The influence of the inquiry learning model and the Bengkulu
ethnomathematics toward the ability of mathematical
representation

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Abstract. The purposes of this study was to determine the effect of inquiry ethnomathematics
learning oriented to South Bengkulu on the mathematical representation ability and
mathematical connections of high school students. This study uses an experimental approach
with 2x2 factorial design. The population in this study were all students of Senior High School
Bengkulu Selatan. The sample was selected by purposive sampling technique as many as 67
students. The instrument was a test of mathematical representation ability. Data were analyzed
by ANCOVA, the covariate was the students’ initial ability. The results of this study are the
mathematical representation ability of students taught by the inquiry model of higher learning
than students taught with conventional learning models for students given ethnomathematics-
based mathematics material. If students who are given mathematics material are not
ethnomathematics-based, then the mathematical representation ability of students to be taught
with inquiry learning models is lower than students taught with conventional learning models.

1. Introduction
The efforts have been made to improve the learning achievement of mathematics, both by the
government, teachers and the community. However, until now there were still weaknesses and errors of
high school students in learning mathematics [1]. Therefore a learning model is needed that can improve
student learning activities [2].

The learning model was a theoretical framework that can be used as a guide for teachers and the
development of learning to develop learning implementation plans [3]. Learning was an engineering to
control the educational process in order to achieve goals that are planned effectively and efficiently [4].
In this process the role of the teacher is very important, because it was an activity carried out by the
teacher to transfer knowledge, skills and values to students. So that what is transferred has meaning not
only for itself but also for society [5]. Therefore, students are expected to be able to find their own
mathematical concepts through the application of inquiry learning.

According to Duran and Dokme Inquiry Based Learning (IBL) is a way of asking questions, seeking
information, and finding new ideas related to an event [6]. Learning materials developed in the IBL are
believed to contribute to more effective science (and math) instruction. Smallhorn, et. al. stated that
fosters the development of independent learners, by encouraging students to take responsibility for their
own learning [7]. Implementation of discovery learning through the inquiry learning should be close to
student culture [3]. Therefore, Widada and Herawaty suggested ethnomathematics-based mathematics material [4].

Now, people are beginning to realize that school children from many cultures meet together as a daily part of many classrooms [8]. This made it easy for teachers to take advantage of the diversity of local culture into the starting point of learning mathematics.

According to Katsap and Silverman, the problem of multiculturalism in mathematics responds to two levels: pure mathematics and mathematics education [9]. The pure mathematics was emphasizes structuralistic content, and the mathematics education had seeks mathematical learning techniques [2]. The nature of multiculturalism in mathematics, identifying cultural components in algorithms and in mathematical models, and disclosing differences in the presentation of mathematical objects in different cultures. Meanwhile, multiculturalism in mathematics is tested through the prism of mathematics education in all its components [9]. When we look at South Bengkulu, there is a culture in the form of a popular dance that can motivate students to develop knowledge well. The dance is used as a basis for students to learn about the concept of relationships and functions.

According to Mizliati Andun dance is a traditional dance that is maintained by the people of Selali Village, Pino Raya District, South Bengkulu Regency [10]. As a traditional dance Andun dance is always displayed in traditional ceremonies Nundang Padi, in other areas this Andun dance is often also used in weddings, welcoming guests and others, Andun dance is an identity that is attached to the people of Bengkulu. In Selali Village this dance is used as a series of Nundang Padi traditional ceremonies.

Based on experience, the dance made students learn mathematics meaningfully. Students increasingly enjoy the interaction between student learning resources and between students, as well as with teachers. Students do more dynamic learning.

The concept of relations is based on pairs of male and female dancers. Every woman has exactly one male dancer pair, this is one study for the concept of function. According to Mizliati [10], in the Andun Dance, Nundang means rice hatchery, a new rice hatchery process which will be planted in the field, where a hatchery is made of a room of size, which is made of planks and uses a rumbio leaf roof. Inside the house, in the middle there is a mosquito net for storage that will be in Nundang (hatchery). The rice fields were invited by eight children (4 boys and 4 girls) aged 5-6 years, the task of the children to enter rice into liters to be invited (hatchery) after completion of the rice-rice submission was distributed to the community to be used as seeds, the community believes that the invited rice will bring blessings. This is a form of ethnomathematics that can be used for relationship learning and function.

The implementation ethnomathematics can improve the quality of students' mathematical thinking responses during mathematics learning [11]. This is, according to Widada students utilize the right contextual learning media according to their needs [12]. It can improve students' ability in the process of achieving mathematical concepts and principles and improve student learning completeness.

Thus, we implement IBL and ethnomathematics in mathematics learning. The aim is to increase the ability of mathematical representation for senior high school students.

2. Methods
This study has provided treatment in the form of inquiry learning (LI) and ethnomathematics (E). We apply an experimental approach with 2x2 factorial designs. The first group was treated (LI, E), the second group was (LI, nE) with nE = non-ethnomathematics, the third group got (LC, E) with LC = conventional learning, and the last group was (LC, nE). The four groups are taught by the same teacher. The treatment lasts for four weeks, using the same duration for each group. The population is all students of SMA N 2 and SMA N 5 South Bengkulu. The sample was selected with a random sampling technique of 67 students. The instrument is a test of mathematical representation ability. Data were analyzed by ANCOVA, covariates were students' initial abilities.
3. Result and discussion
The data of experimental were analyzed using ANCOVA statistics. It was done by controlling the initial ability of students. Prerequisite tests were performed to determine the homogeneity of variances and the parallel of the regression. The results are presented table 1.

**Table 1.** Levene’s test of equality of error variances.

|   | F   | df1 | df2 | Sig. |
|---|-----|-----|-----|------|
|   | 0.574 | 3   | 60  | 0.065 |

Based on table 1, the Levene’s test shows variance errors with $F = 0.574$, df $(3, 60)$ and p-value $= 0.065 > 0.050$. The means that Ho is accepted. It can be concluded that the average parameter of the four groups of sample data is to have the same variances.

**Table 2.** Tests of between-subjects effects.

| Source          | Type III Sum of Squares | df | Mean Square | F     | Sig. |
|-----------------|-------------------------|----|-------------|-------|------|
| Corrected Model | 106.234                 | 7  | 15.176      | 108.69| 0.000|
| Intercept       | 5.164                   | 1  | 5.164       | 28.963| 0.000|
| A * B           | 0.326                   | 3  | 0.109       | 0.524 | 0.765|
| X               | 21.737                  | 1  | 21.737      | 158.151| 0.000|
| A * B * X       | 0.123                   | 3  | 0.041       | 0.289 | 0.735|
| Error           | 7.952                   | 56 | 0.142       |       |      |
| Total           | 3269                    | 64 |             |       |      |
| Corrected Total | 115.243                 | 63 |             |       |      |

The table 2 is a summary of the regression alignment analysis of the four treatment groups. The description is as follows.

Column A * B * X in Table 2 obtained a count of $F = 0.241$ with df $(3, 56)$ and p-value $= 0.289 > 0.05$. This shows that Ho is accepted. This result can be concluded that the regression coefficients of the four groups are homogeneous. This means that the four regression equations are parallel.

Because the prerequisite test is fulfilled, namely that the variance of the four groups is the same, and the regression equation of the four groups is parallel, then the statistical test can proceed.

**Table 3.** Estimates parameters.

| Parameter | B     | Std. Error | t     | Sig. |
|-----------|-------|------------|-------|------|
| LI, E     | 1.201 | 0.172      | 6.983 | 0.000|
| LI, nE    | -0.436| 0.14       | -3.114| 0.005|

See table 3 on the second line (LI, E), it was an analysis to compare the mathematical representation ability of students who are subjected to the treatment of inquiry and ethnomathematics learning with conventional learning groups and ethnomathematics. Statistics show that $t = 6.983$ and p-value $= 0.000 < 0.05$. This means that Ho is rejected. Therefore, if students are given ethnomathematics teaching materials, then the ability of students' mathematical representation taught with the inquiry learning model is higher than students taught conventionally. On the other hand, the t-test in the line (LI, nE) is an average comparison analysis of the ability of students given non-ethnomathematics mathematics material. Statistical test results showed that $t = -3.114$ and p-value $= 0.032 < 0.05$. Also means Ho is rejected. Thus, if students learn without ethnomathematics, then the ability of mathematical representation of students taught will control covariates, namely the initial ability of students.
The results of this study were suitable with [13], that students who were instructed through inquiry-based learning scored higher than those instructed through traditional methods. According to the inquiry-based learning have improved the learning outcomes of students [7]. The inquiry-based learning is based on scientific principles, it is a teaching method which can be used in other disciplines to promote discovery. The inquiry based learning focuses on knowledge construction [14]. It is engages students’ analytic and critical-thinking skills [6]. The implementation, according to begins with content and experiences that may be familiar to students, so that they can make connections to their existing knowledge structures [15]. Therefore, learning ethnomathematics becomes important to be combined [4].

Thus, inquiry learning by approaching ethnomathematics material has a positive effect on improving student learning outcomes. Students have a good level of understanding after participating in the learning [11].

4. Conclusion

The implementation of ethnomatematics-based mathematics materials has a positive impact on students' mathematical abilities. It is a mathematical representation. The ability of students taught with inquiry learning models is better than conventional. Statistical analysis controls the initial ability of mathematical representations, and the result is that: for the given of ethnomatematics-based mathematics material, students' mathematical representation abilities taught by inquiry learning models are higher than students taught with conventional learning. Conversely, for students who are given non-ethnomathematics mathematics material, students' mathematical representation abilities to be taught with inquiry learning models are lower than students taught with conventional learning.

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