



The Influence of a Realistic Mathematics Approach Based on Local Wisdom on Improving Elementary School Students' Mathematical Numeracy Abilitt

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ABSTRACT

The aim of this research is to comprehensively describe the influence of a realistic mathematics approach based on local wisdom on elementary school students' mathematical numeration abilities. The research method used was quasi-experimental, with a posttest control group research design. The population in this study were all state elementary school students in class V odd semester of the 2022/2023 academic year in Ternate City. The sample involved 124 students spread across two elementary schools based on experimental and control levels and classes. The instruments used include mathematical numeracy ability test items and student attitude scale guidelines. Data analysis was carried out quantitatively and the statistical tests used were the t-test, Mann-Whitney test, and two-way ANOVA test. Next, to find out the average increase in students' mathematical numeration abilities, namely by using the mastery level and normalized gain test (N-Gain). Based on the results of data analysis, it shows that learning factors have an influence on increasing students' mathematical numeration abilities, namely where the normalized gain test (N-Gain) was obtained at 0.58 with a class average value of (62.82%), but there was no interaction between the learning approach and the students' KAM (initial mathematical ability) category. When viewed from Meltzer's classification, the overall increase in students' mathematical numeracy abilities is included in the high category. The conclusion is that there is an increase in the achievement of each indicator of students' mathematical numeracy abilities through a realistic mathematics approach (RML) based on local wisdom (LW) which is better than conventional/usual learning.

Keywords: *Improvement, local wisdom, mathematical numeration, PMR*

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INTRODUCTION

The shift in the educational paradigm in Indonesia, which directs students to be able to use their knowledge in solving everyday life problems, has become the government's concern. This, along with current advances in science and technology, is one of the reasons that students need to master mathematics. This demand is in line with the Independent Learning curriculum program (Chemla 林, 2022; Di Lonardo Burr dkk., 2022; Pelland, 2020), namely equipping and preparing a strong young generation to have the ability to live as individuals and citizens who are productive, creative, innovative and effective and able to contribute to the life of society, nation and state. Meanwhile, Umar (2017) revealed that mathematics have role big in progress knowledge knowledge And technology Because own superiority And its efficacy.

Without realizing it, mathematics seen as something knowledge knowledge with pattern think Which systematic , critical, logical, careful and consistent, and demands creativity and innovative (Chrisomalis, 2021; Hartatiana dkk., 2024; Jayanti dkk., 2021). Even though many people think that mathematics has abstract objects, various concepts and theory mathematics appear And arranged from phenomenon/situation real For help solve problem. In other words , mathematics contains concepts and ideas that are connected to everyday life, which aims to develop and solve problems encountered. Sutawidjaja (2013) said that school mathematics is an important learning material in order to educate the nation's life, so that the abilities that can be developed are not limited to students being able or skilled at applying mathematics, but rather students must have the ability to solve problems.

Marpaung (2013), said that the quality of education in general is still low, especially the quality of mathematics education. Students' mathematics achievements both nationally and internationally have not been encouraging. The implication is that the learning process that occurs in the classroom is generally mechanistic in nature which only produces instrumental understanding. Students are not empowered to think, even the only abilities developed are the ability to memorize, resulting in students being very weak in mathematics . Jennings (Gowers & Schreiber, 2024; Huencho & Chandía, 2023; Krylov & Tuganbaev, 2021) said that most students have difficulty applying mathematics to real life situations, this is what makes it difficult for students to understand mathematics.

One of the abilities that is identical in studying mathematics is mathematical numeracy ability. Mathematical numeracy ability is the ability to apply number concepts and skills operation count in in life daily. This is in line with Armiana's opinion, et al. (2021), which states that mathematical numeracy ability is the ability to collaborate knowledge And understanding mathematical in a way effective For face various type challenge life daily. Meanwhile, Central Books Ministry of Education and Culture (2021) defines numeracy as ability think use concepts, procedures, facts, and mathematical tools For finish problem daily in various forms, contexts and situations.

In other words, mathematical numeracy ability is the ability to understand and use mathematics in various ways context for solving problems, as well as being able to explain to others how to use mathematics.

A number of view in on confirm that ability mathematical numeration is matter Which very important for student, No only in limitation activity learning in class, but Also For bridge student with situation world real. Utari, et al. (2017) say that Mathematical numeracy skills are very important for student Because mathematics Alone related tightly with various aspect life man . Other authors, Inayah , et al. (2019) view that learning oriented numeracy student mathematics can know role mathematics in world real And as base consideration And determination decision Which needed by public.

However thereby, fact d in related fields students' numeracy abilities in Indonesia have not reflects satisfactory results. Results PISA final Which followed Indonesia on year 2018 show that students' mathematical numeration abilities are still low. Matter This seen from ability score mathematics student Which Still is below the average value of ASEAN countries and average OECD value (2019). This is also reinforced by the results Assessment Competence Minimum (AKM) For held at the elementary school level government Indonesia in 2022 shows that nationally numeracy ability student mathematics is at in lower ability minimum (Chemla, 2022; Oyejide dkk., 2023; Sravya dkk., 2022).

The low ability numeracy mathematical student Of course become problem Which need resolved together by various stakeholders in the education sector. It means, role Teacher in effort repair And increase ability Students' mathematical numeracy becomes a very important thing crucial. By operational, Teacher own more time and space together students in learning activities in class, so that important for Teacher For Can plan treatment learning which is so annoying can increase ability mathematical numeration student. Election, planning, And implementation treatment learning Which intended Of course just No Can done in a way spontaneous, let alone careless. In this case, mathematics learning must accommodate the formation of numeracy abilities students' mathematics, because this ability is very essential and useful for students now and in the future.

In on the other hand, a realistic mathematical approach based on local wisdom is a way of teaching and learning that gives students the opportunity to construct their own knowledge through examples of images that are in accordance with local wisdom (Fellner dkk., 2022; Lin dkk., 2020). Teachers guide students to rediscover mathematical concepts through a horizontal mathematization process and vertical which ultimately leads students to understand the concept. Students are given contextual examples of fraction concept material which is closely related to local wisdom, as an effort to motivate students to construct models of fraction concepts, so that students optimize the development of reasoning, it is hoped that from an early age students' thinking potential begins to develop. Armiana, et al. (2021) revealed that developing

students' mathematical numeracy and curiosity from the start is very necessary, because these are valuable skills for life in the future.

Learning mathematics through a realistic mathematics approach based on local wisdom allows students to develop mathematical numeracy skills (Manche dkk., 2023). Because through the local context it will be easy for students to understand, translate the context and then represent it in the form of a model. Both models with simple shapes (model of) and tall models (model for). The context of local wisdom will bring students from the world of reality, namely the environment known to students, into mathematics. (Primasari dkk., 2019) stated that mathematics becomes fun because in its context a learning trajectory will occur. Thus, learning mathematics using local contexts is expected to be able to overcome students' difficulties in learning mathematics. Students build and develop mathematical numeracy based on mathematical concepts, because these concepts come from local wisdom that students know and understand and are not something that is separated from students' real lives (Mata dkk., 2021; Mutiara dkk., 2021; Vaiopoulou dkk., 2024). Furthermore, learning mathematics through local wisdom, students create representations of the models they know in written form and then communicate them among students in oral form. Models are expressions of what students know and understand, the result of translating the local context into simple language, and finally arrives at formal symbolic language. Simple models and formal models are mathematical numerations in written form which students then communicate orally through presentations or class discussions.

Learning mathematics with a mathematical approach Realism based on local wisdom can encourage students to search for and find algorithms, and analyze and compare whether the resulting model is an algorithm that is fast and short in determining answers (Larsson, 2021; Pérez-Rúa dkk., 2020). Is the resulting algorithm superior to other algorithms? This means that when the teacher introduces the concept of fractions $\frac{1}{2}$ and $\frac{2}{3}$, but it is difficult for the child, the teacher will connect it to the local context of the child's daily life so that it is easier for them to understand. For example, give an example with food ownership: "Father gave my sister $\frac{1}{2}$ of the Lapis Tidore cake, then Mother also gave my sister $\frac{2}{3}$ of the same type of cake (Rocha dkk., 2020; Trimble, 2021; Zhou dkk., 2021). How much is Lapis Tidore cake now, bro?" Of course, students will more easily understand the concept of fractions which are presented in the context of stories based on real life stories. This is the context presented in the implementation of this research.

On the other hand, State Elementary Schools 15 and 44 in Ternate City are two schools that have been accredited with levels A and B. Of these two State Elementary Schools, since 2015, learning has been implemented using a realistic mathematical approach. During the implementation of learning with a realistic mathematics approach, the teaching and learning process was not optimal. Learning still tends to be carried out conventionally and mechanistically, where the teacher dominates learning, so that students pay a lot of attention, listen and imitate what the teacher explains. Teachers do not give students enough opportunities to develop mathematical

numeracy and are less active in carrying out learning activities that are in accordance with realistic mathematical principles (Aldila Afriansyah dkk., 2021; Ancheta-Arrabal & Segura, 2022; Johari dkk., 2023). The teacher's task as a facilitator, guide and guide of students to rediscover mathematical concepts does not occur. Teachers feel unable and difficult if they do not immediately explain and give examples of solving problems to students. So, teaching with this pattern affects important aspects such as attitude creativity that must be formed in students is neglected. The conclusion is that so far teachers have taught by explaining fractions, however does not emphasize understanding concepts let alone level thinking abilities tall.

Objective facts in the field show that teachers generally view mathematics as merely a tool for solving problems related to calculations. Mathematics learning in class is limited to teachers exposing concepts through examples, students listening to explanations and imitating the teacher's work. Students are relatively passive individuals, not creative, and can only work if there is an example (Erhardt dkk., 2020; Fiangga dkk., 2021; Zhu dkk., 2022). The critical attitude that must be reflected in daring to express opinions does not appear in class. Students rarely ask questions, students are rarely given the opportunity to communicate ideas mathematically in class. Thus, this research focuses on a comprehensive description of the influence of a realistic mathematics approach based on local wisdom on elementary school students' mathematical numeracy abilities from the school level.

Matter This intended For give description comprehensively related ability mathematical numeration student fifth grade elementary school in the two schools studied . With thereby, results this research not only become information Which nature general related ability students' mathematical numeracy , but is also expected to be able to become reference And consideration for teacher and researcher furthermore in determine strategy and/or approach appropriate learning for students For increase ability numeracy student mathematics .

RESEARCH METHODOLOGY

method used was quasi-experimental, with a posttest control group design. The population in this study were all State Elementary School students in class V odd semester of the 2022 / 2023 Academic Year in Ternate City. This research design is illustrated as follows : versus conventional learning (CL).

The sample involved 124 students from two public elementary schools in Ternate City, spread across two elementary schools based on school level . between the experimental class and the control class. Sample Which chosen use technique random sampling class , Which done without random individual , keep attending class Which Already There is. School Which set is elementary school Country 44 Ternate City North as control class and SD Negeri 15 South Ternate City as the experimental class. The experimental class received realistic mathematics learning (RML) based on LW and the control class received conventional learning (CL).

The instruments used in this research include mathematical numeracy ability (MNA) test items and student attitude scale guidelines. Observation data was obtained from the student attitude scale questionnaire given at the end of the lesson. Next, the data was analyzed quantitatively and the statistical tests used were the t -test, the Mann-Whitney test, and the two-way ANOVA test. To find out the average increase in students' KNM, namely by using the mastery level and normalized gain test (N-Gain) first, before using this combined statistical test.

RESULT AND DISCUSSION

RESULT

1. students' mathematical numeration abilities (MNA).

The results of the KNM data analysis for experimental class and control class students consisting of pre-test data, normality test data, and two-mean difference test data based on learning can be shown in the table below.

Table 1. Recap of Pretest Test Results for Students' Mathematical Numeracy Ability

School Level	Learning	N	Pretest Score		Normality	Mean Difference Test (Mann-Whitney Test)
			Average	SB		
Tall	RML based LW	31	6.36	2.73	abnormal	Significantly different
	CL	30	8.73	3.97	Normal	
Currently	LW based RML	33	4.89	3.15	Abnormal	Not significantly different
	CL	30	4.91	3.35	Abnormal	

Based on Table 1, it appears that at the high school level the average pretest of students in the control class who received conventional learning (CL) was higher compared to the experimental class who received PMR based on local wisdom (LW), while for the middle school level the average pretest of experimental class students was not. very different from students in PK class. Apart from that, the normality test results for high school level in the experimental class show a probability value (sig. 2-tailed) less than the significance level $\alpha = 0.05$, which means that the data is not normally distributed, whereas for the control class the probability value (sig. 2 -tailed) is more than the significance level $\alpha = 0.05$, which means the data is normally distributed. For medium school level, the two classes, namely the data, are not normally distributed. Because one or both of the data is not normally distributed, the Mann-Whitney non-parametric statistical test is used to test the difference

between two means . From the calculation results for the high school level, the probability value (sig. 2-tailed) is obtained which is less than the significance level $\alpha = 0.05$, which means that there is a difference between students in the KL-based PMR class and the control class, while for the medium school level the probability value (sig. 2-tailed) is more than the significance level $\alpha = 0.05$, which means there is no difference between students in the KL-based PMR class and PKV (control class).

Table 2. Recap of Post-Test Test Results for Students' Mathematical Numeration Ability

School Level	Learning	N	Posttest Score		Normality	Mean Difference Test (Mann - Whitney Test)
			Average	SB		
Tall	LW based RML	31	58.80	9.17	abnormal	Significantly different
	CL	30	48.22	7.15	Abnormal	
Currently	LW based RML	33	62.82	9.81	Normal	Significantly different
	CL	30	45.35	9.85	Abnormal	

From Table 2 it is known that at the high school level, the average mathematical numeracy ability of the group of students who received realistic mathematics education based on local wisdom was 58.80, higher than students who received conventional learning, which was 48.22. Likewise, at the medium school level, the average mathematical numeracy ability of the group of students who received realistic mathematics approach learning based on local wisdom was 62.82, higher than those who received conventional learning, which was 44.37. After testing the difference between the two means of the four sample groups, the results showed that both school levels, both high and medium school levels, had significant differences in mathematical numeracy abilities between students who received realistic mathematics approach learning based on local wisdom and students who received conventional learning.

Table 3. Recap of N-Gain Data Test Results for Students' Mathematical Numeracy Ability

Levels School	Learning	N	N-gain		Statistic test Normality	Mean Difference Test (Mann-Whitney Test)
			Average	SB		

Tall	LW based	31	0.52	0.09	Normal	Significantly different
	RML					
	CL	30	0.44	0.07	Abnormal	
Currently	LW based	33	0.59	0.103	Normal	Significantly different
	RML					
	CL	30	0.39	0.097	Abnormal	

Table 3 above shows that for high school level and medium school level, there is a difference in the increase in mathematical numeracy abilities of students who receive realistic mathematics approach learning based on local wisdom and students who receive conventional learning. This means that the improvement in mathematical numeracy skills of students who receive realistic mathematics approach learning based on local wisdom is better than students who receive conventional learning in terms of high school and medium school levels.

2. Student Attitude Questionnaires

The following are the results of analysis of data on achievement of filling out attitude questionnaires based on school level for students in realistic mathematics approach classes based on local wisdom and control classes or conventional learning consisting of pre-test data, normality test data, and two-mean difference test data based on learning, which can be presented in table below.

Table 4. Recap of N-Gain Data Test Results for Student Attitude Scale

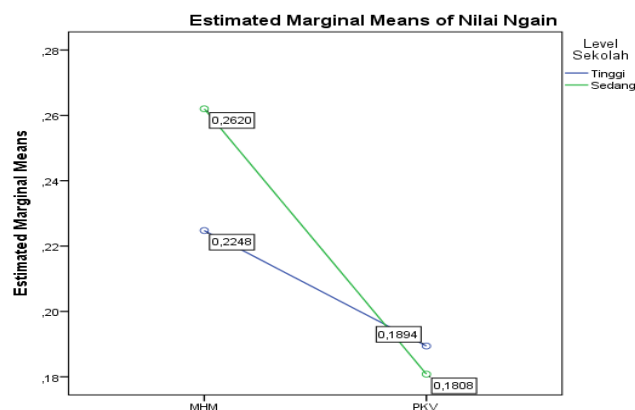
Levels School	Learning	N	N-gain		Statistic test	Mean Difference Test (Mann-Whitney Test)
			Average	SB	Normality	
Tall	RML is based on local wisdom	31	0.52	0.09	Normal	Significantly different
	Conventional	30	0.44	0.07	Abnormal	
Currently	RML is based on local wisdom	33	0.59	0.103	Normal	Significantly different
	Conventional	30	0.39	0.097	Abnormal	

From the results of statistical tests, it appears that at the high school level, the increase in the student attitude scale is significantly different, meaning that the increase in the attitude of the group of students who receive a realistic

mathematics approach based on local wisdom is better than the group of students who receive conventional learning. This is different from the medium school level, where the increase in student attitudes is not significantly different, meaning that the increase in attitudes of students who receive a realistic mathematics approach based on local wisdom is no different from the group of students who receive conventional/ordinary learning.

3. The Interaction Effect between a Realistic Mathematics Approach Based on Local Wisdom and School Level on Student Attitude Scales

To determine whether or not there is an interaction effect between learning and school level (high and medium) on improvement Student attitudes were carried out using a two-way ANOVA statistical test. This is based on the basic assumption that if the data is normally distributed then it is necessary to carry out a two-way ANOVA test. However, based on previous data, it shows that the average increase in student attitudes based on school level is not normally distributed, so the two-way ANOVA test cannot be carried out. Thus, analysis of the influence of interaction on data on improving student attitudes was carried out descriptively from the resulting graph. The results are as follows.



From the graph it appears that the average attitude has increased students who receive realistic mathematics learning based on local wisdom are higher than conventional learning (CL). However, middle school level students who received a realistic mathematics approach based on local wisdom experienced significant improvements compared to high school level students. The two lines seen in the graph appear to intersect each other, this shows the influence of the interaction between learning and school level on improving students' attitudes towards learning.

DISCUSSION

The results of the research show that students who receive realistic mathematics approach learning based on local wisdom are more likely to develop mathematical

numeracy skills along with students' curious attitude towards mathematics. In other words, the role of a realistic mathematics approach based on local wisdom is superior to conventional learning in developing students' mathematical numeracy abilities. This is similar to the results of the summary of N-Gain data analysis of students' mathematical numeracy abilities presented in Table 3 above, showing that the average increase in experimental class students who received realistic mathematics approach learning based on local wisdom was greater than control class students who received conventional learning. Thus, it is concluded that there is a significant difference in improving the mathematical numeracy skills of students who receive a realistic mathematics approach based on local wisdom and students who receive conventional learning in terms of high and medium school levels. The rationale above can, among other things, be explained as follows: that in the implementation of a realistic mathematical approach based on local wisdom, students collaboratively carry out mathematical thinking habits to solve contextual problems given by the teacher. These mathematical thinking habits help students build knowledge and at the same time develop mathematical numeracy skills. A positive attitude/ habit of mathematical thinking as above, if continued continuously, will provide opportunities for mathematical numeracy skills and the growth of an attitude of curiosity. students towards mathematics learning.

The student's attitude or habit of curiosity that is built through learning a realistic mathematics approach based on local wisdom is identifying problem solving strategies that can be applied to solve problems on a wider scale and asking themselves whether there is "something more" than the mathematical activities that have been carried out. This attitude allows students to build knowledge or develop their own mathematical numeracy skills to solve problems. Such attitudes or habits are in line with the philosophy of constructivism. According to Sutawidjaja (2013), constructivism assumes that students must construct their own knowledge. Such habits enable students to develop the potential for high-level mathematical thinking or HOTS. Constructivism and mathematical numeration skills have the same idea or keyword, namely constructing or creating. Individuals are said to be creative in developing mathematical numeracy if they are able to create or construct themselves. On the other hand, Haji (2005) said that learning with the PMR philosophy is part of the process of high-level mathematical numeracy skills.

This study also found that there was an interaction effect between a realistic mathematics approach based on local wisdom and the school level on students' attitude scales. On the other hand, students in the experimental class who received realistic mathematics learning based on local wisdom had better curiosity than students who received conventional learning. These findings indicate that learning with a realistic mathematics approach based on local wisdom is relatively suitable for developing the mathematical numeracy abilities of students as a whole or both groups of students. In addition, such learning tends to be more suitable for developing students' attitude scales in learning mathematics.

CONCLUSION

Based on the results of data analysis, findings and discussion, it can be concluded that the implementation of a realistic mathematics approach based on local wisdom shows a superior role compared to students who receive conventional learning. In other words, there is a difference in the increase in mathematical numeracy abilities of students who receive realistic mathematics learning based on local wisdom and students who receive conventional learning. On the other hand, students in the experimental class who received realistic mathematics learning based on local wisdom had a better positive attitude towards mathematics than students who received conventional learning (CL). There is an interaction effect between learning with a realistic mathematics approach based on local wisdom and school level on the scale of students' positive attitudes/curiosity.

The implication of this research is that the implementation of a realistic mathematics learning approach based on local wisdom provides greater benefits to students in developing mathematical numeracy skills or other mathematical abilities, and students' positive attitudes/curiosity towards mathematics.

From the conclusion And implications on, suggested, right ? that there is the influence of a realistic mathematical approach based on local wisdom significant on improving the mathematical numeracy abilities of elementary school students is reviewed from school level. With thereby, Realistic mathematics education based on local wisdom potential applied in school in effort improve quality mathematics learning in elementary school. Meanwhile, for support success implementation realistic mathematics education based on local wisdom required material teach Which more interesting, problem contextual designed so that challenge so that trigger happen conflict cognitive Which can develop mathematical numeration skills, as well as students' curiosity towards the material being developed.

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