# The Enhancement of Students' Mathematical Problem Solving Ability through Contextual Approach Bamboo Dance Technique Viewed from Mathematical Initial Ability

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**Abstract**

This study is based on students' lack of ability in mathematical problem solving. To overcome such problems, so, study of mathematics learning is conducted through learning with contextual approach by using bamboo dance technique. This study will discuss about the enhancement of mathematical problem solving between students who are taught by contextual learning by bamboo dance technique and students who are taught by direct learning at school levels (high, medium and low level). This study is quasi experimental study. The study design which is used is Pre test-Posttest Control Group Design. The population of this study are $8^{th}$ grade students of Public Junior High School at Pekanbaru. The sample of this study are all $8^{th}$ grade students at six classes which represent high, medium and low school levels. The study result shows that, the enhancement of mathematical problem solving ability of students who are taught by technique contextual approach bamboo dance technique is higher compared with students who are taught by direct learning at school levels and the initial mathematics ability. The tendency is, there is no interaction between contextual approach learning with bamboo dance technique and students' mathematical initial ability towards the enhancement of students' mathematical problem solving ability.

**Key words**: Contextual approach, bamboo dance technique, mathematical problem solving ability, mathematical initial ability

## A. Introductioan

Education domain is one of domain which is needed to be given attention in order to create reliable and excellent human being, in addition education domain is a foundation of nation's development. Good education can be made to become strategic asset to prepare Human Resource who is highly skilled in solving the problem, should be really considered professionally. It had been seen partially by improving the education sector in all lines by government either of welfare, education infrastructure, and education competence.

The continued effort to enhance the quality of education process and product is normally given more attention, because it is believed that education can maximize students potential as Human Resource prospective who is excellent and highly skilled to capable to has critical, creative , logical and innovative behavior and attitude to face and solve the problem. One of education which should be given attention is mathematics education.

Many students struggle to achieve mathematics particularly in problem solving, but they still need to learn mathematics because its importance in daily life, kaufman (2008). The similar is suggested by Sajadi, Amiripour and Mohsen (2013) that problem solving is one of important element of mathematical problem solving which merge real life problem and experience. According to Anderson (2009) problem solving is life skill which is needed to be mastered by students in which its process consist of analysis, interpretation, prediction, evaluation and reflection. Problem solving ability is basic skill which should be possessed by everyone in order to live their life better. The problem for anyone is not certainly the problem for another people, which means that the problem is relative. Determining whether or not a situation is a problem can be done by seeing how a person react to that situation.

Problem solving is regarded as a process or a way someone used to solve mathematical problem based on information obtained by using mathematical concept which is possessed by him/her. Student who is trained by problem solving will skillful in selecting relevant information, analyzing and evaluating its result. In parallel with it Nasution (2000) said that skill will result in intellectual satisfaction in student, enhance intellectual potency, and train student how to do tracing through discovery. According to Lambertus (2014) problem solving can be defined as basic problem solving ability which is an answer to very complex question, even more complex than problem solving itself. Similar with Montague (2007) who said that mathematical problem solving is a complex cognitive activity accompanied by some processes and strategies.

Based on explanation above, it is needed learning which emphasize development of mathematical problem solving ability and learning which follow development of knowledge. Learning with contextual approach enable students to develop and discover mathematical concepts and another knowledge through process of constructing knowledge meaningfully. Even though in process of constructing the knowledge to solve the problems which are related with daily life problem personally and in group with Scaffolding technique, then students will be challenged and have opportunity to master understanding ability.

The regulation of contextual learning through group discussion can be packed by bamboo dance technique. By bamboo dance technique, beside students have strength of team cooperation in group, they also demanded to understand problem/task/material which are varied in solving a problem by discussing or studying learning material more than two time. In bamboo dance technique, students are involved in verbal conflicts concerned with the opinion of their group members. Cooperative learning of bamboo dance technique is modification from small circle, big

circle technique where in process of forming discussion group of small and big circle technique, students from two circles, whereas in bamboo dance technique students from group who are lined up in rows and face each other. Bamboo dance technique is developed by Anita Lie. Reference Lie (2008) revealed that this learning model give opportunity to students to share information in the concurrent time with different and regular partner.

According to Lie (2008), cooperative learning with bamboo dance technique has some stages as follow:

1. Half of class (fourth of class if there are too many students) sit in row. Another possibility is students learn in between the chairs.
2. Half of another class learn by facing the first row.
3. Two paired groups of those two rows share the information.

One group move to another group in its row. By this way, each group has new partner to share. The movement can be done continually as necessary.

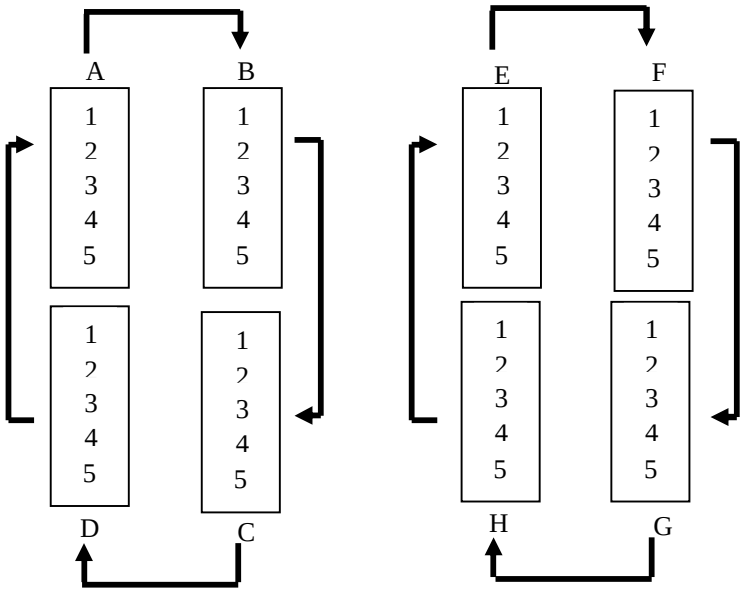


Figure 1. Group position and the way the group move in cooperative learning application with bamboo dance technique.

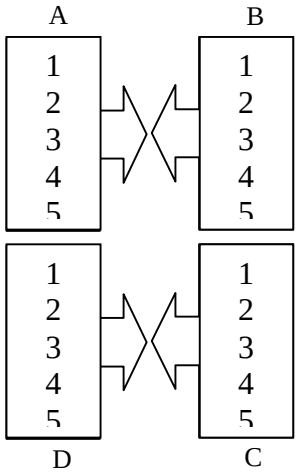


Figure 2. Students hold discussion in their own group

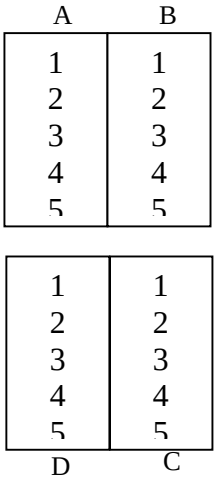


Figure.3. Group A join with group B and group C joint with group D

Therefore, learning with bamboo dance technique contextual approach direct students to construct their knowledge with contextual problem. Students also demanded to be able to understand the material entirely and deliver discussion result in front of class confidently. Students who are skillful to discover the concept/knowledge make knowledge concepts which are learned by students will become more meaningful in students' memory so they are involved actively and creatively in learning process. This is parallel with Reference Ruseffendi (1991). "……discover something by themselves can grow self confident toward themselves, can enhance motivation (included intrinsic motivation), do further examination, can grow positive attitude toward mathematics".

*Purpose and Significance of Research*

Problem solving is very important component in mathematics education. The importance of problem solving ability by students in mathematics is asserted by Syaiful (2013) namely: 1) problem solving ability is general aim in mathematics teaching, even as the heart of mathematics; (2) problem solving which is consist of method, procedure, and strategy is core and main process in mathematics curriculum; and (3) problem solving is basic ability in mathematics learning.

The purpose of this study was to describe the enhancement of *mathematical problem solving ability* (MPSA) of students who are taught by *contextual approach with bamboo dance technique* (CABDT) is better compared with students who is taught by *direct learning* (DL) which is seen from school levels (high, medium, and low) and Is there interaction between CABDT learning and SL toward MPSA enhancement.

Problems which are proposed as follows: (1) Is the enhancement of *mathematical problem solving ability* (MPSA) of students who are taught by *contextual approach with bamboo dance technique* (CABDT) is better compared with students who is taught by *direct learning* (DL) which is seen from *mathematical initial ability* (MIA) category (high, medium, and low). (2) Is there interaction between CABDT learning and *students' mathematical initial ability* (MIA) category towards students' mathematical problem solving ability enhancement.

## B. Research Methods

This study is a quasi experimental study, subjects are not grouped randomly, but researcher takes the subjects for granted. In this study, the researcher uses two classes which are divided into experimental class and control class. In initial stage, the researcher purposively determines school samples from each school levels (high, medium, low). From each school, it was taken two classes randomly, one class is assigned as experimental class ant other class is assigned as control class.

Contextual approach learning with bamboo dance technique is given to students of experiment class whereas direct learning is given to control class with aim to see comparison between learning model and to see the influence of contextual approach with bamboo dance technique toward enhancement of problem solving ability in each school level.

This study used pretest-posttest control grup design, as described below Ruseffendi (2005).

*O* *X* *O*

*O* *O*

Note:

X = CABDT

O = Pretest of MPSA = Posttest of MPSA (*mathematical problem solving ability)*

### *1. Population and Sample*

Population in this study are 8$^{th}$ students of Public Junior High School in Pekanbaru City, Riau province in 2015/2016 academic year which consist of three school levels. high school level, medium school level, and low school level. Total of 230 students become sample in this study

which consist of high school level with 66 students, medium school level with 84 students and low school level with 80 students. Each school divided into two classes namely experiment class and control class.

*2. Instruments*

Instrument used in this study is mathematical initial ability (MIA) test and essay test of mathematical problem solving. MIA test consist of 25 items in the form of multiple choice and each items consist of four answer choices. The material in MIA test is material which had been learned by students in elementary school level and junior high school in $8^{th}$ grade. As for essay test of mathematical problem solving ability is arranged based on indicator of problem solving ability. Indicator of problem solving ability in this study are: (1) Understand the problem: identify the elements known, asked and the adequacy of elements needed; (2) Make/arrange mathematical model: the ability to formulate daily life into mathematical model; (3) Choose problem solving strategy; and (4) Explain and check the correctness answer. The material in problem solving ability test consist of two chapters namely chapter of function relation and chapter of line equation. Test in each chapter consist of three problems with high, medium and low difficulty level.

## C. Discussion

### 1. The Enhancement of Students' MPSA Based On Students' Mathematical Initial Ability (MIA) Category

Data recapitulation of students' mathematical problem solving ability enhancement based on *students' mathematical initial ability* (MIA) and learning consist of minimum score, maximum score, and pre test average, post test average, enhancement average (n-gain) and standard deviation, it can be seen on Table 1.

**Table 1. Data Recapitulation Of Students' Mpsa Enhancement Based On MiaCategory**

| MIA Category | Learning | N | Data | Score | | Average | Standard Deviation |
|---|---|---|---|---|---|---|---|
| | | | | Min | Max | | |
| High | CABDT | 26 | Pre test | 10 | 42 | 22,42 | 8,44 |
| | | | Post test | 44 | 100 | 64,04 | 12,93 |
| | | | ***n-Gain*** | 0,32 | 1,00 | **0,54** | **0,16** |
| | DL | 21 | Pre test | 12 | 40 | 21,67 | 8,51 |
| | | | Post test | 17 | 62 | 39,90 | 13,21 |
| | | | ***n-Gain*** | 0,05 | 0,49 | **0,23** | **0,15** |
| Medium | CABDT | 67 | Pre test | 4 | 31 | 13,22 | 6,27 |
| | | | Post test | 42 | 87 | 57,75 | 9,90 |
| | | | ***n-Gain*** | 0,29 | 0,84 | **0,52** | **0,11** |
| | DL | 75 | Pre test | 4 | 31 | 13,22 | 6,27 |
| | | | Post test | 17 | 67 | 30,36 | 9,08 |
| | | | ***n-Gain*** | 0,00 | 0,60 | **0,19** | **0,11** |
| Low | CABDT | 22 | Pre test | 2 | 21 | 8,36 | 4,64 |
| | | | Post test | 40 | 83 | 53,68 | 10,81 |
| | | | ***n-Gain*** | 0,32 | 0,72 | **0,55** | **0,10** |
| | DL | 19 | Pre test | 2 | 15 | 8,42 | 3,19 |
| | | | Post test | 19 | 52 | 27,95 | 8,16 |
| | | | ***n-Gain*** | 0,17 | 0,41 | **0,29** | **0,079** |

Based on Table 1, it can be described that: (a) In general, the average of MPSA enhancement of students who are taught by CABDT is bigger compared with students who are taught by direct learning. (b) the average of MPSA enhancement of students from high category of MIA who are taught by CABDT is bigger than students who are taught by direct learning. (c) the average of MPSA enhancement of students from medium category of MIA who are taught by CABDT is bigger than students which is taught by direct learning. (d) the average of MPSA enhancement of students from low category of MIA who are taught by CABDT is bigger compared with students who are taught by direct learning. It can be concluded that from each high, medium or low students' mathematical initial ability category, mathematical problem solving ability of students who are taught by CABDT is better than students who are taught by direct learning.

Before conducting differentiation test of students' mathematical problem solving ability between data group, it is first conducted data distribution normality test by using Shapiro-Wilk test and data variance homogeneity test by using Levene test towards both sample group. Hypothesis which are tested are:

$H_0$ : The data of students' mathematical problem solving ability enhancement towards each students' mathematical initial ability (MIA) category is normally distributed.

$H_1$ : The data of students' mathematical problem solving ability enhancement towards each students' mathematical initial ability (MIA) category is abnormally distributed.

Testing criteria $H_0$ is accepted if probability value (sig.) is bigger than $\alpha = 0,05$ and $H_0$ is rejected if probability value is smaller than $\alpha = 0,05$. The calculation result of data normality test on students' mathematical problem solving ability enhancement based on students' mathematical initial ability (MIA) category and learning can be seen on Table 2.

**Table 2. Data normality test in students' mpsa enhancement based on Students' mathematical ability (mia) category**

| MIA Category | Learning | N | *Sig. (2- tailed)* | Conclusion |
|---|---|---|---|---|
| High | CABDT | 26 | 0,084 | $H_0$ is accepted |
| | DL | 21 | 0,014 | $H_0$ is rejected |
| Medium | CABDT | 67 | 0,000 | $H_0$ is rejected |
| | DL | 75 | 0,010 | $H_0$ is rejected |
| Low | CABDT | 22 | 0,000 | $H_0$ is rejected |
| | DL | 19 | 0,055 | $H_0$ is accepted |

Based on Table 2, it can be seen that students' mathematical problem solving ability which is seen from high students' mathematical initial ability (MIA) category in CABDT learning and low students' mathematical initial ability (MIA) category towards direct learning has sig. value more than $\alpha = 0,05$, it means that $H_0$ is accepted. Meanwhile in high students' mathematical initial ability (MIA) category towards direct learning, medium students' mathematical initial ability (MIA) category and CABDT learning and direct learning and low students' MIA category towards CABDT learning has sig. value less than $\alpha = 0,05$, it means that $H_0$ is rejected. So, data of students' mathematical problem solving ability enhancement on high students' mathematical initial ability (MIA) category towards CBDT and low students' mathematical initial ability (MIA) category towards direct learning is normally distributed, meanwhile data of students' mathematical problem solving ability enhancement on high students' mathematical initial ability (MIA) category towards direct learning, medium students' mathematical initial ability (KAM) category towards CABDT learning and direct learning and low students' mathematical initial ability (MIA) category towards CABDT learning is abnormally distributed.

Because of high students' mathematical initial ability (MIA) category, medium students' mathematical initial ability (MIA) category and low students' mathematical initial ability (MIA) category is abnormally distributed, it is conducted by using differentiation test on enhancement, by using non parametric statistic, namely, Mann-Whitney U Test. The testing hypothesis, namely:

$H_0$ : the enhancement of s mathematical problem solving ability of students who are taught by CBDT is equal with the enhancement of mathematical problem solving ability of students who are taught by direct learning.

$H_1$ : the enhancement of mathematical problem solving ability of students who are is taught by CBDT is better compared with the enhancement of mathematical problem solving ability of students who are taught by direct learning.

Testing criteria $H_0$ is accepted if probability value (sig.) bigger than $\alpha = 0,05$ and $H_0$ is rejected if probability value is smaller than $\alpha = 0,05$. The calculation result from differentiation test on students' mathematical problem solving ability enhancement based on students' mathematical initial ability (MIA) category and learning can be seen on Table 3.

**Table 3. The enhancement of students' mathematical problem solving ability based on Students' mathematical initial ability (mia)**

| MIA Category | Learning | N | Mann-Whitney U Test | *Sig. (2- tailed)* | Conclusion |
|---|---|---|---|---|---|
| High | CABDT | 26 | 179,500 | 0,000 | $H_0$ is rejected |
| | DL | 21 | | | |
| Medium | CABDT | 67 | 48,500 | 0,000 | $H_0$ is rejected |
| | DL | 75 | | | |
| Low | CABDT | 22 | 10,500 | 0,000 | $H_0$ is rejected |
| | PL | 19 | | | |

Based on Table 3 above, it can be described that data of students' mathematical problem solving ability enhancement with CABDT learning and direct learning towards high students' mathematical initial ability (MIA) category, medium students' mathematical initial ability (MIA) category, and low students' mathematical initial ability (MIA) category has sig. value which is less than $\alpha = 0,05$, it means that $H_0$ is rejected. The conclusion which is obtained towards each student's mathematical initial ability (MIA) category, namely, the enhancement of s mathematical problem solving ability of students who are taught with CABDT is better than enhancement of mathematical problem solving ability of students who are taught by direct learning.

## 2. Interaction between Learning and Students' Mathematical Initial Ability (MIA) Category towards Students' Mathematical Problem Solving Ability Enhancement

To find out if there is interaction or no between learning and students' mathematical initial ability (MIA) category (high, medium, level) towards students' mathematical problem solving ability enhancement, it is proposed hypothesis as follows.

Hypothesis:

There is interaction between learning and students' mathematical initial ability (MIA) category (high, medium, level) towards students' mathematical problem solving ability enhancement.

Before conducting two way ANOVA test, it is first conducted normality test and data variance homogeneity on students' mathematical problem solving ability enhancement. Based on normality test result by using shapiro-wilk, it can be seen that students' mathematical problem solving ability is viewed from high students' mathematical initial ability (MIA) towards CABDT and low students' mathematical initial ability (MIA) towards direct learning has sig. value which is smaller than $\alpha$ = 0,05, it means that $H_0$ is is accepted. Meanwhile high students' mathematical initial ability (MIA) towards direct learning, medium students' mathematical initial ability (MIA) category towards CABDT and direct learning and low students' mathematical initial ability (MIA) category towards CABDT has sig. value less than $\alpha$ = 0,05, it means that $H_0$ is rejected. So, data of students' mathematical problem solving ability enhancement at high MIA category towards CABDT and low MIA category towards direct learning is normally distributed, meanwhile the data of students' mathematical problem solving ability enhancement on high MIA category towards direct learning, medium MIA category towards CABDT learning and direct learning and low MIA category towards CABDT learning is abnormally distributed.

Because there is data on students' mathematical problem solving ability enhancement which is normally distributed, the testing by using two way ANOVA cannot be conducted, so, analysis of the effect of interaction between learning and MIA category towards students' mathematical problem solving ability enhancement is conducted by using Figure 4 as follows.

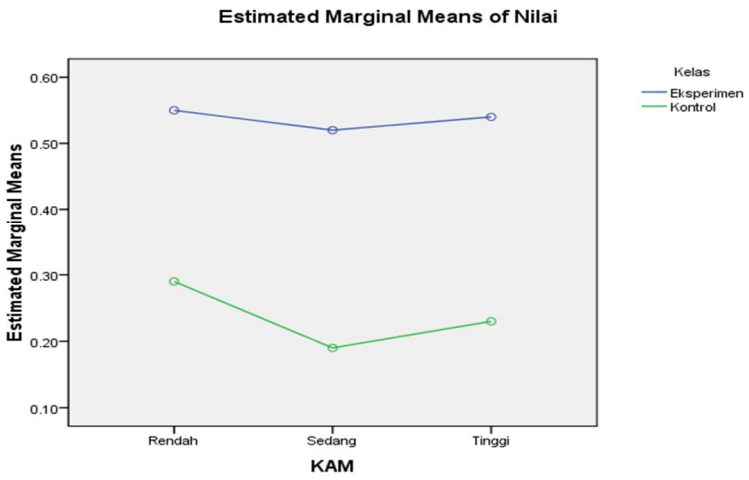


Figure 4. Interactions between Learning and MIA Category towards Students' Mathematical Problem Solving Ability Enhancement

From Figure 4, it can be seen that for all MIA category (high, medium, and low) towards experimental class, they get higher enhancement compared with control class. If it is ordered based

on average of enhancement from the biggest until the smallest, for experimental class, the orientation is students at low MIA category, high MIA category and medium MIA category. Meanwhile, the orientation towards control class is in order, namely, low MIA category students, high MIA category students and medium MIA category students.

The similarity of average orientation n-Gain students' mathematical problem solving ability enhancement on MIA category (high, medium, and low) towards experimental and control class become indication that there is interaction between learning and MIA category (high, medium, and low). Besides, it can be seen that from the differences of *n-Gain* average on students' mathematical problem solving ability. The differences of *n-Gain* average on students' mathematical problem solving ability enhancement in experimental class and control class at high school level is almost equal with medium school level and low school level.

The Hypothesis Conclusion:

There is no influence of interaction between learning and MIA category (high, medium and low) towards students' MPSA enhancement.

## D. Conclusion and Recommendation

Based on data analysis, finding and study result, it can be drawn conclusion as follows: (1) MPSA enhancement of students who are taught by CABDT based on MIA category (high, medium and low) is better than students who are taught by direct learning. (2) There is no interaction between learning (CABDT and DL) and MIA category (high, medium and low) towards students' MPSA enhancement.

Recommendation from researcher are: (1) Learning with CABDT can be made as one of mathematics learning which can be taught towards high school students, especially for MIA category (high, medium and low) and in general with the learning. This learning can enhance students' creativity and activity to interact more positively with other students. (2) Students' initial mathematical ability (MIA) towards prerequisite material has important role towards students' ability in stating ideas, communicating well, helping each other, and improves students' self-confidence. (3) By using CABDT, teacher is expected can manage time towards learning process and can handle the problems in students' work sheet and its solving process with contextual problem which is related with students' work sheet, so, such problem can bring up many mathematical concept which can be completed with various strategies which is suitable with students' ability level.

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