective. In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.), *Educational Design Research* (pp. 17-51). London: Routledge.

Grigoryan, L. K., Lebedeva, N., & Breugelmans, S. M. (2018). A cross-cultural study of the mediating role of implicit theories of innovativeness in the relationship between values and attitudes toward innovation. *Journal of cross-cultural psychology*, *49*(2), 336-352. https://doi.org/10.1177/0022022116656399.

Irawan, A., & Kencanawaty, G. (2017). Implementation of Realistic Mathematics-based Etnomathematics Learning [in Bahasa]. *Journal of Medives, 1*(2), 74-81.

Jaelani, A., Putri, R. I. I., & Hartono, Y. (2013). Students' strategies of measuring time using traditional gasing game in third grade of primary school. *Journal on Mathematics Education, 4*(1), 29-40. https://doi.org/10.22342/jme.4.1.560.29-40.

Kamaliyah, Zulkardi, & Darmawijoyo. (2013). Developing the sixth level of PISA-like mathematics problems for secondary school students. *Journal on Mathematics Education*, *4*(1), 9-28. https://doi.org/10.22342/jme.4.1.559.9-28.

Nasrullah & Zulkardi. (2011). Building Counting by Traditional Game a Mathematics Program for Young Children. *Journal on Mathematics Education 2*(1), 41-54. https://doi.org/10.22342/jme.2.1.781.41-54.

Nurhasanah, F., Kusumah, Y. S., & Sabandar, J. (2017). Concept of triangle: Examples of mathematical abstraction in two different contexts. *International Journal on Emerging Mathematics Education, 1*(1), 53-70. http://dx.doi.org/10.12928/ijeme.v1i1.5782.

Prahmana, R. C. I. (2017). *Design Research (Theory and its implementation: An Introduction)* [in Bahasa]. Jakarta: Rajawali Pers.

Prahmana, R. C. I., Zulkardi, & Hartono, Y. (2012). Learning multiplication using Indonesian traditional game in third grade. *Journal on Mathematics Education*, *3*(2), 115-132. https://doi.org/10.22342/jme.3.2.1931.115-132.

Radovic, D., Black, L., Williams, J., & Salas, C. E. (2018). Towards conceptual coherence in the research on mathematics learner identity: a systematic review of the literature. *Educational Studies in Mathematics, 99*(1), 21-42. https://doi.org/10.1007/s10649-018-9819-2.

Revina, S. (2018). Influence of culture on the adaptation of realistic mathematics education in Indonesia. *Unpublished Ph.D. Thesis*. Hongkong: The University of Hong Kong.

Revina, S., & Leung, F. K. S. (2019). How the same flowers grow in different Soils? The implementation of realistic mathematics education in Utrecht and Jakarta classrooms.

International Journal of Science and Mathematics Education, 17(3), 565-589. https://doi.org/10.1007/s10763-018-9883-1.

Risdiyanti, I., & Prahmana, R. C. I. (2018). Etnomathematics: Exploration of Javaness traditional games. *Journal of Medives, 2*(1), 1-11.

Risdiyanti, I., Prahmana, R. C. I., & Shahrill, M. (2019). The learning trajectory of social arithmetic using an Indonesian traditional game. *Elementary Education Online, 18*(4), 2094-2108. https://doi.org/10.17051/ilkonline.2019.639439.

Sembiring, R. K., Hadi, S., & Dolk, M. (2008). Reforming mathematics learning in Indonesian classrooms through RME. *ZDM-Journal on Mathematics Education, 40*(6), 927-939. https://doi.org/10.1007/s11858-008-0125-9.

Sembiring, R. K., Hoogland, K., & Dolk, M. (2010). A Decade of PMRI in Indonesia. Utrecht: APS International.

Simonson. (2006). Design-based research: Applications for distance education. *Quarterly Review of Distance Education, 7*(1), vii-viii.

Soedjadi, R. (2007). Dasar-dasar pendidikan matematika realistik Indonesia. *Jurnal Pendidikan Matematika, 1*(2), 1-10. https://doi.org/10.22342/jpm.1.2.807.

Stacey, K. (2011). The PISA view of mathematical literacy in Indonesia. *Journal on Mathematics Education, 2*(2), 95-126. https://doi.org/10.22342/jme.2.2.746.95-126.

Subijanto. (2015). The policy of local excellence-based education programs in state senior high school 2 Pekalongan [in Bahasa]. *Jurnal Pendidikan dan Kebudayaan, 21*(2),115-134.

Susetya, W. (2007). *Bharatayuda: Teaching, symbols, philosophies and their meanings for daily life [in Bahasa]*. Yogyakarta: Kreasi Wacana.

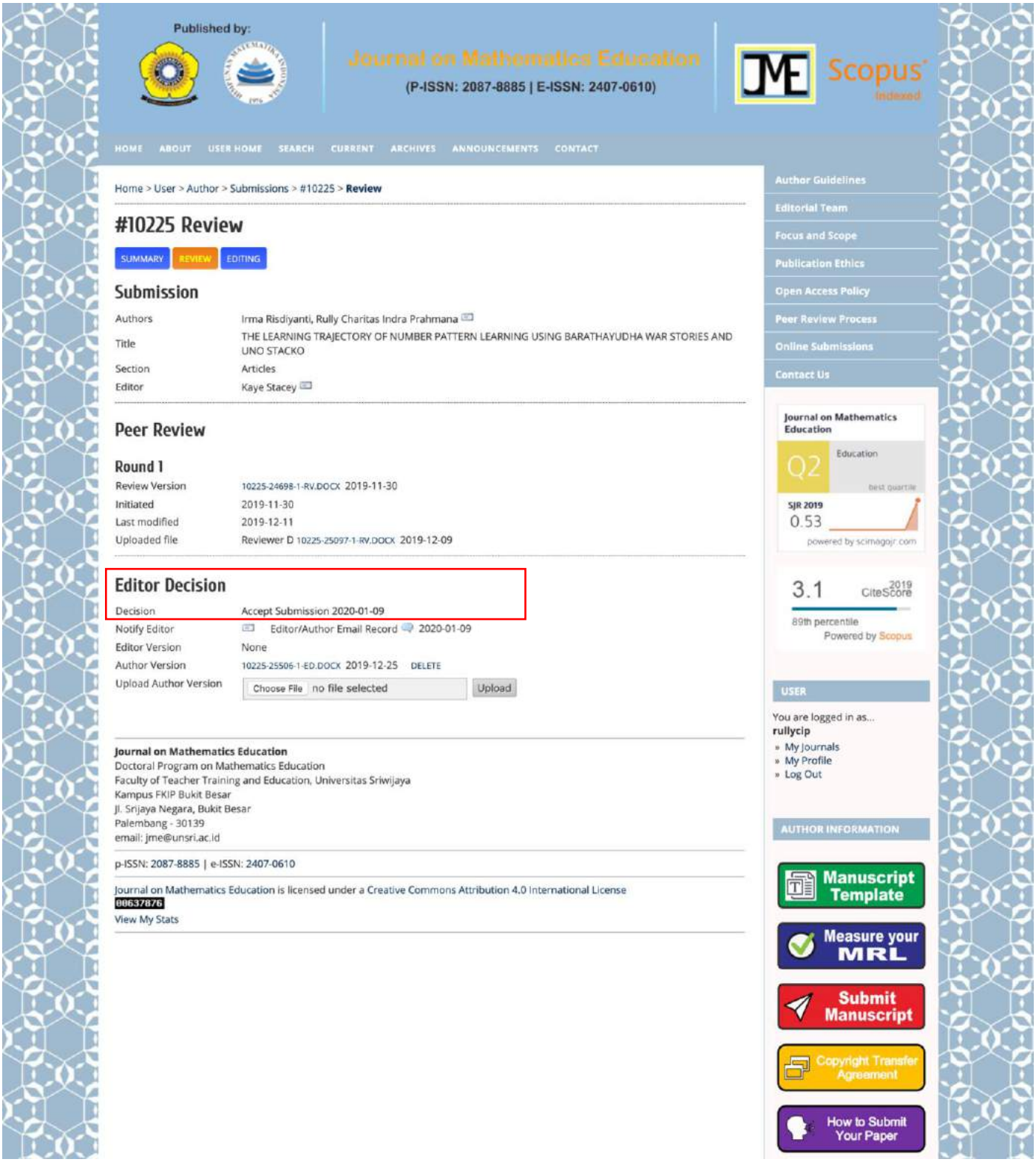
Tanujaya, B., Prahmana, R. C. I, & Mumu, J. (2017). Mathematics instruction, problems, challenges, and opportunities: A case study in Manokwari Regency, Indonesia. *World Transactions on Engineering and Technology Education, 15*(3), 287-291.

Uge, S., Neolaka, A., & Yasin, M. (2019). Development of social studies learning model based on local wisdom in improving students' knowledge and social attitude. *International Journal of Instruction, 12*(3), 375-388. . https://doi.org/10.29333/iji.2019.12323a.

Wahyudi, T., Zulkardi, & Darmawijoyo. (2016). Developing of TIMSS type reasoning questions using the Lampung cultural context [in Bahasa]. *Jurnal Didaktik Matematika, 3*(1), 1-14. https://doi.org/10.24815/jdm.v3i1.4300.

Wijaya, A. (2008). Design research in mathematics education: Indonesian traditional games as means to support second graders' learning of linear measurement. *Thesis*. Utrecht: Utrecht University.

Keputusan diterima pasca revisi pada tanggal 9 Januari 2020.



Published by:

Journal on Mathematics Education
(P-ISSN: 2087-8885 | E-ISSN: 2407-0610)

Scopus Indexed

HOME ABOUT USER HOME SEARCH CURRENT ARCHIVES ANNOUNCEMENTS CONTACT

Home > User > Author > Submissions > #10225 > **Review**

#10225 Review

SUMMARY REVIEW EDITING

Submission

Authors	Irma Risdiyanti, Rully Charitas Indra Prahmana
Title	THE LEARNING TRAJECTORY OF NUMBER PATTERN LEARNING USING BARATHAYUDHA WAR STORIES AND UNO STACKO
Section	Articles
Editor	Kaye Stacey

Peer Review

Round 1

Review Version	10225-24698-1-RV.DOCX 2019-11-30
Initiated	2019-11-30
Last modified	2019-12-11
Uploaded file	Reviewer D 10225-25097-1-RV.DOCX 2019-12-09

Editor Decision

Decision	Accept Submission 2020-01-09
Notify Editor	Editor/Author Email Record 2020-01-09
Editor Version	None
Author Version	10225-25506-1-ED.DOCX 2019-12-25 DELETE
Upload Author Version	Choose File no file selected Upload

Journal on Mathematics Education
Doctoral Program on Mathematics Education
Faculty of Teacher Training and Education, Universitas Sriwijaya
Kampus FKIP Bukit Besar
Jl. Srijaya Negara, Bukit Besar
Palembang - 30139
email: jme@unsri.ac.id

p-ISSN: 2087-8885 | e-ISSN: 2407-0610

Author Guidelines
Editorial Team
Focus and Scope
Publication Ethics
Open Access Policy
Peer Review Process
Online Submissions
Contact Us

Journal on Mathematics Education
Q2 Education
best quartile
SJR 2019
0.53
powered by scimagojr.com

3.1 CiteScore 2019
89th percentile
Powered by Scopus

USER
You are logged in as...
rullycip
» My Journals
» My Profile
» Log Out

AUTHOR INFORMATION
Manuscript Template
Measure your MRL
Submit Manuscript
Copyright Transfer Agreement
How to Submit Your Paper

Artikel terbit di website Journal on Mathematics Education pada tanggal 15 Januari 2020, dengan URL artikel berikut https://ejournal.unsri.ac.id/index.php/jme/article/view/10225

Published by:

Journal on Mathematics Education

(P-ISSN: 2087-8885 | E-ISSN: 2407-0610)

JME Scopus Indexed

HOME ABOUT USER HOME SEARCH CURRENT ARCHIVES ANNOUNCEMENTS CONTACT

Home > Vol 11, No 1 (2020) > **Risdiyanti**

THE LEARNING TRAJECTORY OF NUMBER PATTERN LEARNING USING BARATHAYUDHA WAR STORIES AND UNO STACKO

Irma Risdiyanti, Rully Charitas Indra Prahmana

Abstract

In recent years, several researchers have tried to use stories and games as a starting point for learning mathematics. This is allegedly able to increase students' mathematical abilities and make learning mathematics more enjoyable. Therefore, this research is aimed to design a mathematics learning trajectory in pattern number using *Barathayudha* War Stories and Uno Stacko games as a starting point or context in the learning process with the Indonesian Realistic Mathematics Education (IRME) approach. The research method used is a design research that contains three stages, preliminary design, teaching experiment, and retrospective analysis. The result of this research is the learning trajectory design of number pattern learning using *Barathayudha* war stories and Uno Stacko. The design consists of four activities, which is a detective of *Barathayudha* war; rebuilt *Abimayu* fortress at the battlefield of *Kurusetra*; find the unique secret number code of *Abimayu* fortress; and built another fort using number pattern. The results showed *Barathayudha* war stories and Uno Stacko can stimulate students to understand their knowledge of pattern number concept which is the stages in the learning trajectory of student have an essential role in understanding the concept.

Keywords

Learning Trajectory, Number Pattern, Barathayudha War Stories, Uno Stacko, Design Research

Author Guidelines
Editorial Team
Focus and Scope
Publication Ethics
Open Access Policy
Peer Review Process
Online Submissions
Contact Us

Journal on Mathematics Education
Q2 Education
best quartile
SJR 2019
0.53
powered by scimagojr.com
3.1 2019 CiteScore

Artikel terbit di Journal on Mathematics Education Vol. 11 No. 1, 157-166
[DOI: https://doi.org/10.22342/jme.11.1.10225.157-166]

ISSN 2087-8885
E-ISSN 2407-0610

Journal on Mathematics Education
Volume 11, No. 1, January 2020, pp. 157-166

THE LEARNING TRAJECTORY OF NUMBER PATTERN LEARNING USING *BARATHAYUDHA* WAR STORIES AND UNO STACKO

Irma Risdiyanti, Rully Charitas Indra Prahmana

Universitas Ahmad Dahlan, Yogyakarta, Indonesia
Email: rully.indra@mpmat.uad.ac.id

Abstract

In recent years, several researchers have tried to use stories and games as a starting point for learning mathematics. This is allegedly able to increase students' mathematical abilities and make learning mathematics more enjoyable. Therefore, this research is aimed to design a mathematics learning trajectory in pattern number using *Barathayudha* War Stories and Uno Stacko games as a starting point or context in the learning process with the Indonesian Realistic Mathematics Education (IRME) approach. The research method used is a design research that contains three stages, preliminary design, teaching experiment, and retrospective analysis. The result of this research is the learning trajectory design of number pattern learning using *Barathayudha* war stories and Uno Stacko. The design consists of four activities, which is a detective of *Barathayudha* war; rebuilt *Abimayu* fortress at the battlefield of *Kurusetra*; find the unique secret number code of *Abimayu* fortress; and built another fort using number pattern. The results showed *Barathayudha* war stories and Uno Stacko can stimulate students to understand their knowledge of pattern number concept which is the stages in the learning trajectory of student have an essential role in understanding the concept.

Keywords: Learning Trajectory, Number Pattern, *Barathayudha* War Stories, Uno Stacko, Design Research

Abstrak

Dalam beberapa tahun terakhir, sejumlah peneliti mencoba untuk menggunakan cerita dan permainan sebagai titik awal pembelajaran matematika. Hal ini disinyalir dapat menumbuhkan kemampuan matematis siswa dan membuat pembelajaran matematika menjadi lebih menyenangkan. Oleh karena itu, penelitian ini bertujuan untuk mendesain lintasan belajar matematika pada materi pola bilangan menggunakan cerita peperangan *Barathayudha* dan permainan Uno Stacko sebagai titik awal atau konteks dalam proses pembelajaran menggunakan pendekatan Pendidikan Matematika Realistik Indonesia (PMRI). Metode yang digunakan dalam penelitian ini adalah penelitian desain yang terdiri dari 3 tahapan, yaitu desain pendahuluan, percobaan pengajaran, dan analisis retrospektif. Hasil dari penelitian ini merupakan desain lintasan belajar pada pembelajaran pola bilangan menggunakan cerita peperangan *Barathayudha* dan permainan Uno Stacko. Desain ini terdiri dari 4 aktivitas, yaitu seorang detektif dari perang *Barathayudha*, membangun kembali benteng *Abimayu* di medan perang Kurusetra; menemukan kode nomor rahasia unik dari benteng *Abimayu*; membangun benteng lain menggunakan pola angka. Hasil penelitian menunjukkan bahwa kisah peperangan *Barathayudha* dan Uno Stacko dapat merangsang siswa untuk menumbuhkan pemahaman siswa tentang konsep pola bilangan, yang mana seluruh tahapan dalam lintasan belajar yang dilalui siswa memiliki peran penting dalam penanaman konsep tersebut.

Kata kunci: lintasan belajar, pola bilangan, Cerita Peperangan *Barathayudha*, Uno Stacko, Penelitian Desain

How to Cite: Risdiyanti, I., & Prahmana, R.C.I. (2020). The learning trajectory of number pattern learning using *Barathayudha* war stories and Uno Stacko. *Journal on Mathematics Education, 11*(1), 157-166. http://doi.org/10.22342/jme.11.1.10225.157-166.

The development and application of the mathematics concept daily problems are part of a learning process (Tanujaya, Prahmana, & Mumu, 2017). Freudhental (1991) explained that mathematics is a human activity and must be related to daily life. However, in reality, the mathematics in schools tend to be taught using practical formulas and most often, not seamlessly associated with everyday life and culture, as should be experienced by the students (Stacey, 2011; Arisetyawan, Suryadi, Herman, & Rahmat, 2014; Nurhasanah, Kusumah, & Sabandar, 2017). The society, including the teachers, generally does not regard mathematics to be related to culture, and the learning of mathematics in the

classroom can also be regarded with almost having no relation to culture. In fact, culture is part of a student's life that may guide the way a student learns and regard mathematics (Stacey, 2011; Revina, 2018; Revina & Leung, 2019). It may significantly influence the student's ability to solve mathematics projects that relate to daily life. The results of the Programme for International Student Assessment (PISA) for Indonesia showed that the students' abilities to solve and interpret problems in various situations are still considered at a level, which is low (Kamaliyah, Zulkardi, & Darmawijoyo, 2013).

Subsequently, Irawan and Kencanawaty (2017) and Sembiring, Hoogland, and Dolk (2010) suggested that appropriate strategies and learning methods are needed to develop students' thinking ability that orientate towards technical skills and the reformation of mathematics education based on problem-solving in the daily life. The learning method suggested is the *Pendidikan Matematika Realistik Indonesia* (PMRI), which is an adaptation of the Realistic Mathematics Education (RME). The PMRI is aligned with the Indonesian culture, geography and the ability of Indonesian society in general (Soedjadi, 2007; Sembiring, Hadi, & Dolk, 2008; Prahmana, Zulkardi, & Hartono, 2012, Arsaythamby & Zubainur, 2014).

Furthermore, Wahyudi, Zulkardi, and Darmawijoyo (2016) and Subijanto (2015) explained that one of the contexts that can be used in PMRI is a culture that is applied to realistic mathematics learning and modified according to the local context where the school is located. Consequently, it may result in engaging, contextual knowledge if it is to be taught in schools as it may increase the students' ability to solve a problem that has a relation to their daily life. Also, the cultural context can be a solution to the lost aesthetic value and character of a student due to the influence of modernization (Prahmana, 2017; Grigoryan, Lebedeva, & Breugelmans, 2018; Uge, Neolaka, & Yasin, 2019). Other researchers also use cultural contexts such as folklore as a starting point for learning mathematics, including the use of *Legend Putri Dayang Merindu* story as folklore in understanding Least Common Multiple (Triyani, Putri, & Darmawijoyo, 2012) and the legend of *Kemaro* Island story for supporting students in learning average (Lestariningsih, Putri, & Darmawijoyo, 2012). These results show that the cultural context can support students to develop their mathematics knowledge.

On the other hands, professional teachers, as the product of reform in education, must have higher education qualifications and be able to innovate in teaching and learning (Prahmana, Zulkardi, & Hartono, 2012; Risdiyanti & Prahmana, 2018). So, every prospective teacher should be prepared to become a professional teacher to equip himself through higher education and knowledge of the learning and teaching process.

In Yogyakarta, there is a study club called the Yogyakarta Mathematics Study Club (YMSC) consisting of several mathematics education graduates who are engaged in innovating mathematics learning as a way to improve the qualifications and innovative learning abilities for graduates of mathematics education in Yogyakarta. In this research, some of YMSC members act as research subjects (students) who are given treatment in the form of mathematics learning activities using cultural context and games, namely *Barathayudha* war stories and Uno Stacko game.

The culture context product should be fun and contained concepts of mathematics for learning purposes and aspects of moral values (Radovic, Black, Williams, & Salas, 2018; Risdiyanti, Prahmana, & Shahrill, 2019). The design learning activities of the number pattern using *Barathayudha* war stories and Uno Stacko game are expected to be innovative in terms of learning mathematics so that the concept will be easy for students to understand thus enabling them to solve any daily-related problems. This context was chosen mainly because of its familiarity with the participants from the perspectives of culture as well as their daily life. Furthermore, this design is expected to cultivate and develop the cultural values that may influence a student's character.

METHOD

This research uses design research as a research method. Design research was chosen in this research because this method is a systematic and flexible method to improve the quality of learning in the classroom by collaborating between researchers and teachers to develop a learning design (Gravemeijer, 1994). The development of learning design is carried out in three phases, which are preliminary design, design experiment, and analysis retrospective (Bakker, 2004; Gravemeijer & Cobb, 2006; Simonson, 2006; Prahmana, 2017).

The preliminary design aims to design the Hypothetical Learning Trajectory (HLT), which is then refined in the design experiment stage (Prahmana, 2017). The activities carried out in this stage are collaborating with the teacher to conduct a literature review of the concept of number patterns, realistic mathematics education, and contexts that can be used in learning number patterns namely *Barathayudha* war stories and Uno Stacko game. Also, researchers analyzed the concept of number patterns in the mathematics education curriculum in Indonesia. Furthermore, the results of the literature study and curriculum analysis were used as a basis for designing learning trajectories and developing conjectures to become HLT. In this case, theory aims as guidelines that will improve in each learning activity, so it is flexible and can be revised during the experimental design stage.

In the design experiment stage, the learning trajectory that has been designed at the preliminary design stage is then implemented in the learning process (Prahmana, 2017). The purpose of this implementation is to explore and observe the strategies and thoughts of students. There are two cycles in this stage; the first cycle is a pilot experiment that aims to evaluate and improve the learning trajectory that has been designed. The second cycle is a teaching experiment that seeks to implement a learning trajectory that is evaluated and revised in the pilot experiment of the design experiment stage. The implementation of number pattern learning activity using *Barathayudha* war stories and Uno Stacko game consists of four activities.

The last stage is retrospective analysis. All data collected in the design experiment stage are analyzed by comparing conjecture and HLT with the results of the application of the learning trajectory that has been carried out in the design experiment stage (Gravemeijer & Cobb, 2006). From the results of the analysis will obtain a learning trajectory description of number pattern learning using

Barathayudha war stories and Uno Stacko game.

RESULTS AND DISCUSSION

The results of this study obtained a trajectory description of the number pattern learning using the *Barathayudha* war story and Uno Stacko. The learning activities consist of four activities. The first activity is to be a detective of *Barathayudha* war. Activity two is to rebuild *Abimayu* Fortress at Battlefield of *Kurusetra*. Furthermore, the third activity is to find the unique secret number code of *Abimayu* fortress. Lastly, the fourth activity is to build another fortress using the number pattern. Students can understand the concept of number patterns using the *Barathayudha* war story and Uno Stacko. It viewed from the results of the final evaluation and the positive responses of students.

Regarding this learning can be seen from the comments, students feel more comfortable understanding the number pattern using this context. The results of this study indicated that the learning design of number patterns using *Barathayudha* War Story and Uno Stacko has very important to be the starting point and can increase student motivation in the learning process. In detail, the researchers discusses the results of this study as follows.

Activity 1: Be a detective of Barathayudha War

The learning activities begin with the teacher describing the *Barathayudha* war, which is a civil war between *Kurawa* and *Pandhawa* in *Pewayangan* Stories. The student will be told the original story, for, in the end, it will be slightly modified to fit the material to be learned. *Barathayudha*'s story was chosen as the starting point because this learning was carried out in Java, which was very thick with the *Pewayangan* stories culture. So, it would create a new stigma for students who had felt that actually, mathematics was far from their lives to think that mathematics existed and became part of their culture.

In this activity, it told that at once upon a time. There was a civil war between *Kurawa* and *Pandhawa*. In the *Pewayangan* story, *Kurawa* and *Pandhawa* have the same father named *Prabu Pandhu,* but from different mother. Before dying, *Prabu Pandhu* handed over the authority of the state to purify *Pandhawa,* because he was considered capable of managing and leading wisely. *Kurawa* did not accept his father's decision and always tried to seize the power of *Pandhawa* (Susetya, 2007). Finally, one day, a civil war took place on a battlefield, namely *Kurusetra*. The Hindus believe that *Kurusetra* existed on this earth precisely in India, but no one had succeeded in proving the truth.

At the time of the war, *Abimayu,* one of the members of *Pandhawa* made a triangular fortress of rock arranged in a unique arrangement of numbers, consisting of the results of repetitive number operations. According to archeologists, there are several ways to prove whether the war really happened and took place in *Kurusetra,* India are by breaking the secret code used *Abimayu* to compile the fort (Susetya, 2007; Suparjo, 2011; Priyatni, 2016). Based on historical records, it is known that the fortress was composed of 30 pieces of stone, consisting of 8 levels, the most basic of which had eight bricks,

and the top is one brick (Hatley, 2005; Susetya, 2007). Until now, no one has been able to crack the secret code.

After the story is complete, the teacher provokes the students' interest in breaking the secret code. The teacher invites students to be a detective looking for truth. They seem to be in *Kurusetra*, India and found the ruins of the fort there, but did not know whether the debris was a fortress built by *Abimayu* as in the *Pewayangan* story. Therefore, students formed a group of 4 to 5 people who acted as a detective team. The team did research by collecting debris that was suspected of being *Abimayu*'s fortress and then rebuilt and solved its secret code. In this study, the fortress debris is illustrated using Uno Stacko sticks. As a result, at this stage, the students were enthusiastic about listening to the *Pewayangan* story and were interested in deciphering the secret code of *Abimayu* fortress which was actually a pattern number.

Activity 2: Rebuilt Abimayu fortress at battlefield of Kurusetra

In this activity students who have collected fortress debris that is suspected to be the fortress of *Abimayu*, then they try to compile the fort with the arrangement as recorded in history that the *Abimayu* fortress is triangular in shape, arranged uniquely, consisting of the results of repetitive number operations, organized of 30 pieces of stone that from 8 levels, the bottom is composed of 8 pieces of stone. The top is arranged for one stone. At this stage, students need creativity and critical thinking because students must expect a form of the fort that they have never seen, and they rebuild that fort only based on the clues given. As a result, students managed to make a fortress with an arrangement that formed a triangle with eight levels and the provision of each level, creating a number pattern. The students' activities of rebuilt the *Abimayu*'s fortress can be seen in Figure 1.

Figure 1. Students rebuilt *Abimayu* fortrees at battlefield *Kurusetra*

Activity 3: Find the unique secret number code of Abimayu fortress

In the third activity, students are given a student worksheet, which will serve to help students find the secret code of the *Abimayu* fortress arrangement. The student worksheet consists of columns that will be filled with the number of stones arranged in each level. Then students look for the relationship

of the number operation of the number of rocks arranged on each level. It is done to test whether the structure that students make has been the same as the one recorded in history, and to prove the truth of the ruins of the fortress in *Kurusetra*, India is the landscape of *Abimayu* in the puppet story. At this stage, students then look for formulas from the number pattern that has been found. The activity in the third stage is essential to do as a bridge to understanding the concept of number patterns from the formal level to the informal level.

Figure 2. Students find the unique secret number code of *Abimayu* fortress

Activity 4: Built another fortress using number pattern

In this fourth activity, students make a fortress with a pattern according to the number pattern they want as this stage, students' understanding has been on understanding the informal level. Students have understood the concept of number patterns and can make these patterns without using the help of Uno Stacko sticks and can visualize the number pattern in the form of a fort made using Uno stick.

Figure 3. Students built another fortress using number pattern

All activities could change the stigma of students and society that mathematics that is felt far from daily life exists and becomes part of the culture of the community. This study was able to take on the role of developing the learning trajectory of number pattern learning using *Barathayudha* war stories and Uno Staco as the local context of education. In addition, a few of researchers have documented the results of their research related to the implementation of daily activities of students in the learning process of mathematics, such as using *Tepuk Bergambar* Indonesian traditional game in learning number operations (Prahmana, Zulkardi, & Hartono, 2012), playing one house in learning number operations (Nasrullah & Zulkardi, 2011), *Patok Lele* stakes in learning measurements (Wijaya, 2008), *Kubuk Manuk* Indonesian traditional game as stimulated starting point to understand the knowledge of the social arithmetic concept (Risdayanti, Prahmana, & Shahrill, 2019), and *Gasing* game in measuring time learning (Jaelani, Putri, & Hartono, 2013), and several mathematical activities in estimating, measuring, and making patterns using Sundanese culture (Muhtadi, Sukirwan, Warsito, & Prahmana, 2017). Therefore this study takes a role to add to the study of contexts that can be used as a starting point for learning mathematics.

CONCLUSION

The learning trajectory can be practiced using local contexts such as culture or other things easily found in the daily activities of the students. The students were able to understand the concept of number pattern more easily since it is fun for them and importantly after doing all learning activities. Lastly, the game is also relatable to activities in their daily life.

ACKNOWLEDGMENTS

The researchers would like to thank Universitas Ahmad Dahlan for providing facilities and opportunities to develop this research to completion. Furthermore, we also thank members of Yogyakarta Mathematics Study Club (YMSC) for their participation in this research. Lastly, the authors thank all the 7th SEA-DR International Conference committee for choosing this article to be the best paper at the conference and recommending this manuscript to Prof. Dr. Zulkardi, as the chief editor of Journals on Mathematics Education (JME) and also thanks to the chief editor of JME who have willing to review again, consider the recommendations of the 7th SEA-DR committee, and accept this submission, so that this paper is suitable for publication in JME.

REFERENCES

Arisetyawan, A., Suryadi, D., Herman, T., & Rahmat, C. (2014). Study of Ethnomathematics: A lesson from the Baduy Culture. *International Journal of Education and Research, 2*(10), 681-688.

Arsaythamby, V., & Zubainur, C. M. (2014). How a realistic mathematics educational approach affect students' activities in primary schools?. *Procedia-Social and Behavioral Sciences, 159*, 309-313. https://doi.org/10.1016/j.sbspro.2014.12.378.

Bakker, A. (2004). Design research in statistics education-On symbolizing and computer tools. *Unpublished Ph.D. Thesis*. Utrecht: The Freudenthal Institute.

Freudenthal, H. (1991). *Revisiting Mathematics Education: China Lectures*. Dordrecht: Kluwer Academic Publishers.

Gravemeijer, K. (1994). Educational development and developmental research in mathematics education. *Journal for Research in Mathematics Education, 25*(5), 443-471. https://doi.org/10.2307/749485.

Gravemeijer, K., & Cobb, P. (2006). Design research from a learning design perspective. In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.), *Educational Design Research* (pp. 17-51). London: Routledge.

Grigoryan, L. K., Lebedeva, N., & Breugelmans, S. M. (2018). A cross-cultural study of the mediating role of implicit theories of innovativeness in the relationship between values and attitudes toward innovation. *Journal of cross-cultural psychology, 49*(2), 336-352. https://doi.org/10.1177/0022022116656399.

Hatley, B. (2005). Theater, politics, and Javanese "Tradition": Yogyakarta's Sultan onstage. In H. Antlőv and J. Hellman (Eds.), *The Java that Never Was: Academic Theories and Political Practices* (pp. 67-96). Műnster: Die Deutsche Bibliothek.

Irawan, A., & Kencanawaty, G. (2017). Implementation of Realistic Mathematics-based Etnomathematics Learning [in Bahasa]. *Journal of Medives, 1*(2), 74-81.

Jaelani, A., Putri, R. I. I., & Hartono, Y. (2013). Students' strategies of measuring time using traditional gasing game in third grade of primary school. *Journal on Mathematics Education, 4*(1), 29-40. https://doi.org/10.22342/jme.4.1.560.29-40.

Kamaliyah, Zulkardi, & Darmawijoyo. (2013). Developing the sixth level of PISA-like mathematics problems for secondary school students. *Journal on Mathematics Education, 4*(1), 9-28. https://doi.org/10.22342/jme.4.1.559.9-28.

Lestariningsih, Putri, R. I. I., & Darmawijoyo. (2012). The legend of Kemaro Island for supporting students in learning average. *Journal on Mathematics Education, 3*(2), 165-174. https://doi.org/10.22342/jme.3.2.1932.165-174.

Muhtadi, D., Sukirwan, Warsito, & Prahmana, R.C.I. (2017). Sundanese ethnomathematics: mathematical activities in estimating, measuring, and making patterns. *Journal on Mathematics Education, 8*(2), 185-198. https://doi.org/10.22342/jme.8.2.4055.185-198.

Nasrullah & Zulkardi. (2011). Building Counting by Traditional Game a Mathematics Program for Young Children. *Journal on Mathematics Education 2*(1), 41-54. https://doi.org/10.22342/jme.2.1.781.41-54.

Nurhasanah, F., Kusumah, Y. S., & Sabandar, J. (2017). Concept of triangle: Examples of mathematical abstraction in two different contexts. *International Journal on Emerging Mathematics Education, 1*(1), 53-70. http://dx.doi.org/10.12928/ijeme.v1i1.5782.

Prahmana, R. C. I. (2017). *Design Research (Theory and its implementation: An Introduction)* [in Bahasa]. Jakarta: Rajawali Pers.

Prahmana, R. C. I., Zulkardi, & Hartono, Y. (2012). Learning multiplication using Indonesian traditional game in third grade. *Journal on Mathematics Education, 3*(2), 115-132. https://doi.org/10.22342/jme.3.2.1931.115-132.

Priyatni, E. T. (2016). Contradictory transformation of Amba novel: Critical response with intertextuality approach. *Journal of Nusantara Studies, 1*(1), 46-59. https://doi.org/10.24200/jonus.vol1iss1pp46-59.

Radovic, D., Black, L., Williams, J., & Salas, C. E. (2018). Towards conceptual coherence in the research on mathematics learner identity: a systematic review of the literature. *Educational Studies in Mathematics, 99*(1), 21-42. https://doi.org/10.1007/s10649-018-9819-2.

Revina, S. (2018). Influence of culture on the adaptation of realistic mathematics education in Indonesia. *Unpublished Ph.D. Thesis*. Hongkong: The University of Hong Kong.

Revina, S., & Leung, F. K. S. (2019). How the same flowers grow in different Soils? The implementation of realistic mathematics education in Utrecht and Jakarta classrooms. *International Journal of Science and Mathematics Education*, *17*(3), 565-589. https://doi.org/10.1007/s10763-018-9883-1.

Risdiyanti, I., & Prahmana, R. C. I. (2018). Etnomathematics: Exploration of Javaness traditional games. *Journal of Medives, 2*(1), 1-11.

Risdiyanti, I., Prahmana, R. C. I., & Shahrill, M. (2019). The learning trajectory of social arithmetic using an Indonesian traditional game. *Elementary Education Online*, *18*(4), 2094-2108. https://doi.org/10.17051/ilkonline.2019.639439.

Sembiring, R. K., Hadi, S., & Dolk, M. (2008). Reforming mathematics learning in Indonesian classrooms through RME. *ZDM-Journal on Mathematics Education, 40*(6), 927-939. https://doi.org/10.1007/s11858-008-0125-9.

Sembiring, R. K., Hoogland, K., & Dolk, M. (2010). A Decade of PMRI in Indonesia. Utrecht: APS International.

Simonson. (2006). Design-based research: Applications for distance education. *Quarterly Review of Distance Education, 7*(1), vii-viii.

Soedjadi, R. (2007). Dasar-dasar pendidikan matematika realistik Indonesia. *Jurnal Pendidikan Matematika, 1*(2), 1-10. https://doi.org/10.22342/jpm.1.2.807.

Stacey, K. (2011). The PISA view of mathematical literacy in Indonesia. *Journal on Mathematics Education, 2*(2), 95-126. https://doi.org/10.22342/jme.2.2.746.95-126.

Subijanto. (2015). The policy of local excellence-based education programs in state senior high school 2 Pekalongan [in Bahasa]. *Jurnal Pendidikan dan Kebudayaan, 21*(2),115-134.

Suparjo. (2011). On land (wealth) distribution: A cultural approach to justice in Indonesia. *Indonesia Law Review, 1*(3), 334-347. http://dx.doi.org/10.15742/ilrev.v1n3.60.

Susetya, W. (2007). *Bharatayuda: Teaching, symbols, philosophies and their meanings for daily life [in Bahasa]*. Yogyakarta: Kreasi Wacana.

Tanujaya, B., Prahmana, R. C. I, & Mumu, J. (2017). Mathematics instruction, problems, challenges, and opportunities: A case study in Manokwari Regency, Indonesia. *World Transactions on Engineering and Technology Education, 15*(3), 287-291.

Triyani, S., Putri, R. I. I., & Darmawijoyo. (2012). Supporting student's ability in understanding least common multiple (LCM) concept using storytelling. *Journal on Mathematics Education, 3*(2), 151-164. https://doi.org/10.22342/jme.3.2.572.151-164.

Uge, S., Neolaka, A., & Yasin, M. (2019). Development of social studies learning model based on local wisdom in improving students' knowledge and social attitude. *International Journal of Instruction, 12*(3), 375-388. . https://doi.org/10.29333/iji.2019.12323a.

Wahyudi, T., Zulkardi, & Darmawijoyo. (2016). Developing of TIMSS type reasoning questions using the Lampung cultural context [in Bahasa]. *Jurnal Didaktik Matematika, 3*(1), 1-14. https://doi.org/10.24815/jdm.v3i1.4300.

Wijaya, A. (2008). Design research in mathematics education: Indonesian traditional games as means to support second graders' learning of linear measurement. *Thesis*. Utrecht: Utrecht University.

Document details

Journal on Mathematics Education Open Access
Volume 11, Issue 1, 2020, Pages 157-166

The learning trajectory of number pattern learning using barathayudha war stories and uno stacko (Article) (Open Access)

Risdiyanti, I., Indra Prahmana, R.C.
View additional authors Save all to author list

Universitas Ahmad Dahlan, Yogyakarta, Indonesia
View additional affiliations

Abstract

In recent years, several researchers have tried to use stories and games as a starting point for learning mathematics. This is allegedly able to increase students' mathematical abilities and make learning mathematics more enjoyable. Therefore, this research is aimed to design a mathematics learning trajectory in pattern number using Barathayudha War Stories and Uno Stacko games as a starting point or context in the learning process with the Indonesian Realistic Mathematics Education (IRME) approach. The research method used is a design research that contains three stages, preliminary design, teaching experiment, and retrospective analysis. The result of this research is the learning trajectory design of number pattern learning using Barathayudha war stories and Uno Stacko. The design consists of four activities, which is a detective of Barathayudha war; rebuilt Abimayu fortress at the battlefield of Kurusetra; find the unique secret number code of Abimayu fortress; and built another fort using number pattern. The results showed Barathayudha war stories and Uno Stacko can stimulate students to understand their knowledge of pattern number concept which is the stages in the learning trajectory of student have an essential role in understanding the concept.

Author keywords

Barathayudha War Stories | Design Research | Learning Trajectory | Number Pattern | Uno Stacko

ISSN: 20878885
Source Type: Journal
Original language: English
DOI: 10.22342/jme.11.1.10225.157-166
Document Type: Article
Publisher: Sriwijaya University

References (36)

View in search results format >

All Export Print E-mail Save to PDF Create bibliography

1 Arisetyawan, A., Suryadi, D., Herman, T., Rahmat, C.
Study of ethnomathematics: A lesson from the Baduy Culture
(2014) *International Journal of Education and Research*, 2 (10), pp. 681-688. Cited 24 times.

2 Arsaythamby, V., Zubainur, C.M.
How a realistic mathematics educational approach affect students' activities in primary schools?
(2014) *Procedia-Social and Behavioral Sciences*, 159, pp. 309-313. Cited 31 times.
https://doi.org/10.1016/j.sbspro.2014.12.378

3 Bakker, A.
(2004) *Design Research in Statistics Education-On Symbolizing and Computer Tools*. Cited 120 times.
Unpublished Ph.D. Thesis. Utrecht: The Freudenthal Institute

4 Freudenthal, H.
(1991) *Revisiting Mathematics Education: China Lectures*. Cited 543 times.
Dordrecht: Kluwer Academic Publishers

5 Gravemeijer, K.
Educational development and developmental research in mathematics education
(1994) *Journal for Research in Mathematics Education*, 25 (5), pp. 443-471. Cited 123 times.
https://doi.org/10.2307/749485

6 Gravemeijer, K., Cobb, P.
Design research from a learning design perspective
(2006) *Educational Design Research*, pp. 17-51. Cited 235 times.
J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen Eds, London: Routledge

Metrics

View all metrics >

4 Citations in Scopus

Field-Weighted Citation Impact

Cited by 4 documents

A learning trajectory for probability: A case of game-based learning
Wijaya, A. , Elmaini , Doorman, M.
(2021) Journal on Mathematics Education

Ethnomathematics: Pranatamangsa system and the birth-death ceremonial in yogyakarta
Prahmana, R.C.I. , Yunianto, W. , Rosa, M.
(2021) Journal on Mathematics Education

Prospective primary school teachers' activities when dealing with mathematics modelling tasks
Viseu, F. , Martins, P.M. , Leite, L.
(2020) Journal on Mathematics Education

View all 4 citing documents

Inform me when this document is cited in Scopus:

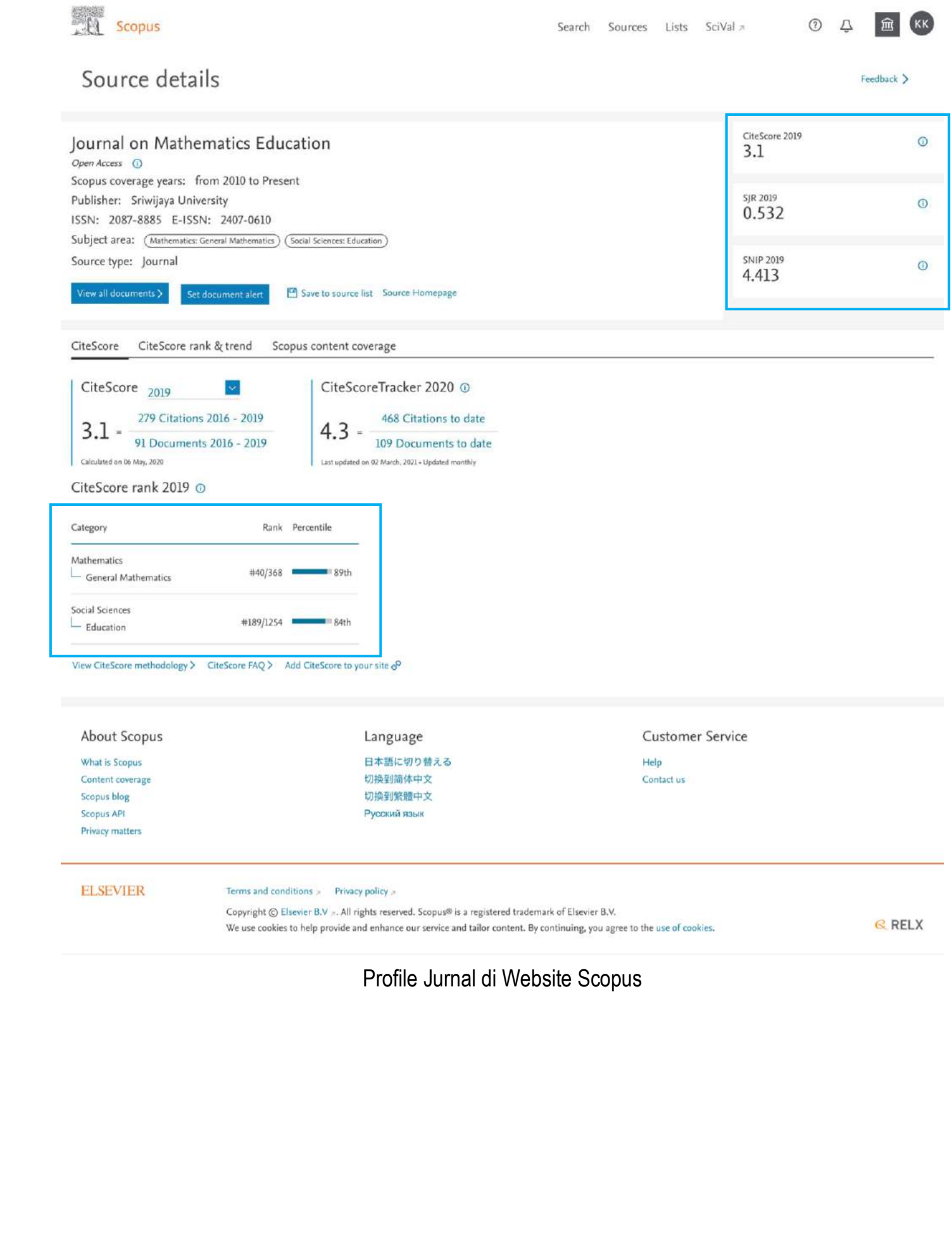
Set citation alert >

Related documents

Find more related documents in Scopus based on:

Authors > Keywords >

Profile Artikel di Database Scopus



Profile Jurnal di Website Scopus