How mathematics attitude of mothers in rural area affects their children’s achievement

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Abstract. Math attitude has been considered as the essential variable determining students' math achievement. It has been perceived that mothers and children math attitude play a significant part in children math achievement. Therefore, the purpose of this study was specifically to describe the role of the mother in assisting their children’s math achievement. This research was conducted in Manggarai Regency, a rural area in East Nusa Tenggara Indonesia to investigate how mother’s perspective and attitude about mathematics can help their children to shape their idea about math and lead them to shape their math attitude. Most families here are from low-income communities and have low levels of formal education. Total 90 students of the age ranging from 9 to 12 (4th to 6th grade) selected based on their mathematics test achievement and their mothers participated in the study. Four mothers who felt able to communicate were investigated further through interviews. Data were obtained through mathematics achievement test results, questionnaire, and an interview. The data analysis and interpretation showed that mothers' perspective and attitude about mathematics affected their children's math attitude. Although the relationship were not very strong, the significant relationship between these two variables should be acknowledged. Mothers with better math attitude performed better to assist their children's math achievement. Parent especially mother serve as consistent role models for their children as the children closely observe the mothers' attitude. The math attitude is shown to the children in the way the mothers consider mathematics as a valuable and understandable subject. Students can get a better learning result if besides supported by teachers' quality of teaching, and they also receive full attention from their mothers on what they are learning. The findings lead to the recommendation to design an activity to engage parents especially mother in the math activities in school so that they can support their children at home.

1. Introduction

Vygotsky theory stated that children's intellectual development is highly influenced by child’s social environment [1], meaning mothers' contribution correlates significantly to their children cognitive process and attitude since children first education comes from family. When they enter school, education system, in this case, teachers join in the process of improving students' knowledge and attitude. Some studies revealed that better learning result can be achieved by the students only if they are supported by the teachers and their parents including mothers [1-8]. It was explained that when all
The home environment comprises of various motivational variables, but the most relevant one involves the mothers [9]. Mathematics achievement is affected by children’s attributes and behaviours, which is primarily influenced by parental involvement [5]. Although parents can make a difference in their children’s mathematics performance, they may encounter challenges when trying to provide such support. This is especially true when parents have low levels of formal education or come from communities who have low-income. Mistretta [10] explained that poor and less educated families can struggle with family engagement because of limited time due to multiple jobs, trouble speaking national language, and difficulty feeling comfortable in the school community.

Math attitude has been considered as the significant variable determining students’ math achievement [11]. Math attitudes and achievement are particularly noted as benefiting from home influences [10]. Many studies that discuss how a child's attitude towards mathematics affects his mathematical learning outcomes. But it can not be denied that the attitude of the child is greatly influenced by the environment especially by parents who raise them. In particular, Mother plays a crucial role in shaping the attitude of a child. Home environments that nurture children's self-confidence help minimize math anxiety levels and, in turn, positively influence children's academic success [12]. The last two decades, mathematics researchers conducted studies about the role of parents in developing positive mathematics attitude of students and how this related to obtain better math achievement. Specifically, there have been number of studies showed that both mothers’ and children' math attitude play an important role in students’ math achievement [1, 7]. It has been observed that family’s involvement, particularly mothers in their children's education correlates significantly with their children's success at school. The purpose of this study was to describe the role of the mother in assisting their children’s math achievement. Mother and child interactions were specifically studied since preliminary research showed that mothers in the rural area, despite their lack of understanding of mathematics, usually help their children finish their homework. This research was conducted to investigate how mother’s perspective and attitude about mathematics can help their children to shape their idea about math and lead them to develop their math attitude.

Specifically, the following research questions were addressed: (1) was there a significant relationship between mothers’ math attitude and children’ mathematics achievement; if yes, how large was the correlation coefficient?, (2) could mathematics achievement be significantly predicted by their mothers’ mathematics attitude?

2. Math Attitude

Math attitudes are defined as a composite measure of one's feelings and emotions towards mathematics consisting of value, self-confidence, enjoyment and motivation. Value of mathematics is defined as someone's beliefs on the usefulness, importance and worth of mathematics. Pleasure refers to the degree students like doing mathematics exercise. Motivation is defined as someone’s interest in mathematics and intentions to pursue studying mathematics [13]. In other words, students’ positive attitudes towards mathematics can improve their willingness to learn mathematics, while their negative attitudes may cause the resistance of it [14, 15]. It can be concluded that math attitude refers to a personal tendency to like or dislike mathematics; to deal or evade from any scientific activities during school, and their motivation regarding the usefulness of mathematics in their present or future life.

There is a strong connection between math attitudes and achievement and home influences [5, 9, 10]. Many studies have discussed how children's attitude towards mathematics are influenced by their home environment especially from their parents since they closely observe their parents attitude. The positive attitude towards mathematics can significantly improve their mathematical learning outcomes.

There have been some investigations assessing the relationship between the attitudes towards mathematics and the approaches of parents. Children adopt many views of their parents because they take them as role models. The attitude towards mathematics has been known to be affected by the
relationship between parents and children [1, 10, 12]. Researches showed that parents’ especially mothers' attitudes towards mathematics could in some way influence their children’ attitudes and mathematical achievement [7, 11, 16]. They suggested that developing positive attitudes towards mathematics would be an essential aim in the education of primary school student and this positive attitude was strongly affected by their parents. This study was specifically designed to investigate how mother math attitude can improve their children math achievement.

Mother's math attitude is defined as mothers feeling and emotions about how they consider mathematics as a valuable and understandable subject so they can improve their children perspective towards mathematics especially self-confidence, enjoyment, and motivation regarding math tasks or math tests. Mother's attitude towards mathematics was constructed as a consequence of her past experiences regarding mathematics, and it is the tendency of behavioural preparation rather than observed behaviour.

3. Method
This research was conducted by using a quantitative research approach. Since the purpose of the study was to discover the relationship between mothers’ math attitude and mathematics achievement, then this research used correlation research design. Besides, the research aimed to examine whether maternal math attitude can be used for predicting a student’s math achievement.

This research was conducted in Manggarai, a rural area in East Nusa Tenggara, Indonesia. Total 90 students of the age ranging from 9 to 12 (4th to 6th grade) were selected based on their mathematics test achievement, and their mothers participated in the study. While filling out the questionnaire, the researcher separately interviewed four selected mothers to obtain a better understanding of their attitude and perspective towards mathematics. Data were collected through mathematics achievement test results, questionnaire, and an interview.

4. Measures

4.1. Attitude Questionnaire Maths
The scale was adapted from Attitude Questionnaire Maths developed by the Faculty of Education, University of Cambridge. This questionnaire was designed to assess each construct as a subscale of the questionnaire. The inventory consisted of 25 statements regarding students' perceptions about their math ability, value, enjoyment and relevance of math in their everyday lives specifically to measure students, math attitude and anxiety. Since the purpose of this research was to know specifically only about mother's math attitude, the researchers adapted it. The modified questionnaire consisted of 25 statements is used to measure mothers’ math attitude only. Researchers provided questionnaire in Indonesian language and all the statements in English could be seen in Table 1.

| No | Statements |
|----|------------|
| 1  | The math that learnt at school is useful in other subjects |
| 2  | Understanding the maths is important to anyone |
| 3  | Math is boring |
| 4  | I believe my children can usually manage the maths they do at school |
| 5  | I'd like a job or activity that involves using maths |
| 6  | Many of the things in math are useful in daily life |
| 7  | I like assisting my children in learning maths. |
| 8  | I help my children think things through in maths until they’re clear to my children. |
9 I find maths difficult.
10 I sometimes do something related to maths ever since I leave school.
11 School maths is relevant to life in today’s world.
12 I look forward to doing maths.
13 I like to explain the thinking behind the maths while helping my children study.
14 I’m good at maths.
15 I avoid maths since I left school.
16 I can teach maths well without really understanding it.
17 Everybody will need to know some maths in their adult life.
18 I find maths interesting.
19 Even when it gets hard, I can help do my children maths work.
20 I’ll support my children to carry on studying maths when the time comes to choose.
21 I help my children to make sense of what they are learning in maths.
22 I encourage my children that learning maths is vital for getting a job in the future.
23 I enjoy assisting my children studying maths.
24 I always support my children when maths course becomes harder.
25 I realize the importance of mathematics in my children's future careers

4.2. Interview
Quantitative data collection can employ interview approaches, by using more closed-ended procedures in which the researcher identifies set response categories [17]. Data were collected with semistructured interviews since the interview is considering as one of the most powerful ways in which researchers try to understand fellow human beings. The one-on-one interview approach is used since during the data collection process the researcher asked questions to and records answers from only one participant in the study at a time.

4.3. Math Achievement test result
Children’s math score in school final examination was taken as math achievement test results. This math score report become a reference to determine students' mathematical achievements.

5. Procedure
This research was conducted in Manggarai, a rural area in East Nusa Tenggara Indonesia 2018. The researchers personally approached mothers who met the criteria of researchers who have children aged 9-12 years, have varying educational backgrounds, and different levels of income and willing to be participants in the research. The Researchers explained the purpose of the study to all mothers in Manggarai who willingly participated in the process of data collection and have children from grade 4 to 6. Firstly, the researcher asked for the mothers' permission to also allow their children to be part of the study. After mothers agreed, they were provided with the questionnaire and their children math test results were collected.

After filling out the questionnaire, the researcher asked four mothers who felt able to communicate well to be investigated further through interviews. The researchers employed a semistructured interview with a few questions based on the circumstances that occur in everyday life related to the mother's attitude pertaining to mathematics and how the mothers play a role in shaping the mathematics attitude of their children. The subjects were tested on these dimensions with the measures mentioned earlier. The scoring was carried out according to the standardised manuals of the respective tests. The data were analyzed using SPSS (20.0 version), and the researchers interpreted the results.
6. Result and discussion

6.1. Results
Data analysis and interpretation showed that mothers' perspective and attitude towards mathematics had a significant effect on their child's mathematical attitude. As expected, mothers with better math attitude performed better to help the mathematical achievement of their children. Mothers played a consistent role model for their children because their children closely watch their attitude. The positive attitude towards mathematics was shown to children in the way mothers considered mathematics to be a valuable and understandable topic. Besides, students obtained better learning outcomes when the teachers were supportive. The students also received full attention of their mothers about what they learned.

After analyzing the data using SPSS, the correlation coefficient $R = 0.503$ is obtained. It can be interpreted that there was a strong linear relationship between maternal math attitude and children math achievement, i.e. mothers’ attitude towards mathematics significantly affected their children's math achievement. R Square (determination coefficient) shows how good regression model is. Since the determination coefficient is 25.3%, we can conclude maternal math attitude score has contribution 25.3% to children math achievement score.

| Model  | Sum of squares | df  | Mean square | F     | Sig. |
|--------|----------------|-----|-------------|-------|------|
| 1Regression | 1998,097      | 1   | 1998,097    | 29.847| .000 |
| Residual | 5891,059      | 88  | 66,944      |       |      |
| Total  | 7889,156      | 89  |             |       |      |

Table 2. ANOVA Result

Table 2 is used to determine the significance level or linearity of regression. The criteria can be established based on the F test or the significance value test (Sig.). From Table 2, it can be seen that the calculated F value is 29.847, while the F table value can be obtained using table F (0.05 significance level, $v_1 = 1, v_2 = 88$) obtained 3.95. Based on the significance value, it was seen in the 0.000 significance column. Because the calculated $F_{value} > F_{table}$ or significance value is less than 0.05, it can be concluded that the obtained linear regression model can be used.

The data analysis and interpretation based on Table 3 showed that mothers’ attitude towards mathematics significantly affected their children's math achievement ($R = 0.503$). Mothers with better math attitude performed better to assist in their children's math achievement, and it can be predicted by using $Y = 26.840 + 1.092X$.

| Model      | Unstandardized Coefficients | Standardized Coefficients | t    | Sig. |
|------------|-----------------------------|---------------------------|------|------|
| 1Constant  | 26.840                      | 3.135                     | 0.002|
| TotalScore | 1.092                       | .503                      | 5.463| 0.000|

Table 3. Regression Model

Those mothers, who have a positive attitude towards mathematics, visualize success scenarios that provide positive guidance and supports for the performance of their children. Those who doubt their ability envision failure scenarios and dwell on the many things that can go wrong with their children's math performance.

6.2. Discussions
The primary purpose of the present study was to investigate whether there was a significant relationship between mothers’ math attitude and mathematics achievement and how large the
correlation coefficient and whether their mothers' mathematics attitude can significantly predict their children's mathematics achievement. The results show the pathway of parental math attitude toward their child's mathematical achievement. Mothers play an important role model to shape their children math attitude since their children closely observe their attitude, in this case, math attitude in their daily lives. The positive attitude towards mathematics is shown to children in the way mothers consider mathematics to be a valuable and understandable topic. This is consistent with the theory that one tends to think of himself as capable of accomplishing something when people who are deemed to have the same background can solve it. Children tend to think that they can imitate what their mothers do. Students can get better learning outcomes if the quality of teachers' teaching also supports them, they also get the full attention of their mothers about what they learn.

Mothers' opinions about the mathematical abilities of children will greatly affect the children's perceptions of their abilities even though past achievements also have influenced their later mathematical accomplishments. Mothers have a tremendous influence on their children in the areas of academic achievement and career orientation. This study shows the math attitude of mothers contributes 25% to the mathematical performance of their children. Based on the research, it can be said that the academic achievement of children is the result of parental involvement. Based on the results of data analysis, it is found that there is an influence of mathematical attitude of mother to children's math achievement. The results of this study demonstrate that children's math achievement is influenced by the perspective, attitude and behaviour of mothers to mathematics.

To convey a bit more about the nature mothers' responses, extracts from transcripts are presented as illustrations. These extracts, of course, transmit the verbal content and only limited information about other qualities such as gestures, but they do convey much of what the interviews were like. The following is an extract from a mother who scored low on the mathematical attitude, and her child had low math achievement score.

Respondent 1

R : According to Mama, is learning mathematics important?
M1 : Yes
R : Do you like math?
M1 : Hmm.. No. I didn't learn much back then.
R : Do you always pay attention to children's learning at home?
M1 : Yes
R : Did you help guiding children to learn mathematics?
M1 : No, I usually just remind them to study and do their homework.
R : Why not guiding them during the learning?
M1 : Well, you know, I myself don't understand mathematics, so I often ask them to study on their own
R : Do you facilitate children to learn at home?
M1 : No. We [refer to her and her husband] don't prepare a study desk or anything else. Just some basic stuff, like notebooks and pens.
R : After coming back from work in the farm, do you have time to help children to learn?
M1 : Well.. Usually we got home at 5-ish and already tired. We only have them study and do their homework.

Respondent 2

R : According to Mama, is learning mathematics important?
M2 : Yes, because I think it is necessary for everyday life.
R : Do you like math?
M2 : Hmm ... Not really, but at least I'll need it for buying and selling goods.
R : Do you always pay attention to children's learning at home?
M2 : Yeah, sometimes, if I'm not busy.
R : Did you help guiding children to learn mathematics?
M2 : I usually just watch over them, not assisting in their learning.
R : Do you facilitate children to study at home?
M2 : Hmm ... I don't think it's necessary, they can use what is available.
R : After coming back from work in the farm, do you have time to help children to learn?
M2: Nope. I usually do other work directly: take care of livestock, prepare dinner, and do other chores.

The following excerpt offers sharp contrast, with a mother who scored very high on mathematical attitude and her child had high math achievement score.

Respondent 3
R: According to Mama, is learning mathematics important?
M3: I think it's very important, so that later you can get a good job.
R: Do you like math?
M3: Yes, I often use it during social gathering [Arisan]. Our Arisan has money-saving program, and I think math is useful for calculating money and interest.
R: Do you always pay attention to children's learning at home?
M3: Yes, but not every day because I have to do other work, too.
R: Did you help guiding children to learn mathematics?
M3: Sometimes, if I understand about the content being studied. If I don't know, I ask them to study on their own.
R: Why not guiding them during the learning?
M3: It's not that I didn't want to guide, but I couldn't. So I just tried to accompany them to study.
R: Do you facilitate children to study at home?
M3: The best I can do is providing brighter lights in the dining room [used for studying] to protect their eyes.
R: After coming back from work in the farm, do you have time to help children to learn?
M3: Yes, usually after dinner, but not too long. Mostly just to sign their home works as required by the teachers.

Respondent 4
R: According to Mama, is learning mathematics important?
M4: Yes, of course. If you are good at counting, it's easy to trade.
R: Do you like math?
M4: I did like math when I was a student, especially multiplication. But I did not continue to further education back then.
R: Do you always pay attention to children's learning at home?
M4: Yes, I always tell them to study and stop idling around or playing too much.
R: Did you help guiding children to learn mathematics?
M4: Occasionally. My daughter usually can do her homework on her own. So, I just have to check that it's finished or not.
R: Why not guiding them during the learning?
M4: My daughter is pretty good at math, she just needs to be controlled. I usually just accompany her, and if she is confused, I tell her to look at her notes again. But honestly, I couldn't finish the math assignment as well.
R: Do you facilitate children to study at home?
M4: Whenever they ask for it, I try to provide. But it depends on our financial as well.
R: After coming back from work in the farm, do you have time to help children to learn?
M4: Usually I will do some other things because all day I've been in the farm.

Mother's attitudes and behaviors contribute to the motivation and learning outcomes of children. This was supported by interviews with four respondents about "Is mathematics an important subject to learn?". Three of the four respondents explained that math is fundamental to learn because it has an important role and used to complete various problems in everyday life. Mathematics has a vital role in the development of globalization. While one other respondent explained that it is important to learn math because it was beneficial during social gathering (specifically called arisan, when the mothers collect money from the members and take turn to receive the total money – usually monthly). When asked about "Do you like / happy with math? The first respondent explained that she is not too fond of mathematics, while the other three respondents could not answer with the excuse of not understanding mathematics in depth.
On the question of "what do mothers do in helping the mathematics learning achievement of children?" The first respondent explained that parents should do the mentoring, supervision and guidance on children's learning activities. While three other respondents revealed that they are only able to remind children to always learn, and are not able to do supervision or get involved in mathematics learning activities because they do not have knowledge and understanding of mathematics. Besides, the three respondents also explained that the busyness of the work and the grueling factor caused difficulties in accompanying the children. Nevertheless, three of the four respondents have the same perspective that parents’ involvement in supervising, guiding and assisting children in learning also helps in improving the learning achievement of children's math. This finding supports Mistretta's study [10] which is explained that poor and less educated families could struggle with family engagement because of limited time due to multiple jobs, trouble speaking Indonesian language, and difficulty in feeling comfortable in the school community.

The mother as a parent is responsible for every development of learning mathematics of children. Mothers must have sensitivity and attention to the child's learning patterns. This is in line with the results of interviews to the third respondent who said that the caring attitude and mathematical attitudes of parents influence the formation of children's character. Such attitude includes guiding and accompanying children's learning so that it will form the habit of learning. Consequently, the habit of building good studying schedule will affect the success of children's learning. Mathematics learning is considered as social activity involving more than one parties to increase their higher order thinking skills [18], namely students itself and in this case their mothers. The existence of a mother does not have to be in her role to teach mathematics content, but can also be as a friend to discuss a mathematical problem, or as a supporter when the child is doing math assignments. The existence of the mother in the learning process motivates the child to continue in his/her effort to learn math because he knows he has the full support of others so that he can reach his maximum potential.

Parents, particularly mothers around the world, have huge contributions to children's Mathematics learning. They usually provide the resources to improve their children's performance in learning math [1,2,3]. Besides, the ideal role of a mother in such situation is that she should be actively involved to supervise the children while learning math. To achieve this, a mother has to be able to analyze the children's need. Identifying her children cognitive domain seems really important as it relates with their ability to solve a problem. Furthermore, a mother has to have a concern on the children's task, the encouragement on motivating them to learn, and may also be capable to have the solution in solving the problem. Students can get a better learning result if besides supported by teachers' quality of teaching, and they also receive full attention from their mothers on what they are learning.

From the result of data analysis, it is found that there is a contribution between math attitudes of mother to children' math achievement, but the connection is not very strong. This is in line with the statement of Pesu in [2] the role of mothers’ beliefs about their children mathematics ability which is dependent on the level of the mothers performance: mothers beliefs were positively related to their children’s self-concept of mathematics ability among high-performing children but less so among low-performing ones. There are still other factors or variables that influence children achievement. It shows that there are many factors or other variables that affect the learning outcomes of children. The result obtained also reveals that besides math attitude, the learning result of children is also influenced by the parents’ social-economy background. Even though it is not true for every case, but it could help to design learning activities that accommodate children's background. The results of interviews with the four respondents show that the economic limitations deprive parents to provide facilities that support the learning achievement of children. Nevertheless, they realize that the availability of learning facilities is beneficial for children in supporting children's learning achievement. Even though the relationship was not very strong, the significant relationship between these two components should be acknowledged.
7. Conclusion
The results drawn from this study have significant implications in which mothers play a significant role in their child's academic achievement. Mothers need to understand the emotional state and attitudes of their children to be able to overcome their academic problems. The interaction between mothers and their children dramatically affects the academic performance of their children. Mothers play a crucial role in shaping the personality and development of the child as a whole. With the help of mothers, teachers can find out the factors that improve positive attitude towards mathematics and academic achievement of student; educators can help students succeed in mathematics.

The findings lead to the recommendation to design an activity to engage mothers in the exploration of standards-based mathematics through the school-family partnership program. Parental involvement, through encouragement and monitoring of educational and behavioral activities which is conducive to successful educational outcomes, is considered to be critical factors in academic success. For this reason, educators need to be aware of possible parental influences and should promote and recommend the involvement of parental attention in education. Eventually, mothers should do their best to optimize positive attitudes towards school and learning and the intrinsic academic motivation in students.

It is generally concluded that students’ attitude gives a significant influence on student achievement in learning. It is suggested that mothers should pay attention to how to nurture and improve their children's math attitude. Furthermore, in school, a teacher is advised to create a learning process that can generate and enhance student's math attitude.

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