

Development of Snakes and Ladders as Teaching Tool in *Contextual Teaching and Learning* to Improve the Learning Outcome in Subject of Natural Science

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Abstract

This research aimed to develop snakes and ladders learning media based on Contextual Teaching and Learning (CTL). This research used Research and Development (R&D) method based on Brog and Gall's theory. The result of the research in 5th grade of SDN Bringin 02 showed that snakes and ladders learning media based on CTL have certain characteristic that different from common snakes and ladders. This media is feasible to be used based on expert judgment because it has media feasibility value of 91,66% and material aspect equal to 84,37% with criteria is very feasible. The effectiveness of snakes and ladders learning media based on CTL is evaluated from the improvement of student learning result by using pretest and posstest value analysis. Learning outcomes in the cognitive domain were analyzed using the t-test showing $t_{count} > t_{table}$ ($12,041 > 2,032$). In addition, the N-gain test that showed an increase with medium category of 0.46.

Keywords: Contextual Teaching and Learning, Learning Outcomes, Snakes and ladders learning media

1. INTRODUCTION

Curriculum of primary and secondary education is obliged to contain the lessons of the subject of Natural Science. In School-Based Curriculum (BSNP, 2006) it is written that the learning of Natural Science is aimed at providing the students with the following competencies: (1) having faithfulness in God's greatness based on the existence, the beauty, and the regularity of the nature He creates, (2) developing the knowledge and acknowledgment of the useful and applicable concepts in Natural Science, (3) developing the curiosity, positive behavior, and the awareness of the interinfluencing relationship among Natural Science, environment, and the society, (4) developing the processing skill to study the neighborhood, to solve the problems, and to make decisions, (5) raising the awareness of participation to keep, maintain, and conserve the nature, (6) raising the awareness of valuing the environment and its orderliness as one of the God's creatures, getting provided with knowledge, concept and the skills of Natural Science as the foundation to continue their education to secondary school/Islamic secondary school.

Furthermore, it is mentioned that the learning of Natural Science should be conducted in *scientific inquiry* way to grow the thinking, working, and being scientific, as well as communication skill as key aspect of life skills. As stated by Cain and Evans (1990:) who classify the basic nature of Natural Science into 4, i.e. product, process, act, and technology. Therefore the learning of Natural Science in Primary School puts emphasis on delivering the direct learning experience by using and developing the processing skill and scientific

behavior. The teaching of subject of Natural Science is expected to be a tool for the students to learn about themselves and the surrounding environment, so that the students will make the good decision and take the right action when applying it in their daily life in order to make good impact on the environment in the future.

As stated by Piaget in the work of Suparwoto, et.al. (2007:84-86) that the students' cognitive development is classified into four phases, i.e. tahap sensorimotor, preoperational, concrete operational, and formal operational. Specifically, the primary students are in preoperational phase to the beginning of formal operational phase which shows that the primary students tend to think of the concrete things. Therefore when teaching Natural Science a teacher needs a teaching tool that attracts the students' attention and motivates them to learn as well as reminds them of the learnt knowledge and skills. Hamalik in the work of Arsyad (2013:2) states that teaching tool is the teacher's communication tool to make the teaching and learning process effective and one of the tool's function is to reach the learning goal. While Rudy Bretz in Sukiman (2012:44) classifies teaching tools based on its key elements, i.e., sounds, visual and movement. Thus, the usage of teaching tool in the learning should really notice its functions and purpose, i.e., to support the learning process.

The survey conducted by *Programme for International Student Assessment (PISA)* in 2015 shows that of 70 countries participating in the assessment, Indonesia is at rank 62 for science. Singapore is at rank 1 with average score 556. The score attained by Indonesian kids have *significant* margin against Singapore at average score attained, i.e., 403 (PISA, 2015:5). Eventhough Indonesian

position is at low rank, Indonesia places the better position when in 2012 showing that Indonesia placed the second lowest position of 65 countries participating in PISA. Indonesia was just a little better than Peru which placed the lowest position with score of science skill about 382. That score is at significant margin with Singapore which placed the top rank at score 580 (PISA, 2012:232).

As time goes by, the teachers start advancing their teaching quality. One of the efforts taken by the teacher of grade VI in SD Negeri Bringin 02 is by involving the students in learning by making learning group. Yet, the conducted learning still looks unpleasant. This condition is supported by the learning outcome in subject of Natural Science attained by the grade V students of SDN Bringin 02 which has low average. Viewed from the scores of Final-term Exam, of 35 students, only 18 (51.43%) meets the learning mastery criteria, while the other 17 (48.57%) doesn't, in other words their score is below LMC, it is 63. Such situation should be fixed in right way. The teacher has necessary role in solving the existing problem. The teacher is also expected to be able to design a fun learning of Natural Science, i.e., by creating a teaching tool which is able to set up the dynamic, spirited, and enthusiastic learning process. But in fact, teacher still can't meet the requirement due to several factors, such as limited time allocation and insufficient competency.

Such real situation drives me to develop a Natural Science teaching tool that will improve the students' learning outcome through *Contextual Teaching And Learning* (CTL)-based snakes and ladders in lesson of Earth and Universe. CTL is a learning concept helping the teachers relates the taught lesson to the real world. The key components of CTL are constructivism, asking questions, inquiry, learning community, modeling and authentic assessment (Trianto, 2007: 103-104). The visual snakes and ladders game is highly applicable to CTL as the usage of the picture as the model is designed as illustrated in real world. The usage of snakes and ladders will encourage the students to collaborate in a group, encourage the students to answer the questions of knowledge, as well as encourage the students' fairness when playing the game. This is relevant with the goal of the creation of the snakes and ladders game stated by Jamil (2016:154).

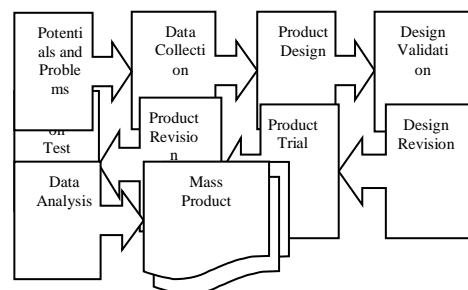
The relevant was conducted by Afandi titled "*Pengembangan Media Pembelajaran Ular Tangga Untuk Meningkatkan Motivasi Belajar Students And Hasil Belajar IPS Di Sekolah Dasar*" (The Development of Snakes and Ladders as Teaching Tool to Raise the Students' Learning Motivation and to Improve the Students' Learning Outcome in Subject of Mathematics in Primary School). The study shows that the usage of snakes and ladders game as teaching tool raises the students' learning

motivation to 66.7% from learning activeness and learning spirit aspects, while from the aspects of students' learning motivation interrelation it raises to 70%. Meanwhile, the students' learning outcome improves to 40% from 55% students attaining below LMC scores into 100% students meeting the LCM. Another relevant study was conducted by MZ titled "*Pengembangan Permainan Ular Tangga Untuk Kuis Mata Pelajaran Sains Sekolah Dasar*" (The development of Snakes and Ladders Game for Conducting Quiz in Subject of Science in Primary School). From the study a conclusion can be drawn that the snakes and ladders game product will involve the students in active learning, at least their sights and auditory are active, and re-explore the students' cognitive side and spirit of competition, i.e., through texts, pictures, and sound in order to attract their attention and then continue the game.

Based on the problem exposed above, then the objectives of the research are: 1) to assess the applicability of the snakes and ladders as teaching tool on the subject of Natural Science learning outcome particularly the lesson of Earth and Universe at grade V of primary school.

2. RESEARCH METHOD

This research I designed as *research and development* (R&D). Sugiyono (2015:407) states that "*metode penelitian and pengembangan adalah metode penelitian yang digunakan untuk menghasilkan produk tertentu and untuk menguji keefektifan produk tersebut supaya dapat berfungsi di masyarakat luas*" (research and development method is a research employed to produce a particular product and to assess the effectiveness of the product in order to be usable in common society). This research aims to develop and assess the effectiveness of a product, i.e., snakes and ladders game on the lesson of Earth and Universe. While the conducted research procedure is shown in the figure below.



Picture 1. Procedure Research and Development of CTL-based snakes and ladders game as Teaching Tool

The emerging potentials and problems were found in observation and interviews on the learning of Natural Science in grade V in SD Gugus Wijaya

Kusuma Semarang City, it is found that the students love playing and want learning by playing a game. The learning of Natural Science at grade V in SD Gugus Wijaya Kusuma Semarang City has been good enough by applying the contextual approach and demonstration method. In fact, however, the ongoing learning process seems to need a change in case of teaching tool usage, mainly the tool constituting a game. The data collection phases concerning the teaching tool creation in form of CTL-based snakes and ladders game are: (1) the initial data in form of observation and interview with the teacher of grade V students in SD Gugus Wijaya Kusuma Semarang City, (2) analyzing the lesson materials used to develop the CTL-based snakes and ladders game as teaching tool, i.e., Earth and Universe, (3) collecting the lesson material and the pictures related to the lesson of Earth and Universe, as well as (4) collecting the materials to create the research instruments, such as experts' assessment sheets as well as the questionnaire of the teacher and students' response.

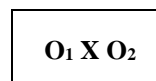
Product design creation of CTL-based snakes and ladders game as teaching tool is creating the tool design in form of a game adapted from the snakes and ladders game. CTL-based snakes and ladders game as teaching tool is designed using *corel draw*. When the product design finished created, the next phase is design assessment. CTL-based snakes and ladders game as teaching tool Product is assessed by the expert. The assessors are media practitioner and materials specialist. The purpose of CTL-based snakes and ladders game as teaching tool assessment is to find that this product can be tested and must be revised.

Revision is undertaken when there is a weakness based on the advice of the assessing media practitioner and materials specialist. The revision process is conducted repetitively until the product is certified as applicable by the experts. The CTL-based snakes and ladders game as teaching tool confirmed as applicable by the experts can be applied for small-scale trial. The revised CTL-based snakes and ladders game as teaching tool based on the suggestions of the experts is then experimented in small-scale experiment which involves 15 students from grade VB in SDN Wates 01. During the small-scale experiment, the students are asked to fulfill the questionnaire of readability on the CTL-based snakes and ladders game as teaching tool.

The fulfilled questionnaire then is then taken as consideration to make revision when there are some weaknesses found according to the small-scale experiment. The revised CTL-based snakes and ladders game subsequently is experimented in big-scale. The teaching tool test is conducted in the classroom of grade V SDN Bringin 02 on 35 students. The classroom selection of the population of grade V for the experiment was carried out in *cluster random sampling* method. In the teaching

tool testing, the learning was carried out in CTL approach as well as asking the teacher and the students to fulfill the survey responses so the data of the teacher's and students' responses to the usage of the CTL-based snakes and ladders game will be received.

The teaching tool testing will be conducted experimentally, i.e. pre-experimental model particularly *one group pretest-posttest design* according to Sugiyono (2015:110-111) in the following pattern:



Picture 2. Pattern of *One Group Pretest-Posttest Design Model*

Remarks:

O₁ = *pretest* score

O₂ = *posttest* score

This research was carried out in grade V SD in Gugus Wijaya Kusuma Semarang City with the taken research subjects in small-scale experiment amounted 15 students of grade VB SDN Wates 01 and the teaching tool experiment was conducted in the classroom of grade V SDN Bringin 02. The independent variable in this research is the treatment on the CTL-based snakes and ladders game as teaching tool in the lesson of Earth and Universe in grade V SD. While the dependent variable is the learning outcome usage treatment of CTL-based snakes and ladders game as teaching tool.

The data collection methods used in this research is: 1) documentation, 2) interviews, 3) questionnaire fulfillment, 4) test, and 5) observation. Data analysis undertaken in the research comprises instrument, product, and final data analyses. Instrument analysis means test instruments. That analysis consists of analysis of item of questions validity, difficulty level, distinguishing contents, and reliability of the questions.

Product analysis was carried out by determining the applicability of the developed tool, i.e., by asking the experts to make assessment. On the other side, the final data analysis was conducted by analyzing *pretest* and *posttest* scores. *Pretest* and *posttest* scores are analyzed using t-test and N-gain.

3. RESULTS AND DISSCUSSION

The product development of CTL-based snakes and ladders game as teaching tool is also adjusted to the cognitive development of the primary school students. Piaget in work of Suparwoto, et.al. (2007:84-86) students cognitive development is classified into four phases, i.e., sensorimotor, preoperational, concrete operational, and formal operational phases. Specifically, the

students of primary schools are between preoperational to the beginning of formal operational one which shows that the thinking aspect of the students of primary school tends to be concrete. In line with Bruner theory which explains that the students learn through 3 phases i.e., enactive, iconic and symbolic phases, in which the students learning phases starts from recognizing the things around them directly using their senses. This is supported by Edgar Dale's cone (Arsyad, 2013:14) which shows that it is easier to convey message using the concrete thing or personal experience than through words or more abstract and confusing symbols. The usage of the real picture consistent with their surroundings will ease the students to understand the lesson materials because based on Edgar Dale's cone, the students will more easily remember what they see than what they hear.

The development of the product of CTL-based snakes and ladders game as teaching tool is conducted to help the students improve the students learning output in the lesson of Earth and Universe in semester 2 of grade V. The improvement of students learning outcome can be conducted by creating the fun learning and involving the students directly. One way to create the fun learning is by playing a game. According to A. Husna M. (2009:145) Snakes and Ladders game is a game using dices to determine how many steps to be taken by the pawns on a plaid board. Development of CTL-based snakes and ladders game as teaching tool is adapted from the snakes and ladders game which according to Jamil (2016:154) will stimulate the students to directly be engaged in and to cooperate with within a group, habituate the students to answer the questions, and to stimulate the students' fair play while playing the game. By directly participating, the students' memory of the lesson materials they have learnt will stay longer. This supported by Vygotsky who puts emphasis on the social aspect in the students' learning though interaction within the group and states that the students build knowledge as the end result of the thinking and the activities of the students on their own. Through snakes and ladders game as a teaching tool, the students will be in the *zone of proximal development* in which this learning task is suitable with their development level. The presentation of the design and the components of the teaching tool as one of the assistance for the students in order to be able to develop the concept they have learnt. One of its examples is by using the information card and questions card to generate the students' curiosity and linking the information they have received. This is consistent with the *Scaffolding* phase stated by Vygotsky (Trianto, 2007:27) where the teacher play a role as assistance giver in compliance with the students development phase in order to be able to take over their own responsibility, in this case it is learning, and to

build their own knowledge. When the students are capable of building their own knowledge, the teacher will fish the students' involvement in making their own choices through observation of the human's act that can conserve the environment around the school which is integrated in the learning where the true assessment is conducted by the teacher.

Development of CTL-based snakes and ladders game as teaching tool can get the students more attracted to learn. It is because the learning atmosphere is more fun so that it helps the students improve their learning outcome. The development of the design of CTL-based snakes and ladders game as teaching tool aims to improve the students' learning outcome. In addition to focusing on its purpose, the teaching tool development applies the general principles of teaching tool making. Aqib (2013:52) states that the general principles of the teaching tool making are: 1) *Visible* : easy to see, 2) *Interesting* : attracts the attention, 3) *Simple*: sederhana, 4) *Useful* : useful to the students, *Accurate*: correct and effective, 6) *Legitimate*: valid and making sense, 6) *Structured* : well and respectively arranged.

The developed CTL-based snakes and ladders game as teaching tool consists of several parts i.e.:(1) Board of snakes and ladders game; (2) questions card (Kanya); (3) Information Card (Kasi); (4) Manual Book; (5) Pin or pawns; and (6) Dice.

The applicability of the developed CTL-based snakes and ladders game as teaching tool is verified through the validation process conducted by the experts, both by media and materials specialists. The media specialist making assessment is H.A. Zaenal Abidin (lecturer in Department of PGSD/Primary Education FIP UNNES). While the lesson materials specialist making assessment is Sri Sulistyorini (lecturer in Department of PGSD/Primary Education FIP UNNES).

The assessment making aims to find out if the developed tool is applicable to support the learning process or inapplicable. Before the assessment starts, I consult with the specialist in advance. From the consultation, some advices were received concerning the development design of CTL-based snakes and ladders game as teaching tool. Among them is that putting more emphasis on indicator for the lesson materials in every session in the developed tool, the color used for font of the Information Card should be diverse. Also, Information Card and Questions Card should be made in color paper in order not to muddle the contents in the paper so that the students will be more attracted

From the media specialist's assessment on the development of CTL-based snakes and ladders game as teaching tool I accept percentage score 91.66% which means highly applicable. While from the lesson materials specialist I accept the

percentage score 84.37%, which means highly applicable. Based on both specialists' assessment, then the product of the developed CTL-based snakes and ladders game as teaching tool receives the average percentage score 88.02% and it is included in the category of highly applicable. While from the data of questionnaire response fulfilled by the teacher and the students on the small-scale experiment of the product, the percentage scores of response received are 90% and 91%, which means highly applicable. The calculation result of the tool applicability is shown in the chart below.



Picture 3. Chart of Tool Applicability Assessment

The effectiveness of the application of CTL-based snakes and ladders game as teaching tool is reflected in the students' cognitive learning comprising *pretest* and *posttest* scores. The *pretest* scores are attained from test conducted prior to the learning using CTL-based snakes and ladders game as teaching tool, while the *posttest* scores are attained from the test conducted after the learning conducted using CTL-based snakes and ladders game as teaching tool. The learning outcome improvement in the cognitive area is reflected in the raising score of the *pretest* and *posttest* using t-test which subsequently are re-tested using N-gain.

From the calculation of the normality test score before and after the application of CTL-based snakes and ladders game as teaching tool in the Natural Science learning, particularly lesson of Earth and Universe in grade V SDN Bringin 02, it is revealed that the significance rate is 0.157 (*pretest*) and 0.060 (*posttest*). The testing criteria on the data normality i.e., if the significance rate > 0.05 then H_0 is accepted and if the significance rate < 0.05 then H_0 is rejected. Each score of *Sig.* from *pretest* and *posttest* is more than 0.05 which means that H_0 is accepted. H_0 acceptance shows that the data before and after the application of CTL-based snakes and ladders game as teaching tool in the Natural Science learning particularly lesson of Earth and Universe grade V SDN Bringin 02 is normally distributed.

After revealed that the data is normally distributed, the next step taken is conducting the homogeneity test. The homogeneity testing criteria is when the significance rate > 0.05 then the variant of the data group is confirmed as similar or

homogenous. From the calculation of homogeneity test of the data before and after the application of CTL-based snakes and ladders game as teaching tool it is revealed that significance rate > 0.05 i.e., 0.086. therefore, from the calculation, I can draw a conclusion that the variant of the two data groups, i.e., *pretest* and *posttest* is similar or homogenous.

Table 1. T-test of Students Learning Outcome *Pretest* and *Posttest*

Criteria	score	
	Pretest	Posttest
Mean	62.62	80.1
Variants	109.60	60.00
T count	10.91	
Degree of independence	58	
T table	2.032	

CTL-based snakes and ladders game as teaching tool is confirmed as effective viewed from the significant average margin between *pretest* and *posttest* scores. During t-test there is hypothesis i.e., H_0 and H_a . H_0 means there is not change of the students' learning outcome before and after the learning process applying CTL-based snakes and ladders game as teaching tool is conducted. While H_a means there is change of the students' learning outcome before and after the learning process applying CTL-based snakes and ladders game as teaching tool is conducted. On t-test, H_a is accepted when $t_{count} \geq t_{table}$. Based on the calculation it was found out that t_{count} score is 10.91 and t_{table} is 2.032, which means that t_{count} is bigger than t_{table} . H_a is accepted, it means, there is significant change of the students' learning outcome before and after the learning process applying CTL-based snakes and ladders game as teaching tool. While the t-test scores of cognitive learning outcome improvement is shown in Table 1.

Gain test is used to reveal average improvement of the learning outcome before and after applying CTL-based snakes and ladders game as teaching tool. The average improvement test scores (*gain*), i.e., *pretest* and *posttest* grade V students of SDN Bringin 02 is 0.47 and the average margin is 18.5. The result of gain-test of *pretest* and *posttest* scores is included in moderate category.

Based Table 2 below the conclusion can be drawn that the students' cognitive learning outcome before and after applying CTL-based snakes and ladders game as teaching tool experiences the significant improvement in moderate category. That result is in line with the study conducted by Muhlisin (2012:142) which explains that the development of CTL-based Natural Science learning tool is integrated, effective, and able to improve the students' learning outcome to 0.64% included in moderate category.

Table 2. Assessment of Average Improvement (Gain)

Category	Score
Average pretest	60.62
Average posttest	80.1
Average margin	18.5
Gain score	0.47
Criteria	Moderate

All principles in the CTL approach have been implemented at best during the learning process, except the principle of *questioning* and (*learning community*) that got some milestones. This was because the students are not used to working in grouping so when the students are given a problem to discuss about, not all the group members are actively involved in the discussion. In addition, the students are not used to expressing their opinion and the questions they found concerning the lesson materials they have learnt. During the learning process applying CTL-based snakes and ladders game as teaching tool, the method is used 4 times. In the beginning of the learning or in the first session, the students looks like having milestone in applying CTL-based snakes and ladders game as teaching tool as they are not get used to yet. In the next session, however, I did not see it anymore as they have understood the application of CTL-based snakes and ladders game as teaching tool better.

The simplicity in this research is analyzed based on the questionnaire response fulfilled by the students and teacher after applying CTL-based snakes and ladders game as teaching tool. The assessment result of the questionnaire response fulfilled by students after being experimented in the big group is that the percentage score attained is 89%. The assessment at the percentage score 89% means very practicable. While from the assessment result of the questionnaire response fulfilled by teacher, the percentage score attained is 91% which means very practicable. In addition, there is not any revision related to CTL-based snakes and ladders game as teaching tool.

Based on the questionnaire response fulfilled by the students and teacher, the big-scale product experiment, it attains the response rate 89% and 91% which means very practicable. The average assessment percentage sore of both is above 82% and it means very practicable. Therefore from the attained assessment score, it can be concluded that CTL-based snakes and ladders game as teaching tool is highly applicable to the learning.

The study is in line with the study conducted by Muhlisin (2012:144) which explains that the

development of integrated CTL-based Natural Science learning tool is confirmed as practicable as most students (87.1%).give positive response.

4. CONCLUSION

Based on the results and discussion, we can make a conclusion that the *Contextual Teaching and Learning*-based snakes and ladders game as teaching tool developed in particular characteristics is applicable as a teaching tool and effectively improves Natural Science learning outcome, the lesson of Earth and Universe di grade V SD, as well as is confirmed as practicable based on the teacher and students' response that shows the positive response.

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