



ISSN 0852-601X
e-ISSN 2549-838X

Available online at
<http://www.pancaranpendidikan.or.id>

*Pancaran Pendidikan FKIP
Universitas Jember
Vol. 07, Issue, 2, pp, 57-66, May, 2018*

Pancaran Pendidikan

DOI:
[10.25037/pancaran.v7i1.179](https://doi.org/10.25037/pancaran.v7i1.179)

The Need of Bringing Discovery Learning Models Based Traditional Games in Mathematics of Teaching Materials

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ARTICLE INFO

Article History:

Received 1 Maret 2018

Received in revised form 10 April 2018

Accepted 17 April 2018

Published online 1 May 2018

Key Words:

Discovery Learning, Traditional Games, Primary School Students

ABSTRACT

Mathematics has not been a finished product given to students, but it is the process constructed by students. Selecting the mathematic teaching material effectively by means of combining traditional game, will help students understand the mathematic content their teachers teach. The objectives of research were: (1) to package traditional game in mathematic learning content significantly, (2) to include Javanese cultural traditional game into mathematic teaching discovery learning model. This study was a qualitative descriptive research based on interview, observation and document analysis. The result of research shows that discovery of learning model and traditional game that can be considered as the innovation source in mathematic teaching material development for elementary school students. The topic of mathematics with unique traditional game for the development of discovery learning model for mathematic teaching material is important to develop as an effective learning source for elementary school students.

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INTRODUCTION

Teaching material is considered as the material to be utilized by teachers and students, as an attempt of improving the learning quality in Belawati (2013, p.14). Teaching material developed should be teaching material that can be constructed inside students and is related to the students' real life context.

This statement is confirmed with the result of observation and in-depth interview conducted in some Public Elementary School in Surakarta City. From the result of interview and in-depth interview, it can be found that: (1) teaching material used elaborates a concept directly, (2) teaching material used has not been able to construct knowledge inside students so that the students have not been able to retrieve general concept or form through the teaching material, (3) game or even traditional game has not been integrated into mathematic teaching material.

One teaching strategy the teacher can use to deal with the students' learning saturation is to apply "learning while playing" concept in Sani (2013, p. 67). Garris et al (2002, p.441-467) suggests that there is a relationship between game, learning, and motivation in learning.

Ibrahim and Suparni (2012, p.79) states that according to Piaget's cognitive theory, elementary school students – aged 7-13 years – are positioned in the concrete operational stage. Considering this stage, the mathematics learning in elementary school should start with something concrete and real that can be close to students' life, knowledge and experience. Moreover, Freudenthal explains that mathematics is human activity that should connect reality in daily life. Freudenthal argues that mathematics is not a finished product given to students, but it is the process constructed by students.

The knowledge of construction can be closer when it derives from real experience, close to students, related to reality, and imaginable. So, the study model consistent with this philosophy is discovery learning connected to surrounding environment, such as society culture including custom, language, traditional game and food, and decorum. Sujarno et al (2013, p.2) states that traditional game is the one sent down hereditarily from one generation to the next. In line with this, Akbari et al also states that traditional games have humanity and cultural values, belief translate by these from one lineage to other (2009, p. 124). This discovery learning-based materials using this traditional game are new and yet to be applied in most schools.

The use of traditional games in teaching materials based on discovery learning is a researchers' breakthrough to prevent the traditional games from extinction. The traditional game in discovery learning based materials is in accordance with government efforts to preserve local culture. Given the importance of the role of books in learning, it is necessary to develop researches on teaching materials in the form of books that are currently still very limited.

METHODS

The study was conducted at State Elementary School in Surakarta in second grade of even semester. The respondents were teachers and second grade elementary school students. This research used qualitative descriptive design. The design was chosen because the design of this study describes what is happens on the field. The development of research model is done through flow stages as (Miles and Huberman 1984) model as follows:

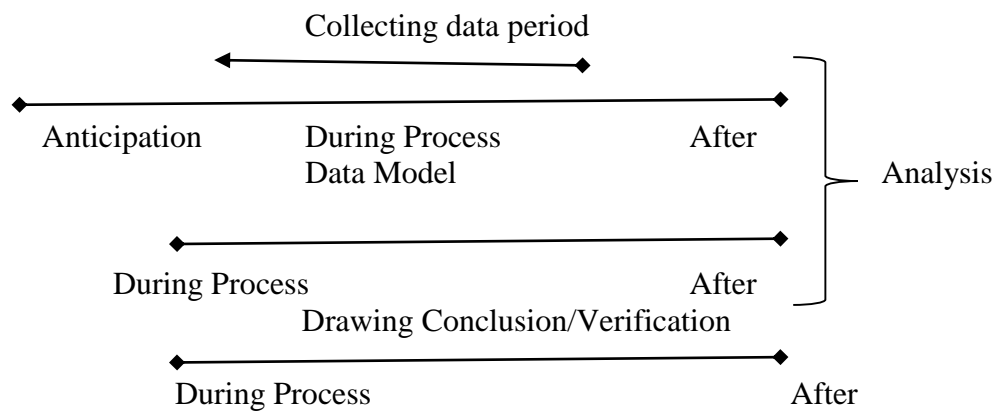


Figure 1 : The development of research model

Methods of data collection in this study include (1), questionnaire and (2) interview method. Questionnaire selected to obtain data about the suitability of teaching materials with learning tools. Questionnaire also used to know the responses of students and teachers on the use of learning materials based on discovery learning. While the interview method were used to get in depth information. To analyze the data in this study used descriptive-qualitative analysis technique.

RESULTS AND DISCUSSION

The result of research using old mathematic teaching material are as follows: (1) the material contained in this teaching material is consistent with basic competency; (2) students book (old teaching material) has not been consistent with teachers' age and cannot motivate the students; (3) there are some material not integrated into games; (4) traditional games that can used to construct the students' knowledge should be constructed. The result of research on the need for additional teaching material consists of: (1) more complete teaching material consistent with the characteristics of elementary school students; (2) instructional material that can motivate students; (3) teaching material that feature authentic example, and (4) teaching material that construct students' knowledge. The integration of traditional games into teaching material is a form of reformation in mathematic teaching material development. The need for an integration of traditional games into old teaching material development. Teaching material can be represented as follows: (1) traditional game is a means of constructing students' knowledge, of connecting basic competencies, (2) including discovery learning model into all materials, (3) integrating traditional games into discovery learning process, (4) exemplifying local cultural values of CentralJava in traditional games for mathematic learning, and (5) providing authentic photograph of traditional games (see figure 1) and its application in discovery learning-based mathematic subject.

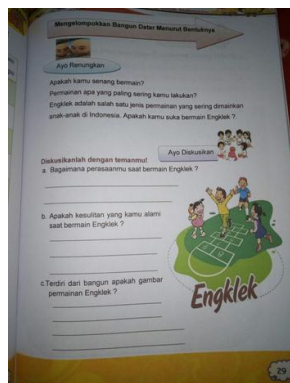


Figure 2. The example of Discovery Learning with Traditional Games integrated in Mathematic.

Considering the result of observation and document analysis relevant to this research, the author found some traditional games in Central Java, particularly in Surakarta City. Those traditional games can be the source of mathematic learning development in elementary school. Traditional games can be seen in the table below:

Table 1. Traditional Games

No	Traditional games	Description and relation to mathematic learning
1.	<i>Engklek</i>	This game is played by firstly drawing 8 squares and a half of circle on the top on land or road. Then put number on each of boxes, with number 9 being put on the half of circle and number 10 on the part of half of circle. In relation to mathematic teaching material, this game introduces flat structure to be learnt by the 2 nd graders of elementary school.
2.	<i>Kite</i>	A framed thin material sheet flown in the air and connected to the land or controller with rope or thread. Kite utilizes wind blowing power as its lifter. It is known widely throughout world as game tool. Kite is known having ritual function as well, hooking or entrapping aid, scientific research aid, and alternative energy media. In relation to mathematic learning, kite constructs children's knowledge on flat structure.
3.	Sodo Lempung (palm leaf rib and clay)	Sodo Lempung (palm leaf rib and clay) is usually played at home, by preparing a variety of imitated animals, human beings and plants. In relation to mathematic learning, this game is used to

	determine sides and angle point in flat structure.
4. Snake and ladder	<p>Board game for children played by 2 or more children. The game board is divided into small squares on some of which a number of “ladders” or “snakes” are drawn connecting them to other square. This game was created in 1870.</p> <p>There is no standardized game board in snake and ladder – everyone can create their own board with varying number of squares, snakes and ladder. In relation to Mathematic learning, this game can modify the board with a variety of flat structure drawings.</p>

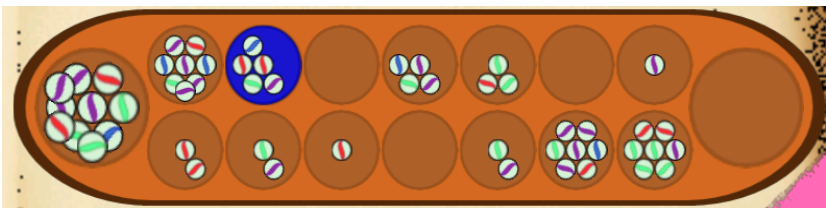


Figure 3. The example of traditional game Dakon.



Figure 4. The example of traditional game Snake and ladder in mathematic learning.

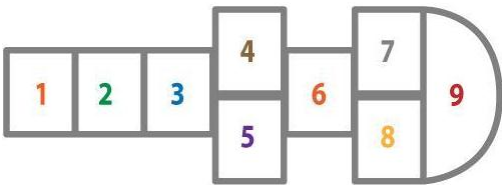


Figure 5. The example of traditional game Engklek.

The use of traditional games in teaching materials based on discovery learning is a researchers’ breakthrough to prevent the traditional games from extinction. The traditional game in discovery learning based materials is in accordance with government efforts to preserve local culture. Given the importance of the role of books in learning, it is necessary to develop researches on teaching materials in the form of books that are currently still very limited.

Based on the results of interviews that have been conducted in some public elementary schools in Surakarta there has been no programmed and continuous evaluation in mathematics learning materials. The evaluation and improvement that has been done is from the teachers’ awareness.

Table 2. Procedure of Discovery Learning in Sutman et al, (2008, p.77)

Stage	Teacher Behavior	Students Behavior
Stage I Stimulation	Teacher informs learning objectives, describing important logistic needs and motivating students to be involved in problem solving they choose themselves	Students pay attention to teacher
Stage II Problem Identification	Teachers give problem, example in real life	Students identify problem, formulating hypothesis, and measures taken to prove the hypothesis.
Stage III Data Collection	Teachers guide students in collecting data	Students collect data to support the hypothesis made by students
Stage IV Data Processing	Teachers serve as facilitator and guide the data processing process	Students perform experiment to prove the result of data found to support the hypothesis formulated.
Stage V Authentication	Teachers facilitate students to authenticate the findings	Students authenticate the hypothesis formulated
Stage VI Conclusion	Teachers help students draw conclusion	Students conclude the findings of experiment

There are 6 points to be considered in developing learning materials: (1) preparing simple and authentic material accessible to students, (2) repeating the instructional material to confirm and to practice the teachers to do it accurately and varyingly, (2) giving positive feedback to students to stimulate their confidence and motivation (Prastowo 2015, p.170). The measures to be considered in developing teaching material are: 1) identifying need; 2) analyzing problem; 3) need factor; 4) formulating and specifying the objective; 5) choosing topic; 6) choosing writing format; 7) compiling content; 8) editing; 9) testing; 10) revising (Ranjit; 2012: 2). The development starts with preparing prototype based on teachers' and students' need for additional teaching material. The form of teaching material prototype is shown in Figure 2.

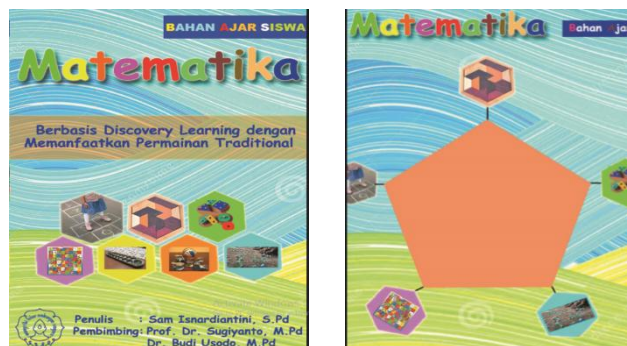


Figure 6. Picture of cover teaching discovery learning with integrated traditional games.

In including traditional game and providing discovery learning plot in mathematic textbook, the following factors should be taken into account: (1) analyzing potential factors of traditional games such as introducing the students with knowledge, life skill, ethics, and character; (2) teachers' competency in applying discovery learning considering the students' cultural background; (3) analyzing the students' background in order to support their learning style culture; and (5) integrating it into textbook as the teaching material. In the teaching material, flat structure belongs to mathematics subject framed with traditional games.

In their study entitled *Game, Motivation and Learning*, Garis R & Driskell, J.E explained that there is a relationship between the three of them, in which, Game can improve learning motivation so that the students' learning outcome improves. Playing games not only improve the students' understanding on material but also impact on the students' behavior in order to be better.

In a research conducted by Michael A. DeDonno entitled *The Influence of IQ on Pure Discovery and Guided Discovery Learning of a complex real world task*, it is explained that pure discovery learning is the learning action without instruction. Poker hold'em game is a complex task resembling the real world action. This research proves that IQ predicts pure discovery learning with poker hold'em. In addition, when combined with the findings of other study (Demaree et al., 2010) currently, this study shows that IQ predicts task learning when cognitive and emotional factors are present. The pure discovery learning is likely to be effective when cognitive and emotional factors are present. From this research, it can be seen that the use of discovery learning is also appropriate to the students with various levels of IQ.

This stage uses *engklek*, snake and ladder, kite, and sodo lempung game as visual aid. Visual aid is used as the connector facilitating the students in discovering element concept – element of flat structure with structure picture approach. The model leads to a mathematic representation of a real problem. The mathematic process model actually results in mathematic model leading to formal construction of mathematic concept.

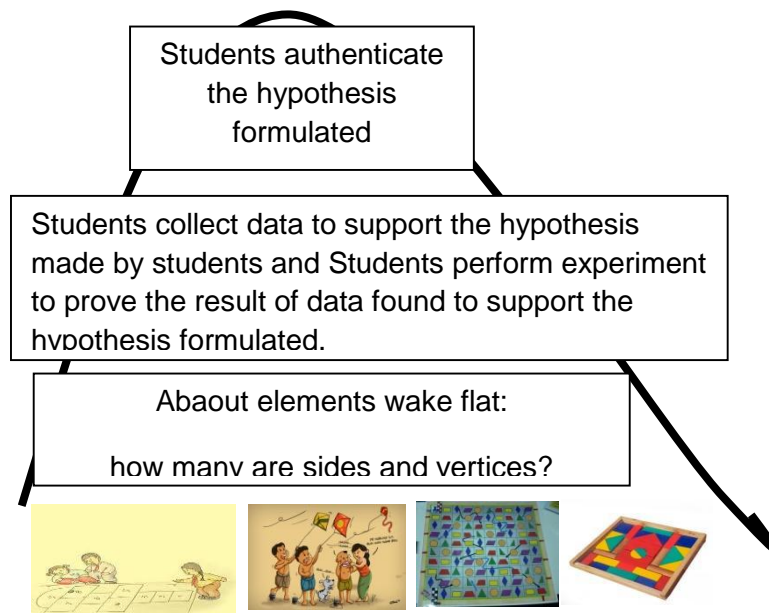


Figure 6. The Utilization of Students' Construction Result

In this stage, students build visualization with Students Worksheet (LKS) and teachers' guide to find out flat structure concept. The result of students' work and construction is then used to be a foundation of mathematic concept development.

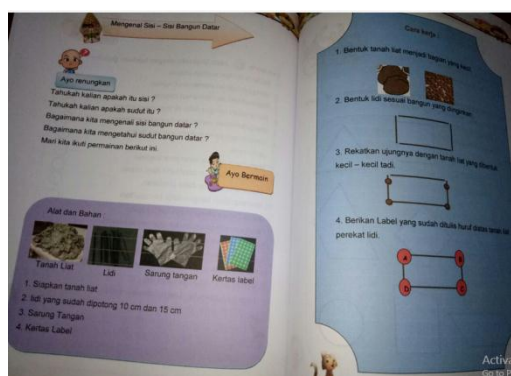


Figure 7. Picture About Traditional Games to Construction of Mathematic Concept

CONCLUSION

Teaching material given is teacher book and student book. The result of research on the mathematic teaching material conducted by interviewing teachers, students, and literature study shows that the old material needs additional active learning model and game application. Teachers' learning style should be changed into constructivism. Discovery learning is one of learning model constructing the students' knowledge. Teaching material is organized attractively and not getting out of the old material's stipulation. Traditional game is a means of making the students interested in and not bored during learning process. From the result of condition of old teaching material, the need for the needed additional teaching material has been obtained. To integrate traditional game into discovery learning model, traditional games can be packaged into a connector between discovery learning model and basic competency in mathematics subject in student book.

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