

# The Use of Oral Questioning in Inculcating Values in Mathematics for Primary School Students

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**Abstract** It is very important to inculcate values in the teaching of mathematics, and one of the ways to inculcate values is through oral questioning. Thus, this study was conducted to explore mathematics teachers' awareness in inculcating values through oral questioning activities. The study also seeks to determine the types of oral questions related to values that are implemented by the teachers in the teaching of mathematics. This case study involved six mathematics teachers from six primary schools in a district in Malaysia, who were selected using purposive sampling method. The data collection comprised of non-participant observations, semi-structured interviews and field notes. A continuous comparative method was performed by the researchers using Atlas.ti 8 software to obtain themes and sub-themes. The study found that the mathematics teachers were aware of the importance of inculcating values in the oral questioning process. In addition, there were three types of value-related oral questions posed by teachers as a way to inculcate values in students, namely oral questions related to pure values, oral questions related to values in daily life, and oral questions related to intrinsic mathematical values. Therefore, mathematics teachers should maximize the use of oral questions as a way to inculcate the values of mathematics so that students can appreciate mathematics more meaningfully while at the same time fostering their love towards mathematics.

**Keywords** Values of Mathematics, Oral Questioning, Mathematics Teacher

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## 1. Introduction

Oral questioning that are carried out in mathematics teaching actually plays one of the major roles in developing

various mathematical skills as well as helping to expand students' thinking to a higher level [1]. [2] posited that element of values should be inculcated either directly or indirectly in the mathematics teaching process and making oral questioning as an important process to generate students' understanding of the values of mathematics, in line with the specifications established in the National Mathematics Curriculum Framework.

Inculcation of values is one of the most important things in mathematics teaching [3]. Values are also seen as supplementary to the mathematics teaching process. The education system in Malaysia included inculcation of values as one of the objectives in mathematics teaching, meant to produce individuals who are holistic and to facilitate the development of mathematical mindset among the students [2]. With mathematical mindset, students would be more capable in doing mathematics and understanding mathematical ideas, as well as applying mathematical knowledge and skills in daily life, based on mathematical attitudes and values [4]. Thus, teachers should be able to inculcate values in the teaching of mathematics, either directly or indirectly, and in line with universal values. This can be accomplished through the various learning experiences provided by teachers in the teaching of mathematics [5].

Students often consider mathematics as a difficult and boring subject compared to other subjects and this indirectly creates mathematics phobia among students [6]. This problem is a serious issue that needs to be addressed in order to avoid further decline in Malaysian students' performance in the Trends in International Mathematics and Science Study (TIMSS) and Programme for International Student Assessment (PISA) mathematics assessments [7]. [8] explained that the problem actually stemmed from how students perceive and appreciate mathematics as they do not see how mathematics is related to their daily lives. For them, mathematics is just about

memorization of formulas and knowing procedures in solving mathematical problems [9], and thus students are not able to see the various values that exist in mathematics [10]. Therefore, the elements of values should be fostered in the process of mathematics teaching to make students aware of the beauty of mathematics, to develop an understanding of the importance of mathematics in life, as well as to foster stronger students' personal values [11]. Thus, mathematics teaching should not only emphasize on the cognitive aspect, but also emphasize on the affective aspects, namely attitude and values [12]. Mathematics teaching that only emphasizes on cognitive development, without including the effective elements, will produce students who acquire the mathematic knowledge, but cannot transfer the values to their daily lives. This needs to be given serious attention so that development of students are holistic, balanced, and shaped by values, hence preparing young generation with good manners and personalities.

In the context of this study, the values of mathematics adopted the definition given by [8] in which the values of mathematics are supported by the mathematical knowledge itself as well as the culture of the society in which mathematics is taught and developed. The values generated from mathematics are referred to the nature (tabii) and the school of thoughts that support mathematical knowledge, while the cultural aspects are viewed in terms of the pure values held by the people of this country. Additionally, past studies have shown that there were several types of values that had been applied by mathematics teachers in their teaching. [13] stated that there were two types of values inculcated by teachers in the teaching of mathematics, namely general educational values and mathematics educational values. Educational values are the quality that teachers, school, society or culture wish to inculcate in students in the classroom to prepare them to become individuals and members of society, such as the value of courage. Whereas mathematics educational values are the quality that is instilled through the practices and norms in mathematics teaching as organized by teachers, mathematics books or the school. For example, asking students to memorize mathematical formulas is a mathematics value (i.e., instrumental value). Apart from that, Ali et al. (2005) classified three types of values, namely intrinsic mathematical values, pure values and useful values in life. The intrinsic values referred to by the respondents were found to resemble the nature of mathematical knowledge, such as thinking divergently, systematically, meticulously, with discipline and so on, while useful values in everyday life and mathematical values are seen as useful values or having a pragmatic element to meet the needs in life.

In addition, [2] emphasized four types of values that teachers need to inculcate in the teaching of mathematics, namely personal values, interaction values, procedural values and intrinsic values. Personal values refer to the values related to the formation of personality and character

of an individual such as being honest, persevere, creative, confident, meticulous, a good time manager, self-reliant, trustworthy, efficient, responsible, patient and dedicated. Interaction values are closely related to the formation of good behavior in the classroom context. These values refer to values emphasized in the interactions during mathematical activities such as teamwork, discussion and sharing of ideas, tolerance, fairness, open mindedness and respect. Procedural values relate to the specific activities in mathematics such as reasoning, representation, problem solving, communicating, relating and using technology, while intrinsic values relate to the formation of mathematical content and its disciplines such as epistemological values, culturalization values and historical values.

It is found that most of past studies have emphasized on the role of oral questioning in improving students' cognitive skills in mathematics. However, there are also past studies regarding oral questioning that have not only emphasized on cognitive development but also examined the importance of oral questions in the affective aspect, which were the values that should be acquired in the oral questions given, in line with the educational goal itself, which was the inculcation of good values to students [14]. In term of oral questioning, [15] categorized it into three types based on three main contexts, namely conceptual, empirical and value. Oral questions in the conceptual context are used by teachers to aid students' understanding of the topic being learned, while empirical oral questions are oral questions used to obtain information from students when carrying out an experiment or activity. Oral questions emphasize on the important values that should be given attention by students as the results of their learning.

The urge to improve student achievement in the subject of mathematics, especially in the TIMSS and PISA global assessments, has initiated more studies that focus on oral questioning in the cognitive aspect, and less on the aspect of oral questioning in developing students' mathematical values [16]. In the same light, [5] also stated that development of values in teaching of mathematics had not been given much attention as the focus is more on the cognitive aspect. Furthermore, as highlighted by [17], students only studied mathematics for the purpose of passing and achieving excellent results in examinations. Thus, little is known on whether teachers are inculcating values in the oral questioning conducted in the teaching of mathematics. Studies on mathematical values in the teaching of mathematics in Malaysia are still new and not comprehensive [8].

[18] found that the teaching of mathematics emphasized greatly on the procedural aspect which resulted in mathematics teaching activities to be more focused on procedural questions and less on inculcation of values. This also happened because mathematics teachers were found to have not understood the meaning of mathematical values, furthermore, values were considered less important than the mastery of mathematical concepts and skills [8]. The

teachers' lack of knowledge on mathematical values makes it difficult for them to inculcate values in the oral questioning process. Therefore, it is very important for teachers to understand the true meaning of mathematical values so that they are internalized by the students [5]. Past studies that were conducted on mathematical values had not focused on the inculcation of values through oral questioning in mathematics teaching, instead the focus is more on teachers' understanding and belief in the inculcation of mathematical values in the classroom [4] as well as on the content of values contained in the textbooks [4], [5]. Studies on values have long been carried out, but it is still a relatively new study in the field of mathematics education. One area of study that has not been fully focused on by previous researchers, thus creating a knowledge gap, is on the inculcation of values through the process of oral questioning in mathematics teaching, particularly on the types of mathematical values that teachers inculcate in the teaching of mathematics in primary schools. Therefore, this study was conducted to identify the forms of mathematical values implemented by teachers during the questioning process in mathematics teaching.

## 2. Methodology

This qualitative study had adopted the case study method. Six primary school mathematics teachers from six different schools in a district in Malaysia were selected as participants of the study using purposive sampling method. Data was collected using partial structural observation, semi-structured interview, and field notes. The use of various data collection techniques help researchers to triangulate the data at the data analysis level while also reinforcing the results obtained [19].

In this study, data was analyzed using the constant comparative analysis which involved combining data collection with analysis to identify patterns and themes that emerged from the primary data collected [20]. The initial analysis of the data began as soon as the field work begins, thus, the processes of data analysis and data collection were done simultaneously and was an ongoing process. The data collected in this study was analyzed using Atlas.ti 8 software to determine themes and sub-themes.

[21] stated that the validity and reliability of a study refers to the extent to which the study's findings can accurately and consistently represent the phenomenon under study. Therefore, in this study, the researcher used several methods to enhance the validity and reliability of the study using triangulation method, member checking and peer review.

## 3. Findings

The study found that mathematics teachers were aware

of the importance of incorporating values in mathematics teaching and were asked three types of verbal questions related to the application of values in mathematics teaching. Each of the explanations discussed in the findings is supported by excerpts from the teacher's observations as well as excerpts from the interviews conducted. Examples of labels for observations are [Azah,P3/12452-12723] where 'Azah' (study participant's name), 'P3' (third observation for Teacher Azah) and '12452-12723' (sentence position in the observation document analyzed). For interview transcripts, the researcher used the label 'SRI' or 'II' where 'SRI' refers to the stimulated recall interview while 'II' refers to the initial interview. For example, the label [Roza, SRI3/4751-5047] refers to 'Roza' (study participant's name), 'SRI3' (third stimulated recall interview), and '4751-5047' refers to the sentence position in the interview transcript document. Besides, for the data involving field notes, researchers use 'NL' labels such as [Ada, NL/17082018] where 'Ada' (study participant's name), NL (field note) and '17082018' refer to field note date as August 17, 2018.

### 3.1. Awareness on Importance of Inculcating Mathematical Values in the Teaching of Mathematics

The results showed that the mathematics teachers in this study were aware of the importance of inculcating values in the mathematics teaching through the oral questioning process. This was mentioned by Teacher Roza as described in the excerpt below:

*"I not only want to teach students about the content of mathematics, but when we ask students, I will also include elements of value to shape students' personalities and attitudes..."*

[Roza,SRI2/ 37491-39011]

This was also further explained by Teacher Roza and Teacher Ada in the following interview excerpts:

*"Teachers should not overlook the value, moral and affective aspects as these are the key factors in shaping students' attitudes and thinking. Teachers not only teach about the knowledge contained in the textbook, but also inculcate values and moral to ensure better student outcomes."*

[Roza,SRI3/4751-5047]

*"My opinion regarding the inculcation of mathematical content to students, there is one thing that needs to be emphasized on by teachers to the students, which is the values. It is even mentioned in the DSKP (referring to Curriculum and Assessment Standard Document) about the values that teachers need to inculcate during the teaching process. So I think teachers need to incorporate the elements of values and moral so that*

*the students will be taught with the good things that can help them to think maturely.”*

[Ada, SRI3/2291-2750]

Teacher Roza added that the aspect of value was important for teachers to implement in the teaching of mathematics to ensure better student outcomes. Teacher Ada also expressed agreement on the importance of incorporating values in the teaching of mathematics so that students could be taught about the good things that could lead students to think more maturely.

### 3.2. Types of Oral Questions Regarding Values

It was found that the teachers were implementing three types of questions related to the inculcation of values in their mathematics teaching.

#### 3.2.1. Questions Regarding Pure Values

Questions regarding pure values are associated with the inculcation of values. Personal values refer to values that relate to the formation of character and personality of an individual, such as being honest, competent, creative, confident, meticulous, a good time manager, self-reliant, trustworthy, efficient, responsible, patient and dedicated. In this context, the inculcation of pure values refers to the formation of individual values of students, including a variety of positive living norms [2]. However, the relevance of pure values to be inculcated may also be dependent on the topics. This is shown in the excerpt below:

*“We usually apply value in a variety of math topics and most famous is in the topic of ‘money’. In this stage two, there are already a lot of skills regarding money. There are GST, invoices and many more. So, these are the points in which the values of honesty are inculcated.”*

[Raha,II/11266-11499]

Based on the above excerpt, Teacher Raha gave an example of the topic of 'Money' within the Year 5 Primary Mathematics syllabus, which require variety of skills that students need to apply. Therefore, she tried inculcating the value of honesty as the pure value that every individual should have, especially when it comes to managing money.

In addition, there are also situations where oral questions are being asked to students, meant as a way of inculcating pure values in an indirect way. For example, when teachers ask questions, it indirectly train students to be courageous and confident especially in cases when the students have difficulty answering the questions asked. This is shown in the lesson excerpt below:

*“Yes. Are there any other operations? Read it again silently. Are there any other operations? No? If you think there are, just say them right away. You have to be confident with yourself. Can you be confident?”*

[Azah,P3/2197-2263]

Based on the above excerpt, Teacher Azah tried to instill the values of confidence and courage in the students to try to respond to the questions asked. Thus, this can indirectly instill reflective values in the students where students will always ask themselves back whether the answer given is accurate or not. Only then can the students confidently and courageously try to answer the questions posed by the teacher. Teacher Azah also added that the answer did not necessarily have to be the correct answer, but more importantly is the courage to try to answer the questions. This is explained by Teacher Azah in the following interview excerpt:

*“Yes. The answer may not be correct. One of the most important things is students try to answer. Otherwise, the mathematics teaching process will be passive and boring”.*

[Azah,SRI2/14212-14600]

In addition, teachers also instill the values of courage and volunteerism during the process of oral questioning in the mathematics teaching. Questions such as, *“Haa...who can show me the way to get the answer?”* [Roza,P4/2803-2852] and *“Who can tell me the measurement that is missing?”* [Nadia,P1/4488-4543] instill the values of volunteerism and being courageous.

Besides that, pure values are also instilled through oral questions where the teacher expect the students to help their friends to answer the questions or to correct the mistakes made. This is shown in the excerpt below:

*“Okay, can you help your friend figure out their mistakes? Point out what is wrong. Please help guide your friend”.*

[Ana,II/23488-23597]

#### 3.2.2. Questions Regarding Values in Life

Values in life refer to the cultivation of awareness among students that the subject of mathematics does not only deal with numbers or mathematics procedures in solving problems, but mathematics is also strongly related with real life. In this context, oral questions regarding life values will promote students' understanding of the inculcation of mathematics in their daily lives. This is raised by Teachers Ana and Ada as shown in the following excerpts:

*“As for the questions, for instance, if we are teaching on the topic of money, we relate the money topic to the students' daily lives. “Okay. how much money do you bring today?”, for example. “Okay. What can you buy with this amount of money, for example, two and a half ringgits? What can you buy with this amount of money at the canteen? Is there any balance?”. That is one of the most common questions that I usually ask the students. If it is not enough, I will ask “Why is it not enough? How much is not enough? If there is a balance, what are you going to spend it on, what is the money for,*

*is it for savings, shopping, buying toys or whatsoever, right?”. Haa, and then we tell them about the benefits of saving up and what not, and we will include it in that”*

[Ana,II/5651-5745]

*“That is called a parallel line... What do you think the use of this parallel line in your life?”*

[Ada,P4/15576-15631]

Based on the examples of the excerpts above, Teacher Ana and Teacher Ada have tried to inculcate values where mathematics has useful values to meet the different needs in the student's life journey. In this context, Teacher Ana incorporated the value of saving up and the value of how money is spent in the daily life. Whereas Teacher Ada asked the questions regarding how parallel lines can be applied to their daily lives and indirectly opened up students' mind about the broader scope and purpose of learning mathematics. This was explained by Teacher Ada *“So that the students can relate the things that we have learned today with their daily life...”* [Ada, SRI2/18677-18818]. This is also supported by findings from field notes which also suggest that Teacher Ada often ask questions to relate students' understanding to various applications in everyday life. [Ada, NL/17082018].

It is further strengthened by Teacher Raha who mentioned that the inculcation of values in life through the process of oral questioning is important to be implemented as an element that cut across the curriculum, as emphasized by the Ministry of Education Malaysia. This is shown in the following excerpt:

*“By linking them to the daily life, mathematics teachers are actually implementing the Cross-Curriculum Element (EMK) in their teaching process. This is important so that students will know that mathematics is used in many fields such as aerospace, medical and even history. Otherwise, students would have narrow-minded thinking and might lose their interest in the mathematics subject.”*

[Raha, SRI2/13312-13664]

### 3.2.3. Questions Regarding Intrinsic Mathematical Values

The findings also show that mathematics teachers ask oral questions regarding intrinsic mathematical values in the mathematics teaching process. Intrinsic values refer to the natural values that exist in mathematics learning such as thinking divergently, following procedures and being systematic, making connections and representations, meticulous and so on [8]. For example, the teacher asked the students on the first step that they need to take to solve a mathematical problem. In this situation, the teacher indirectly emphasizes on the intrinsic mathematical value with regard to the procedure and to be systematic in solving a mathematical problem. This is shown in the

excerpt below:

*“Be patient... What is the first step? Now we want to get the answer in meter first. So what do we do?”*

[Ana,P1/16131-16265]

Based on the above excerpt, through an oral question, Teacher Ana attempted to inculcate to the students, the importance of systematically following a certain algorithm to solve a mathematical problem. This was also supported by findings from field notes that also found that most of the oral questions posed by Teacher Ana were directed to oral questions in the form of mathematical solving procedures [Ana,NL/08082018]. Therefore, the intrinsic value of following a procedure and being systematic can be indirectly inculcated to students. This argument is further supported by Teacher Azah's as shown in the following excerpt:

*“Any calculation steps have to be in a sequence. It has to start with the first, second and third step. Only then will you get the right answer. If the first that needs to be done is not known, only the second one, how is it possible to get an orderly answer. It has to start with the first calculation and then followed by the second calculation. It has to be systematic.”*

[Azah, SRI2/1324-1635]

In addition, there are also situations where the aspect of thinking divergently is inculcated in mathematics teaching. In doing so, the teacher asks students oral questions to find alternative solutions to a given mathematical problem. This indirectly stimulates students' thinking and builds the value of inquiry and exploration among the students. For example, the question asked by Teacher Raha in the following excerpt:

*“Okay, is there any other way besides that?”*

[Raha, P3/13900-13964]

The teacher was also explaining that students are given the opportunity to come up with a variety of creative solutions to a given mathematical problem, intended to prevent students from feeling overwhelmed by focusing too much on only one solution method. This argument is strengthened by the following excerpt of Teacher Azah:

*“So, students have the option of using whatever they can. Let's not stick to one because there may be students who are visual, they are not that good in division so they can use the box technique.”*

[Azah,SRI2/7610-7815]

## 4. Discussion and Conclusion

The results of the study showed that the mathematics teachers were aware of the importance of inculcating values in mathematics teaching. The teachers were able to

state explicitly the importance of inculcating values in mathematics teaching. In the context of this study, the teachers also understood that mathematical values could also be instilled through oral questioning activities where the activities not only play a role in the students' cognitive development but were also used to instill values. It also illustrates that the provisions of the National Mathematics Curriculum Framework are being implemented by the mathematics teachers where the value element and the cross-curricular element are implemented in their mathematics teaching [2, 27]. However, it was found that the mathematics teachers still have a narrow perception of the true definitions in mathematics. This is because the results of the interviews show that teachers talk only about aspects of pure values and do not touch on other aspects of values despite the fact that teachers are implementing broader aspects of their teaching without realizing it and this is consistent with the findings of [8] which also highlighted that teachers perceived mathematical values merely as pure values. This may indirectly limit the scope of oral questions that incorporate values if they were to be implemented in classroom teaching.

The findings also indicated that the primary school mathematics teachers had implemented three types of oral questions related to mathematical values, namely, questions regarding pure values, life values and intrinsic mathematical values. Thus, the conclusion made by [12, 29] on enhancement of understanding and development of students' level of thinking should be considered in a broader context where it should not only emphasize on development of the students' cognitive level of thinking, but also emphasizing on the aspect of value. Therefore, the results of this study highlighted the importance of inculcating the love for mathematics subject in students as well as overcoming mathematics phobia, especially among primary school students.

The oral questions posed by incorporating all elements of values can help develop students who are more creative and innovative as they will have better appreciation of mathematics which is part of the outcome of the inculcation of mathematical values. Therefore, through the implementation of oral questions which incorporate values in mathematics teaching, teachers do not only teach the contents of the textbook, but they also get the opportunity to educate students, either directly or indirectly, through the questions that incorporate values [13, 26].

The findings showed that oral questions that embed pure values were posed by the teachers in their teaching. Inculcation of pure values focusing on character and personality building can be inculcated consistently and continuously in mathematics teaching. This will generate students' awareness and intellectual openness in understanding mathematics based on universal pure values [22, 24]. In this context, oral questioning serves as a stimulus to encourage students to internalize pure values in themselves, but it is more effective as students' thinking

is stimulated through oral questions.

The findings also showed that the teachers implemented oral questions that incorporate daily life values. As suggested by [23], students should be given the opportunity to understand values in the context of real-life. Inculcation of real-life values has helped the students to understand the usefulness of mathematics in a broader context and beyond and using it to solve various everyday problems. As indicated by [13], it was a challenge for the teachers to inculcate values through class questioning, hence most teachers prefer to use explanations to relate mathematical values with real life rather than using oral questions to stimulate students' thinking and inquiry to explore on their own. However, the use of oral questions will help students to use their existing knowledge to relate it to daily life values. This way, the inculcation of values can be implemented more effectively in the teaching process. [8] stated that the inculcation of values regarding daily life can broaden students' thinking and engage students' interest to increase their love for mathematics.

In addition, the findings showed that oral questioning was also used by the teachers to inculcate intrinsic mathematical values in the mathematics teaching. In this context, the intrinsic mathematical values fostered were the natural values available in mathematical knowledge, such as being meticulous, systematic, thinking divergently, disciplined and so on [8]. As such, these values can be used by students to enhance their learning and to apply these intrinsic mathematical values to their daily lives. This is also supported by [12] who posited that the inculcation of intrinsic mathematical values is believed to help the cognitive ability in improving mathematics achievement. However, in fostering the intrinsic mathematical values to students, teachers need to be careful so that the approach used is not too prescriptive, which may result in mathematics learning being a mere collection of facts, rules and specific skills that students need to learn. [5,25] explained that the overly passive and teacher-centered prescriptive approach would contribute to a less meaningful situation in students' mathematics learning. In inculcating the intrinsic mathematical values, oral questioning should emphasize on the building, appreciation and culturalization of mathematical knowledge to help students' understanding of mathematics. Without comprehensive appreciation, it can be difficult to understand and apply the mathematical knowledge that they have.

## 4. Conclusions

Oral questioning conducted during the mathematical teaching process should cover both cognitive and affective aspects, which are the values [28]. This is important as to ensure that students build appreciation of mathematical knowledge and maintain the balance between thinking and

emotional intelligence in students.

The findings of this study are not comprehensive; thus, it does not fully reflect how oral questions are used to incorporate values in mathematics teaching. It is apparent that teachers' thinking and views about the true meaning of inculcating mathematical values are still vague. Therefore, it is important that the study of mathematical values be expanded and further explored.

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