



Analysis of the Challenges and Strategies Faced by Teachers in Enhancing Primary School Pupils' Interest in Learning Mathematics

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Citation: Theresya, J. I., Dzulfiansyah, M. F., & Widagdo, D. E. (2026). Analysis of the Challenges and Strategies Faced by Teachers in Enhancing Primary School Pupils' Interest in Learning Mathematics. *Kognitif: Jurnal Riset HOTS Pendidikan Matematika*, 6(4), 1698–1714. <https://doi.org/10.51574/kognitif.v6i4.5538>

ARTICLE INFO

ARTICLE HISTORY:

Received Jul 20, 2026
Accepted Sep 27, 2026
Published Online Oct 19, 2026

KEYWORDS:

Interest in Learning
Learning Challenges
Mathematics
Primary School Teachers
Teaching Strategy

ABSTRACT

Interest in learning is the primary driver of success in learning mathematics; however, many primary school pupils still view mathematics as a difficult, daunting and boring subject, resulting in low levels of interest that directly impact their learning outcomes. This study aims to describe the challenges faced by teachers in enhancing pupils' interest in learning mathematics, to analyse the Strategies used by teachers to overcome these challenges, and to describe teachers' perceptions of changes in primary school pupils' interest in learning mathematics following the implementation of these Strategies. The method used was a descriptive qualitative approach, with data collection involving semi-structured in-depth interviews with three primary school teachers: Ms EN, a Year 5 teacher with 12 years' teaching experience; Ms ONR, a Year 2 teacher who began teaching in 2022; and Ms FD, a Year 2 form tutor with 9 years' teaching experience. Data analysis was carried out through data reduction, data presentation and drawing conclusions following the Miles and Huberman model, with data credibility maintained through member checking and peer debriefing. The research findings indicate that the main challenges faced by teachers in fostering pupils' interest in learning include pupils' poor mastery of basic mathematics, negative perceptions of mathematics lessons, diversity in pupils' personalities and abilities, a lack of parental involvement, and limited teaching time. To enhance pupils' interest in learning, teachers implemented various innovative Strategies such as Problem-Based Learning (PBL), the use of concrete materials, game-based learning, personalised approaches, and the provision of motivation and rewards. According to the teachers' perceptions, the implementation of these Strategies increased pupils' enthusiasm, conceptual understanding, and interest in learning mathematics. These findings indicate that the success of teachers' Strategies in enhancing pupils' interest in learning needs to be supported by active parental involvement and the provision of adequate school facilities.



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Introduction

Mathematics is one of the fundamental subjects that plays a vital role in developing pupils' logical, systematic and analytical thinking skills from primary school onwards. Unfortunately, the reality on the ground shows that pupils still often view mathematics as a difficult, daunting and boring subject, resulting in low learning motivation which directly impacts their learning outcomes. According to the findings of the study (Putri et al, 2019), low level of primary school pupils' interest in learning mathematics is closely linked to their weak grasp of basic concepts and the limited variety of learning Strategies employed by teachers in the classroom. This situation is all the more concerning given that interest in learning has been shown to have a positive correlation with pupils' achievement in mathematics (Ndraha et al., 2022), consequently, low interest has the potential to hinder pupils' academic achievement in the long term. This issue places teachers in a pivotal position, as it is they who face these issues directly on a daily basis and are required to design learning Strategies capable of rekindling pupils' interest in learning amidst limitations in resources, time, and the diversity of pupils' characteristics within a single class.

Interest in learning is an important variable to examine due to its role as the initial driver of the entire sequence of students' learning activities. Interest is understood as a relatively stable tendency to pay attention to, engage with, and derive pleasure from an activity, which is operationally evident through indicators such as feelings of enjoyment, curiosity, concentration, and student engagement in learning (Slameto, 2010). Students who are interested tend to pay attention for longer, persevere with difficult problems, and process the material in greater depth, whilst students who are not interested tend to avoid the task and only study to the extent required to meet formal demands. Within the framework of interest development, situational interest generated by the learning environment needs to be consistently facilitated so that it develops into a lasting individual interest, and it is this initial stage that is heavily dependent on the lesson plans prepared by the teacher (Hidi & Renninger, 2006). This need becomes even more pressing in the subject of mathematics, which is abstract and hierarchical: when interest in learning is low from primary school onwards, pupils tend to avoid practice, gaps in their grasp of basic concepts accumulate, and this ultimately develops into a fear of mathematics that carries over into subsequent stages of education. Thus, interest in learning is not merely a supplementary affective aspect, but a prerequisite that determines the sustainability of pupils' mathematical learning outcomes.

In practice, efforts to foster an interest in learning mathematics in primary school are not as simple as selecting a single teaching model deemed to be superior. Primary school pupils generally remain at the concrete operational stage of thinking; consequently, teachers are required to bridge the gap between abstract mathematical concepts and pupils' real-life experiences. At the same time, teachers face classes with a wide range of prior knowledge, limited resources and time constraints, as well as the demands of the curriculum that must still be met. These conditions place teachers in a situation of constant decision-making: which Strategies to choose, when to combine them, and how to adapt them when pupils' responses fall short of expectations. The challenges faced by teachers and the Strategies they adopt are therefore two sides of the same coin; consequently, both need to be examined together, rather than in isolation. Without an adequate understanding of the real challenges in the classroom and the considerations teachers take into account when devising Strategies, recommendations for improving interest in learning mathematics risk remaining at a normative level and proving difficult to implement in the context of actual learning.

Various efforts have been made to address this issue, and most previous research has focused on testing the effectiveness of a single learning strategy in isolation. With regard to the implementation of Problem-Based Learning (PBL), for example, a number of studies have demonstrated that this model is consistently capable of improving learning outcomes and student engagement in mathematics education (Hendrayana & Ekasari Putri, 2023; Madadina et al., 2024; Nasution et al., 2024; Sagita & Ikashaum, 2023; Sari et al., 2025). Regarding the use of concrete materials, the findings of studies by Aeni et al. (2019), Asadulloh et al. (2024), and Shoimah (2020) consistently show that real objects are effective in helping primary school pupils understand abstract mathematical concepts. Meanwhile, game-based learning has also been extensively studied; as highlighted by Muzayanati et al. (2022), the use of educational game applications such as Kahoot has been shown to enhance pupils' motivation and learning outcomes in mathematics, in line with the findings of Suciati (2021), Wadud & Lailiyah (2024) who each demonstrated that a mathematical snakes and ladders game is capable of fostering pupils' interest and learning outcomes. From a curriculum policy perspective, research by Fianingrum et al. (2023) and Rahmawati et al. (2024) indicates that the implementation of the Merdeka Curriculum provides scope for teachers to be more creative in selecting mathematics teaching approaches suited to pupils' characteristics, although in practice its implementation in the field does not always run smoothly.

Whilst these studies enrich the body of knowledge regarding the effectiveness of each strategy, a review of previous research indicates that a synthesis of how primary school teachers select, combine and adapt these various Strategies simultaneously to cater for the diverse characteristics of pupils within a single class has yet to be explored in depth. Existing research generally tests a single strategy in isolation through experimental or quasi-experimental designs; consequently, it has not yet delved deeply into the experiences and considerations of teachers, who are the ones directly facing the complex challenges in the classroom and must adaptively devise Strategies. In fact, teachers, as the practitioners of learning, possess a wealth of practical knowledge regarding the real-world circumstances of their pupils, which is difficult to uncover through quantitative approaches alone.

In light of this gap, this study aims to (1) describe the challenges faced by teachers in mathematics teaching in primary schools, (2) analyse the teaching Strategies employed by teachers to address these challenges, and (3) describe teachers' perceptions of changes in pupils' interest in learning mathematics following the implementation of these Strategies. This third research objective has deliberately been formulated in terms of teachers' perceptions rather than as a direct measurement of impact, given that the data sources for this study are derived solely from interviews with teachers; consequently, changes in pupils' interest or responses can only be ascertained through the teachers' perspective as classroom observers, rather than through direct measurement of the pupils themselves. This adjustment to the formulation was made to ensure that the research questions and objectives align with the characteristics of the descriptive qualitative design employed. By providing a comprehensive picture of the interrelationship between challenges, Strategies and teachers' perceptions of changes in pupils' interest, this study is expected to offer a more contextualised understanding of how primary school teachers manage the complexities of mathematics learning in the classroom, whilst also complementing existing quantitative studies.

Method

Research Design

This study employs a descriptive qualitative approach. This approach was chosen because the research aims to gain an in-depth understanding of the challenges and Strategies employed by teachers in enhancing primary school pupils' interest in learning mathematics within a realworld context. Qualitative research methods are designed to understand and explain social phenomena holistically and in depth, with an emphasis on understanding the natural context of the research subjects (Fadli, 2021).

Subjects

The subjects of this study were three primary school teachers who served as interviewees. The three informants were selected using purposive sampling, a technique for determining informants based on specific considerations and criteria relevant to the research objectives (Lenaini, 2021). The criteria used in selecting the informants included: (1) being active primary school teachers teaching mathematics; (2) having backgrounds in different year groups, namely lower and upper years, so as to enrich the variety of experiences; (3) having a varied range of teaching experience, from teachers just starting their careers to those with over a decade's experience; and (4) being willing and able to describe their experiences in depth regarding the challenges and Strategies of teaching mathematics. All three informants teach at different primary schools, thereby further enriching the variety of school contexts, although this study does not specifically compare characteristics between schools as the research focus is directed towards the individual experiences of the teachers. The informants' profiles are presented in Table 1.

The selection of three participants in this study was based on the logic of qualitative research, which prioritises depth of information over breadth of data, rather than statistical representativit (Subhaktiyasa, 2024). Data collection was halted once the researcher assessed that the information from the three informants was beginning to reveal recurring patterns regarding learning challenges and Strategies; consequently, it was anticipated that adding further participants at that stage would not yield significant new variations in the data within the scope of the three schools under study. Nevertheless, the researcher acknowledges that, having involved only three informants, the claim that data saturation has been fully achieved cannot be conclusively confirmed; consequently, this is explicitly recognised as one of the methodological limitations of the study (see the Conclusions section).

Table 1. Profile of Research Informants

Informant	Class	Teaching Experience
Ms EN	Year 5	12 years
Ms ONR	Year 2	Since 2022
Ms FD	Year 2	9 years

Instruments

The main instrument in this study was the researcher herself (human instrument), assisted by a semi-structured interview guide. The interview guide was structured around three main aspects, namely (1) the challenges faced by teachers in mathematics teaching, (2) the teaching

Strategies implemented to enhance pupils' interest in learning, and (3) teachers' perceptions of changes in pupils' interest in learning mathematics following the implementation of these **Strategies and** was developed into 15 questions. The semi-structured nature of the guide allows for a more flexible and in-depth exploration of each teacher's experiences, perceptions and teaching practices. Additional tools used included audio recorders and field notes to accurately document the interview results. An overview of the aspects and examples of questions in the interview guide is presented in [Table 2](#).

Table 2. Interview Guide Framework

Aspect	Example Questions
Learning challenges	What difficulties do you most frequently encounter when teaching mathematics?
Teaching Strategies	What Strategies do you use to overcome these difficulties?
Impact of the Strategies	What changes have you observed in pupils' interest in learning after implementing these Strategies?

Data Collection

Data were collected through in-depth interviews with the three informants using a semistructured technique, to allow for a more flexible and in-depth exploration of each teacher's experiences, perceptions and teaching practices. The interviews were conducted face-to-face with each informant at a mutually agreed time, taking place within the informants' respective school environments (staff room or classroom) outside of active teaching hours. Each interview session lasted approximately 40–60 minutes in a single main session for each informant. Where answers required further explanation, the researcher probed by asking follow-up questions during the same session or sought brief clarification via written messages to the relevant informant. All interviews were recorded using an audio recorder and transcribed verbatim to facilitate the data analysis process, supplemented by field notes containing the researcher's observations of the context and situation of the interview. As part of efforts to maintain data credibility, summaries of the interview results were reconfirmed with each informant (member checking See [Figure 1](#)) to ensure that the researcher's interpretation aligned with the informant's intended meaning ([DeCino & Waalkes, 2019](#)).

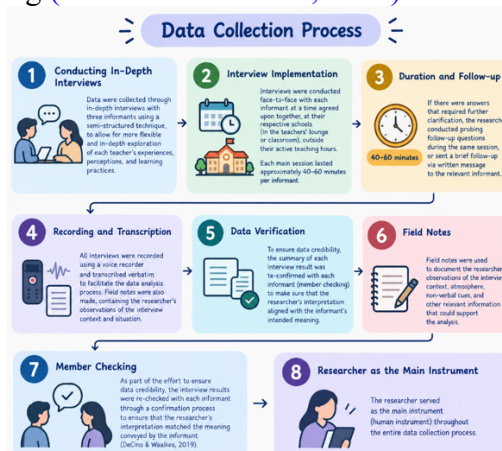


Figure 1. Data Collection Flowchart

Analysis

Data analysis was conducted in stages following the interactive analysis model of Miles and Huberman (Fadli, 2021). The analysis process began with the verbatim transcription of all interview recordings, followed by open coding, which involved labelling ‘meaning units’ in the transcripts relevant to the three research focuses: challenges, Strategies, and teachers’ perceptions of changes in pupils’ interests (Rijali, 2019). The codes that emerged were then grouped into broader categories based on similarities in meaning, before finally being synthesised into main themes. This process aligns with the three stages of interactive analysis according to Miles and Huberman (Fadli, 2021), namely: (1) data reduction, which is the process of selecting and focusing on relevant data from the interview results; (2) data presentation, which involves organising the reduced data into a systematic descriptive account; and (3) drawing conclusions based on the patterns and themes identified in the data.

Table 3. Open Coding of Informant Interview Results

Informant	Research Focus	Open Code	Category	Themes
Ms EN	Challenges	Pupils’ interest is high in the lower years, but declines in the upper years as the subject is perceived as difficult and confusing	A decline in interest as students progress through the year groups	A gap between pupils’ interest and their basic abilities
Ms EN	Challenges	Students’ main difficulty lies in mastering multiplication and division as the foundations of mathematics	Weak grasp of basic concepts	A gap between pupils’ interest and their basic abilities
Ms EN	Challenges	The main challenge is the variation in pupils’ abilities and personalities	The heterogeneity of pupils within a single class	The diversity of pupils’ characteristics
Ms FD	Challenges	Pupils’ views vary; some are enthusiastic about maths, whilst others are afraid of it	Variations in pupils’ affective responses	The diversity of pupils’ characteristics
Ms FD	Challenges	Teachers need to understand the diverse personalities of pupils, ranging from the outgoing to the quiet	Heterogeneity of pupils’ personalities	The diversity of pupils’ characteristics
Ms ONR	Challenges	Time constraints in the classroom are addressed by setting worksheets for pupils to complete at home	Time allocation constraints	Limited learning resources
Ms ONR	Challenges	The greatest challenge stems from differences in pupils’ family backgrounds and communication with parents	Gaps in family support	External factors beyond the teacher’s control
Ms EN	Strategy	Problem-based learning, linking the subject matter to everyday life	Contextual, problem-based learning	Contextualisation of abstract material
Ms EN	Strategy	Protractors, compasses, projectors and classroom resources	Use of concrete materials	Contextualisation of abstract material
Ms EN	Strategy	Utilising the flexibility of the Merdeka Curriculum in selecting methods	Utilising curriculum policy	Diversification of teaching methods
Ms ONR	Strategy	Concrete materials such as pizza slices to aid pupils’ understanding	Use of concrete materials	Contextualisation of abstract material

Informant	Research Focus	Open Code	Category	Themes
Ms ONR	Strategy	A variety of methods: games, lectures and Project-Based Learning	Variation in teaching methods	Diversification of teaching methods
Ms ONR	Strategy	A star and reward system at the end of the term to boost motivation	Strengthening external motivation	Strategies to foster motivation
Ms FD	Strategy	Methods tailored to pupils' personalities; a personalised approach for pupils experiencing difficulties	Differentiation and personalised approach	Adaptation to student diversity
Ms FD	Strategy	Learning through games, numerical materials and InFocus to keep pupils engaged	Variety of methods and media	Diversification of teaching methods
Ms FD	Strategy	Communication with parents is vital to support learning at home	Collaboration with parents	Expanding support beyond the classroom
Ms ONR	Perception of Changes in Interest	Pupils are more enthusiastic and active following the use of concrete materials	Increased active participation	Changes in engagement with learning
Ms ONR	Perception of Changes in Interest	Pupils' marks and understanding improved following the use of innovative methods and media	Improved learning outcomes	Changes in engagement with learning
Ms FD	Perception of Changes in Interest	Pupils' interest is influenced by the teacher's teaching methods and parental support	Interest as a result of teacher-pupilparent interaction	Interest as a jointly constructed construct
Ms EN	Perception of Changes in Interest	Expectations that pupils will be able to master multiplication and division well	Hopes for sustained improvement	Teachers' optimism regarding improvements in interest

Cross-case comparisons were conducted by examining the similarities and differences in themes amongst the three informants for each research focus, thereby identifying patterns that consistently emerged across all three teachers as well as those unique to specific teachers. To ensure the accuracy of the interpretation, the analytical decisions made by the researcher were verified through repeated re-reading of the transcripts and discussed with peers (peer debriefing) as a form of cross-checking the categories and themes that had been formulated (Fikri et al., 2025).

Table 4. Comparison between participants

Research Focus	Themes	Category (code summary)	Event	Pattern
Challenges	Discrepancy between pupils' interest and basic skills	Declining interest in higher year groups; weak grasp of basic concepts (multiplication/division)	Ms EN	Unique
Challenges	Diversity in pupils' characteristics	Differences in pupils' abilities, personalities and affective responses (enthusiastic vs fearful, active vs quiet)	Ms EN and Ms FD	Partially consistent
Challenges	Limited learning resources	Limited teaching time	Ms ONR	Unique

Challenges	External factors beyond the teacher's control	Disparities in support and pupils' family backgrounds	Ms ONR	Unique
Strategy	Contextualisation of abstract material	Use of concrete materials and contextualised learning (PBL, fraction pizza, classroom resources)	Ms EN and Ms ONR	Partially consistent
Strategy	Diversification of teaching methods	Variation in methods (games, lectures, PBL) and utilisation of the Merdeka Curriculum	Ms EN, Ms ONR, and Ms FD	Consistent
Strategy	Adaptation to student diversity	Differentiation and personalised approaches tailored to pupils' characteristics	Ms FD	Unique
Strategy	Strategies to foster motivation	Strengthening external motivation through a reward system	Ms ONR	Unique
Strategy	Expanding support beyond the classroom	Communication and collaboration with parents	Ms FD	Unique
Perception of Changes in Interest	Changes in engagement with learning	Increased active participation and learning outcomes following the use of innovative media/methods	Ms ONR	Unique
Perception of Changes in Interest	Interest as a coconstructed construct	Interest is influenced by teachers' teaching methods and parental support	Ms FD	Unique
Perception of Changes in Interest	Teachers' optimism regarding improvements in interest	Pupils' hopes of mastering the basics of mathematics more effectively	Ms EN	Unique

Research Findings

Based on in-depth interviews with three primary school teachers, data was obtained regarding the challenges faced and the teaching strategies implemented in an effort to improve pupils' interest in learning mathematics. To present the interview data comprehensively and transparently prior to further interpretation, a summary of the findings from the three informants is presented in Table 5. Subsequently, the findings are described narratively based on three research focuses, namely teachers' challenges, teachers' strategies, and teachers' perceptions of changes in pupils' interest in learning following the implementation of the strategies.

Table 5. Summary of Interview Excerpts from the Three Informants

Aspect	Ms EN	Ms ONR	Ms FD
Pupils' interests and perceptions	High in lower classes, decreasing in upper classes; preferred subject matter: data; subject matter considered difficult: calculations, area and perimeter	Not specifically mentioned in the interviews	Mixed: some pupils are enthusiastic, whilst others are already afraid of maths
Main challenges	Mastery of multiplication and division; differences in pupils' abilities and personalities	Weak grasp of basic concepts; differences in family background and communication with parents	Diversity in pupils' personalities; communication with parents is not yet running smoothly
Teaching methods/strategies	Problem-Based Learning (PBL); protractors,	Concrete aids (fractional pizza model); games, lectures, and Project-Based	Games; number aids; projector (InFocus); personalised approach

Aspect	Ms EN	Ms ONR	Ms FD
	compasses, projectors and classroom resources	Learning (PjBL); provision of worksheets to be completed at home	
Curriculum and school facilities	Merdeka Curriculum; laptops, projectors and printers	Projectors and televisions	Merdeka Curriculum; adequate school facilities
Efforts to motivate pupils	Regular verbal encouragement	A star system with rewards at the end of the term	A personalised approach and verbal encouragement
The interviewee's expectations	Pupils are able to master multiplication and division well	Pupils are more enthusiastic about learning and mastering the basics of mathematics	Teachers remain innovative, adaptable and attuned to pupils' psychological needs

Teachers' Challenges in Mathematics Teaching

Interview data indicate that pupils' interest in mathematics varies according to year group. Mrs EN noted that pupils' interest tends to be high in the lower year groups, but declines as they progress to higher year groups because mathematics begins to be perceived as difficult and confusing; the topics pupils enjoy most are data, whilst those considered difficult include calculations, area and perimeter. Ms FD added that pupils' views on mathematics in her class also varied; some were enthusiastic, whilst others already felt afraid of mathematics even before lessons began. Aside from pupils' perceptions, all three informants agreed that a poor grasp of basic mathematical operations, particularly multiplication and division, is a major obstacle to the learning process. Ms EN stated that the majority of Year 5 pupils still struggle with multiplication and division, which affects their understanding of more advanced topics. Ms ONR also emphasised that a weak grasp of basic concepts makes it difficult for pupils to keep up with new material in Year 2.

The diversity of pupils' personalities and abilities also presents a challenge in its own right. Within a single class, there are pupils who grasp the material quickly, those who learn slowly, those who are very active, and those who are very quiet. Ms FD emphasised that teachers are required to understand each pupil's personality in order to adapt their teaching approach, making it difficult for teachers to determine the appropriate pace and depth of material delivery. A lack of parental involvement was also identified as a significant challenge by Ms ONR. Differences in pupils' family backgrounds and communication barriers between teachers and parents make it difficult to coordinate the monitoring of learning progress at home. Ms FD also emphasised that communication with parents does not always run smoothly, meaning that support for learning at home is not yet optimal. The final challenge is the limited time available for learning. This constraint hinders teachers' ability to reinforce concepts comprehensively. Ms ONR addresses this by providing Student Worksheets (LKPD) to be completed at home. This time constraint is felt even more acutely when teachers must give individual attention to pupils requiring extra guidance.

Teachers' Strategies for Enhancing Interest in Learning

Ms EN consistently applies Problem-Based Learning (PBL) by linking maths content to problems pupils encounter in their daily lives, then guiding them to find solutions either independently or in groups. The implementation of this strategy is further supported by the

flexibility of the Merdeka Curriculum adopted by the school, as well as the availability of facilities such as laptops, projectors and printers.

All three interviewees also utilised a variety of concrete learning materials to facilitate conceptual understanding. Ms EN used a protractor, a compass and a projector; Ms ONR used a pizza model to teach the concept of fractions to Year 2 pupils, which was met with a very enthusiastic response, supported by the school's InFocus projector and television; whilst Ms FD utilised numerical aids and a projector (InFocus) to support visual learning, which was also supported by the implementation of the Merdeka Curriculum and adequate school facilities. Ms ONR and Ms FD also utilised games as part of their teaching strategies. Ms FD explained that learning through games makes pupils feel happy and unaware that they are learning maths, thereby increasing the active participation of pupils who previously tended to be passive. In addition to games, Ms ONR also varied her teaching methods between lectures and Project-Based Learning (PjBL), as well as providing Student Worksheets (LKPD) for pupils to complete at home to address the limited learning time in class.

All three speakers also adopt a personalised approach towards pupils experiencing learning difficulties, providing individual guidance both during lessons and outside school hours. Ms FD emphasised the importance of recognising each pupil's personality, including quiet pupils who tend not to dare to openly express their difficulties in front of the class. The final strategy involved providing motivation and rewards. Ms ONR implemented a reward system involving stars that pupils collected each time they participated actively and achieved good results, which were then exchanged for prizes at the end of the term, whilst all three teachers routinely offered verbal encouragement to maintain the pupils' enthusiasm for learning.

Impact of the Strategies on Pupils' Interest in Learning

According to the observations of the three informants, the use of concrete materials and game-based activities they implemented helped to increase pupils' enthusiasm and active engagement in mathematics learning, as evidenced by pupils whom the teachers assessed as being more enthusiastic and more willing to express their opinions and ask questions. Concrete materials such as the fraction pizza model used by Ms ONR, according to her account, also helped pupils understand the concept of fractions more intuitively, accompanied by an improvement in marks and pupils' overall understanding, which she observed following the implementation of more innovative methods and materials. All three informants also observed that the innovative strategies they implemented helped to change pupils' perceptions of mathematics, transforming it from a daunting subject into an enjoyable and challenging one. The personalised approach taken by teachers, combined with the use of varied teaching methods and resources, has also succeeded in creating a more comfortable and conducive classroom atmosphere, so that pupils feel more confident to ask questions and express their difficulties.

In general, the three interviewees hope that pupils will gain a stronger grasp of basic mathematical skills, particularly multiplication and division, and develop a greater enthusiasm for learning. Ms FD emphasised that to achieve these goals, teachers must continue to be innovative, adaptable and attuned to pupils' psychological needs, as pupils' interest in learning mathematics is greatly influenced by the teacher's teaching methods and parental support at home.

Discussion

The findings of this study are then critically discussed with reference to relevant theories and previous research findings, to examine the extent to which these findings reinforce, complement or demonstrate novelty compared to previous research. It should be emphasised from the outset that some of the explanations presented in this section are derived from a review of the literature and serve as an interpretative framework, rather than as empirical findings directly tested in this study.

Teachers' Challenges in Mathematics Teaching

The finding that a low level of mastery of basic mathematical operations constitutes a major challenge is consistent with the research findings of [Putri et al. \(2019\)](#) who also identified weaknesses in basic operations as one of the main factors contributing to primary school pupils' low interest in learning mathematics. Within the literature, such a situation is often interpreted as a 'deficit cycle', whereby pupils who are weak in basic concepts will find more advanced material increasingly difficult, leading to a further decline in their interest; however, it must be emphasised that this study did not directly test this causal relationship, so the description of the deficit cycle above refers to ideas in the literature and is tentative in nature, rather than an empirical finding of this study.

Teachers' perceptions of pupils' negative attitudes towards mathematics are consistent with what has been documented by [Indriani et al. \(2022\)](#). The literature explains that such negative perceptions generally do not form suddenly, but rather result from an accumulation of unpleasant learning experiences; nevertheless, the explanation of this accumulation process is derived from a review of the literature, not from a direct examination of pupils' learning histories in this study, and should therefore be understood as an interpretative framework rather than a conclusion tested in this study.

The challenges posed by the diversity of pupils' personalities, as highlighted by the three informants, underscore the importance of differentiated instruction in the classroom. Meanwhile, the challenge of a perceived lack of parental involvement, as noted by the teachers in this study, aligns with research findings demonstrating that parental involvement has a significant impact on primary school pupils' mathematics learning outcomes ([Hamida & Putra, 2021](#); [Sulistiyanto, 2023](#)). In line with this, [Solikhah & Pujiastuti \(2021\)](#) also found that parents' active role in supporting their children's learning at home can significantly enhance motivation to learn mathematics. Although these findings provide a context that supports the importance of parental involvement, their direct correlation with the conditions at the three schools in this study has not been empirically verified, as the research data was sourced solely from the teachers' perspective.

Teachers' Strategies for Enhancing Interest in Learning

The implementation of Problem-Based Learning (PBL) by Ms EN, as illustrated by her statements linking maths problems to the context of shopping and the daily sharing of cakes, is in line with the principles of meaningful maths learning, which emphasise that learning that connects subject matter to real-life contexts encourages pupils to think critically and understand the relevance of maths ([Dhani et al., 2022](#)). This is also supported by a number of studies demonstrating that the PBL model effectively encourages students' active engagement

in the problem-solving process whilst improving mathematics learning outcomes (Azzahra et al., 2025; Hendrayana & Ekasari Putri, 2023; Madadina et al., 2024; Nasution et al., 2024; Sagita & Ikashaum, 2023; Sari et al., 2025), although the majority of these studies examined PBL as a standalone strategy, whilst in practice Ms EN combined it with a personalised approach and the provision of motivation simultaneously.

The use of concrete media by the three informants, such as the pizza model for fractions and degree arcs for geometry, aligns with Piaget's theory of cognitive development, which states that primary school pupils are at the concrete operational stage and therefore require tangible representations to understand abstract concepts, as also reflected in the research by Aeni et al. (2019), Asadulloh et al. (2024), and Shoimah (2020). These findings are also consistent with the results of the research by Aien et al. (2025) which demonstrated that the use of interactive learning media, such as the Geogebra application, can enhance both conceptual understanding and pupils' interest in learning mathematics. The cross-teacher pattern indicates that all three teachers selected concrete media, particularly for abstract topics and for pupils in lower year groups who were just being introduced to new mathematical concepts, as evidenced by Ms ONR's use of the 'pizza model' specifically with Year 2 pupils who were just learning about fractions.

The use of games as a learning strategy implemented by Ms ONR and Ms FD is consistent with research demonstrating that the use of educational games significantly improves pupils' motivation and learning outcomes in mathematics at primary school level (Muzayanati et al., 2022), and is also in line with the findings of Suciati (2021) and Wadud & Lailiyah (2024) regarding the effectiveness of the mathematical snakes and ladders game in fostering an interest in learning. According to both interviewees, this strategy is primarily used with pupils who previously tended to be passive and lacked self-confidence, as the playful atmosphere is considered to reduce pupils' anxiety about mathematics.

The personalised approach adopted by the three teachers, particularly in engaging with quiet pupils as described by Mrs FD, is consistent with findings that teachers who provide personalised attention contribute to enhancing pupils' enthusiasm and self-confidence in learning mathematics (Aulia et al., 2022). The strategy of providing motivation and rewards implemented by Ms ONR through a star system is also supported by research demonstrating the positive influence of rewards on the motivation and mathematical achievement of primary school pupils (Nainggolan et al., 2024; Nurrohmatulloh & Mulyawati, 2022). The patterns emerging from the three informants indicate that these five strategies are rarely applied in isolation; rather, they are tailored and combined according to pupils' needs and the context of the subject matter. Examples include the combination of concrete materials with a personalised approach for pupils in lower year groups, or the combination of PBL with rewards for pupils in higher year groups who require both challenges and reinforcement of motivation. Compared with previous studies, which generally examined a single strategy in isolation, this study offers a novel perspective by illustrating how these five strategies are interrelated and blended together by teachers based on their direct classroom experience across varying contexts, although evidence regarding these combination patterns remains limited to the accounts of the three informants and therefore cannot yet be generalised.

Teachers' Perceptions of Changes in Pupils' Interest in Learning

The increase in pupils' enthusiasm and active engagement, as perceived by the teachers in this study, is consistent with evidence of the effectiveness of concrete materials in improving the mathematical understanding of lower-year primary school pupils (Asadulloh et al., 2024),

as well as the positive relationship between increased learning interest and better mathematical learning outcomes (Ndraha et al., 2022). It should be emphasised that the improvement in marks mentioned by Mrs ONR refers to the teacher's observation of her pupils' test results, not the results of standardised assessments in this study.

The shift in pupils' perceptions from viewing mathematics as a daunting subject to an enjoyable one, as observed by the three teachers, is an achievement that, in theory, can serve as a foundation for long-term improvements in learning interest, in line with findings that appropriate modifications to mathematics teaching strategies and methods can effectively stimulate the learning interest of primary school pupils (Indriani et al., 2022). Similarly, a more comfortable classroom atmosphere resulting from the teachers' personalised approach confirms that personalised attention tangibly contributes to enhancing pupils' enthusiasm and self-confidence in learning mathematics, as stated by Aulia et al. (2022). Nevertheless, as all the data in this section is derived from teachers' perceptions rather than from direct observation or measurement of pupils, these findings should be interpreted as reflecting the teachers' perspective, rather than as evidence of an objectively measurable impact of the strategies.

Conclusion

Based on the research results and discussion, it can be concluded that primary school teachers face five main challenges in mathematics teaching, namely pupils' low mastery of basic mathematics, negative perceptions of mathematics, diversity in pupils' personalities and abilities, a lack of parental involvement, and limited teaching time. To address these challenges, teachers implement five innovative strategies: Problem-Based Learning, the use of concrete learning materials, game-based learning, a personalised approach, and the provision of motivation and rewards. Teachers perceive these strategies as effective in enhancing pupils' enthusiasm, conceptual understanding, and interest in learning mathematics. The teachers' success in boosting pupils' interest in learning mathematics also requires full support from the school in providing facilities, as well as active parental involvement in supporting pupils' learning at home. This study has limitations regarding the number of informants, which involved only three teachers; consequently, it cannot be confirmed that data saturation has been fully achieved, and the findings cannot yet be widely generalised. Another limitation lies in the data sources, which were derived entirely from the teachers; thus, the information regarding changes in pupils' interest in learning presented in this study represents the teachers' perceptions rather than the results of direct measurements of the pupils. For future research, it is recommended to involve pupils and/or classroom observations as additional data sources to obtain a more objective picture of the impact of the strategies; to broaden the scope of the research using experimental or quasi-experimental designs to measure the effectiveness of each learning strategy in a more quantifiable and comprehensive manner; and to increase the number of informants so that the findings can be generalised more widely.

Declarations

- Conflict of Interest** : The authors declare that there are no conflicts of interest.
- Auhor Contributions** : J.I.T.: Conceptualization, Methodology, Investigation, Writing – original draft.
M.F.D.: Conceptualization, Methodology, Formal analysis, Writing – original draft.
D.E.W.: Writing – review & editing. All authors have read and approved the final version of the manuscript.
- Data Availability Statement** : Data supporting the findings of this study are available from the author, J.I.T., upon reasonable request.
- AI Statement** : The authors state that generative AI tools were used solely to improve the clarity, grammar, and readability of the English language in the manuscript. All content, research findings, and data analysis were produced by the authors. The authors take full responsibility for the accuracy, originality, and integrity of the manuscript.

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