

Early grade pupils' development of Mathematics skills: Perceived challenges and culturally relevant strategies for parental involvement

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Abstract. The current study investigated challenges facing parental involvement and culturally relevant strategies for improving parental involvement in the development of mathematics skills among grade two pupils. A phenomenological qualitative design was employed. A semi-structured interview was used to gather data from 12 early-grade teachers and ten heads of schools. Focused group discussion (FGD) was used to collect data from 63 parents. Thematic analysis procedures guided the data analysis procedure, which was aided by pivotal analysis. The study findings revealed that teachers focused on parents' negative attitude towards the subject while parents reported lack of time and economic hardship as factors affecting their participation in engaging in children's mathematics learning. However, all participants agreed that parents' mathematics knowledge is a factor that affects their involvement. Regardless of the participants' category, the provision of interactive mathematics homework and communication through parents' meetings (group and individuals) were regarded as the best strategies for involving parents in learners' development of mathematics skills. The study concludes that the parents agree with the critical role of their involvement despite the challenges facing parental involvement. Therefore, the study recommends that awareness programs and the use of interactive mathematics homework activities are critical to improved parental involvement in their children's learning.

Keywords: parental involvement · mathematics · early grade learners

1 Introduction and background

Mathematics skills refer to the ability to do basic arithmetic operations, understand simple mathematical ideas and apply the knowledge and skills of mathematics in daily life [18]. Clerkin and Gilligan [11], Harris and Petersen [22]

report that the development of early mathematics competence sets the foundation for learning other subjects, and it is a determinant factor for later academic achievement. Kowiyah et al. [31] adds that the ability to understand mathematical concepts and use mathematical tools and mathematical reasoning triggers the learning of many school subjects and further education. Therefore, the need for early preparation of learners with appropriate mathematics skills is inevitable.

The studies on children's learning suggest that their readiness towards school activities is influenced by both school and home experiences, of which parents play a fundamental role [19]. Specifically, Brossard et al. [8], Lore et al. [33] reports that parental involvement in children's mathematics learning outside school positively impacts children's motivation and achievement in mathematics. Parental involvement in early years may also affect the children's inclination towards mathematics in the later years [1, 57]. It is thus imperative to ensure parental involvement in order to enrich the children's mathematics learning experiences within and outside the school. The study by Papadakis et al. [50], which investigated parental involvement and attitudes towards young Greek children's mobile usage, revealed that parents' positive attitude has a significant impact on children's learning, especially when the parents provide a stimulating home learning environment. Thus, parents' support of the children's learning greatly impacts their learning.

Further, a systematic review of about sixty-six studies which focused on parental involvement in children's learning by Henderson and Berla [23] concluded that the most fundamental predictor of students' academic achievements is not solely an income or social status but the level to which the families commit themselves to create a home supportive learning environment and become involved in their children's learning at school and home. Pezdek et al. [51] examined the effect of homework time specifically on mathematics achievement and revealed that improving parents' awareness of their children's mathematics skills could be an effective step towards enhancing children's mathematics performance at school. Pezdek et al. [51] emphasised that the collaboration between both parents and teachers in helping children with homework enhances the quality of mathematics learning. In this regard, Antony-Newman [3] argues that students whose parents are involved in their education are more likely to perform better in mathematics and achieve more than other students whose parents are less involved. Thus, parental involvement contributes significantly to the achievement of both primary and secondary school students in mathematics [57].

Despite the importance of mathematics and parental involvement in students' mathematics learning, several studies show that both mathematics performance and parents' participation in the education of their children appear to be limited and they are in decline [3, 10]. Hugo and Masalesa [24] report that limited parental involvement in mathematics activities results in continued unsatisfactory performance in mathematics, mostly in developing countries. Nyabuto and Njoroge [48] found out that parental involvement level in elementary classes is low as most of the parents rely only on invitations from the school. Therefore,

if schools do not take adequate measures to welcome parents to school, they become less engaged in children's learning. Similarly, there is limited community or parent involvement in children's learning and school matters in most developing countries [66]. Less involvement of the parents in their children's learning of mathematics skills results in continued unsatisfactory academic achievement, specifically in mathematics [24]. Therefore, understanding the substantial factors affecting parental involvement and strategies among the teachers and parents can ensure the enhancement of students' development of mathematics skills. This might provide potential information that could be used to suggest plans that could maximise the benefits of parental involvement in the student's learning of mathematics.

1.1 Mathematics performance

Despite the fact that Mathematics is fundamental in the development of science and technology [11] and learning of other subjects and executive functions [22], its performance in different levels of education has remained a challenge in developed countries such as New Zealand, Australia and the United States [5, 54]. Likewise, in developing countries, including South Africa, Zimbabwe, Ghana and Nigeria, the learners have a poor foundation in Mathematics in the early primary school years (grades one to three) of learning, thus resulting in continued poor performance in other levels [35, 43]. The factors which are associated with poor performance in most developing countries range from the availability, sufficiency and quality of the instructional materials provided by an institution as well as limited parents' involvement in children's learning [9]. Makondo and Makondo [35] report that most of the initiatives to address these challenges primarily focus on an institution (school) with less attention to home (parents) consideration.

Like other countries, Tanzania also faces unsatisfactory performance in mathematics [37, 60]. Several government reports [58–60] and researches such as [7, 37] show that there has been a decreasing performance of the subject, which is contributed by poor foundation of mathematics skills from early grades to lower secondary school. Empirically, a baseline study report by USAID through RTI International on the assessment of learning outcomes among Tanzanian children, which was done in 2013 by Brombacher et al. [7] using Early Grade Mathematics Assessment (EGMA) tool shows that about 22% of the standard II pupils were unable to answer even a single subtraction level one question. According to RTI International, a total of 58% of standard II pupils were unable to answer subtraction level 2 items correctly.

While the Brombacher et al. [7] reported that most grade two pupils perform below the national benchmark, i.e. subtraction level two, Uwezo East Africa [64] noted that six out of ten grade three pupils could not perform standard two mathematics operations. On this note, Ubale et al. [62] acclaimed that limited performance can be attributed to limited parental involvement in mathematics learning as most of the initiatives at the national level have focused on improving the school learning environment and teacher instructional strategies. Husen and Mansor [26] propose that the academic performance of early-grade mathematics

pupils is influenced by the attitudes and aspirations reflected in their parents. Therefore, parents' limited involvement could be a contributing factor to unsatisfactory pupils' performance in mathematics. Despite the common agreement on the role of parental involvement in early children's mathematics learning, such research seems to be insufficient in Tanzania. However, some studies, such as that by Badrasawi et al. [4], depict limited parental involvement.

1.2 Parents' involvement in the development of mathematics skills in Tanzania

The role of parents' involvement in improving early-grade mathematics skills is recognised by different Tanzanian government documents [39, 40]. For instance, the Tanzania Education Framework recognises the need for schools and parents to collaborate in order to enhance the pupils' learning ability. The framework suggests several approaches towards parental involvement, including Parental Teacher Partnership (PTP) associations, school committees' representation and seeking advice [39]. Further, the curriculum for primary education regards families and community involvement as crucial for early stimulation and children's learning at the primary school level [41]. Some of the identified activities include the decision-making process, volunteering in school events and monitoring and evaluating children's progress both at school and at home [41]. If all the activities in question are ensured, effective mathematics learning among early-grade learners can be enhanced [46].

The literature analysis depicts limited studies on parental involvement in enhancing mathematics skills, as most of them focused on reading skills. For instance, the study by Edward et al. [14] revealed that parents have a significant role in helping children develop pre-literacy skills, especially through shared reading. Another study by Ngorosho [47] reports a moderate correlation between reading scales and home environment variables. Further, an intervention on developing reading skills, which was carried out by Kigobe et al. [30] among grade two pupils, noted a significant impact among children who engaged themselves in shared reading activities with their parents than those who did not. Several programs such as EQUIP-T and the USAID – “Tusome Pamoja”, which were carried out in Tanzania, improved the quality of early-grade reading and mathematics skills instruction through engaging parents and communities. The noted programmes managed to establish the PTP which was reported to be successful in stimulating teacher-parent or community for sustainable and effective school support [45]. However, most of the studies that were conducted in Tanzania focused on reading, which has resulted in unsatisfactory mathematics performance among early-grade learners.

Despite several researches and acknowledgement by government documents, studies [2, 30, 47, 55] report varied constraints on parental involvement in children's learning. For example, Shukia [55] suggests that parents are less inclined to supervise their children's homework or even visit their children's schools to monitor their academic progress. Kigobe [29] and Plante and Palmer [52] report other compromising factors of parental involvement (i.e., poverty, lack of

formal education and poor attendance in school meetings). However, empirical studies on how parental involvement influences the development of mathematics skills among pupils, particularly in the context of Tanzania, remain scarce. This implies that learning mathematics is compromised compared to reading skills. Therefore, the current study establishes the challenges that affect parental involvement in the development of mathematics skills and suggests the ways that schools can adopt to involve parents in the development of mathematics skills among grade two pupils. In this regard, two **research questions** guided this study as indicated below:

- i. What are the challenges facing parental involvement in enhancing the development of mathematics skills among grade two pupils?
- ii. What are the culturally relevant strategies for enhancing parental involvement in the development of mathematics skills among grade two pupils?

1.3 Theoretical context

The current study was guided by the Theory of Overlapping Spheres of Influence, which was advanced by Joyce Epstein in 2002. The theory combines psychological, educational and sociological perspectives in an attempt to explain and give the description of relationships that exist between the parents, schools and local environment [15]. The three spheres of influence in relation to this theory include family, school and local community [68]. The theory recognises the overlapping roles of the school (teachers), family (parents), and community in the learning of a child. Therefore, Epstein et al. [16] argues that an active teacher-parent partnership should be evident to result in the most productive learning experience in mathematics skills for the pupils. Epstein posits six types of parental involvement in children's learning. The preferred types of parental involvement comprise parenting, communicating, volunteering, learning at home, decision making and collaborating with the community [15, 16]. Parenting focuses on parents' acts of helping children to engage themselves in learning at home through the provision of necessary support, while schools help students by creating positive learning conditions. Communication reflects two-way traffic between parents and families in order to increase understanding and cooperation through communication media such as phone calls, emails, or conferences. Moreover, volunteering reflects the activities organised by the school and/or community that need parents' support [16]. Learning at home reflects parents' involvement in different activities, such as assisting in the children's homework and decision-making on school policies or management, both informally or formally [68]. Further, collaborating with the community entails explaining the way in which schools cooperate with community agencies, organisations and other groups to share various responsibilities for children's education and future success [15].

2 Methodology

The current study was guided by qualitative research inquiry. The qualitative approach helped the researcher to gain an in-depth understanding of the chal-

allenges facing parental involvement in children's mathematics learning as well as suggest strategies for improving parental involvement [13]. Qualitative methods were primarily used to minimise misinterpretation and allow for explaining the study's purpose and addressing queries during discussions [17]. The approach also fostered rapport and cooperation between the researcher and informants; hence, it becomes crucial for eliciting authentic views from participants [13]. A phenomenological design was adopted as it is based on the theoretical perspective that advocates for studying direct experiences from the participants' face value [34]. It enabled the study to provide rich and detailed descriptions of the phenomenon under investigation. The design suited the study since it provided an opportunity for the researcher to hear from the participants' (teachers, head teachers and parents) world view while remaining impartial. In this regard, the participants' perspectives on the challenges facing parental involvement in enhancing the development of mathematics skills among grade two pupils and strategies that may be used to enhance the same were explored.

Further, the study was conducted in 10 primary schools in Ukerewe District, Tanzania. Purposive sampling was used to select ten (10) underperforming schools in standard two national learning assessments for three consecutive years were sampled [60]. Therefore, a total of 12 teachers and 10 head teachers were purposefully selected. The head teachers were selected based on their positions. They are crucial for developing parental collaboration at the school level. Further, teachers who taught grade two pupils were involved because they are at the core teaching business in specified early grades and communicate with children's parents every day. Therefore, they were in the best position to share their views regarding the challenges facing parental involvement in enhancing mathematics skills among grade two pupils as well as the strategies that may influence parental involvement in the development of mathematics skills among grade two pupils. The parents, especially those with grade two pupils, were conveniently selected to participate in the current study. The parents were involved in the study because they are prime stakeholders for children learning at home. The researcher requested the head teachers to invite twelve parents to each class based on gender balance. Only the parents who were available and ready to share their ideas were invited. A total of 10 FGDs were conducted and involved 10 groups from ten sampled primary schools. Therefore, 63 parents were involved in the study, and each group had not less than six participants. The validity of findings in qualitative studies tends to rely heavily on the adequacy of the data collected in an attempt to answer research questions [17]. The prepared codebook in advance helped to determine the saturation point of data.

2.1 Data collection methods and analysis plan

The data were collected through qualitative measures. For this reason, two research methods of data collection, namely interviews and focus group discussion (FGD), were used. Two sources of data collection were used for triangulation and complementation reasons. The semi-structured interviews, which were guided by an interview guide, were used to collect the data from the teachers and head

teachers (HTs). FGD guide was used to collect the data from parents. The data collection process involved systematic recording and documenting of the responses using digital voice recorders and notebooks, respectively. An average of one hour was used during the interview with teachers, while an average of one and a half hours was spent in group discussion. The qualitative data, which were collected through semi-structured interviews and focus group interviews, were analysed thematically based on observing six steps as suggested by Braun and Clarke [6]. Firstly, the gathered data through a voice recorder were listened to and re-listened to in order to make sense of them, and then transcribed into the text. The transcription was carried out immediately after the data collection process. All necessary voices were taken as spoken by the participants in order to keep the original meaning intended by participants. After that, the transcriptions, which were in Kiswahili, were translated into English for analysis and report writing. To ensure confidentiality, pseudonyms were provided, and any identifiable information was stripped throughout the transcription trajectory. The analysis of the data started with reading and rereading the transcripts so as to get familiar with the data or immersed in the data, which involved writing down all key ideas.

Then, the data were coded using colours in order to indicate the emerged potential patterns. Prior to theme identification, categories of the coded data were developed. Then, all extracted codes were exported to an Excel spreadsheet for analysis [53]. A pivotal table was developed and used to merge the recurring codes in order to create frequencies of responses as they were categorised. This process enabled easy creation of themes. The development of themes went hand in hand with reviewing them. During this process, the code extracts were regularly checked in order to ensure that they were consistently linked with the themes. The themes that lacked adequate data to support them were merged with themes that resembled them. After that, clear definitions and names for each theme were generated. Finally, the report was written based on the discussion of the findings, and the reviewed literature and theory underpinned by the study were taken into consideration.

2.2 Ethical consideration

The research permit was sought from the President's Office, Regional Administration and Local Government (PORALG), which is in charge of Tanzania's primary and secondary school education, while the ethical clearance form was sought from the University of Dodoma. After reaching the study sites and explaining the purpose of the study, the researcher secured the consent directly from the interview and focus group participants. To ensure confidentiality, the participants' names were kept anonymous, and the responses were kept confidential and used for the current study only.

2.3 Trustworthiness of the study findings

To ensure the trustworthiness of the study findings, four principles, which include credibility, transferability, dependability and conformability, were observed [32]. To ensure the truthfulness of the research instruments, the experts in the field and other experienced teachers (primary teachers) checked both the content coverage and clarity of questions. Further, a pilot study was conducted at one school which was not involved in the actual study in an attempt to test the research instruments. Additionally, the study warranted data triangulation through the use of multiple methods (interviews and FGDs) from different informants (teachers, head teachers and parents). The researcher and one of the trained enumerators were involved in the data collection process. The data collection process covered two weeks in the natural setting (the respective schools). To ensure dependability, the researcher explained the purpose of the research to research participants in order to develop trust among them. Equally important, the participants were asked to offer their consent. In order to confirm the authenticity of the collected data, the researcher read the transcribed and translated data to ensure the retention of the original meaning. Experts reviewed the coded data in order to confirm the transcribed data. Then, a code book that guided the coding process was developed based on the collected data and relevant literature on the field. Inter-rater reliability was calculated in an effort to confirm the coded data.

3 Results

3.1 Challenges facing parental involvement in the development of mathematics skills among grade two pupils

The current study explored the challenges facing parental involvement in enhancing the development of mathematics skills among standard two pupils in Tanzania. The study findings show that the challenges could be categorised into four categories: subject-related challenges, parent-related challenges, teacher-related challenges, and policy-related challenges. However, the analysis shows that most of the challenges focus on subject- and parent-related challenges compared to other mentioned challenges.

3.2 Subject-related challenges

The responses revealed that respondents had shared and varied responses regarding subject-related challenges. On the one hand, all respondents shared the view that mathematics' negative attitude and parents' mathematics knowledge affected their collaboration. On the other hand, only parents reported self-efficacy as the factor that affects their collaboration in enhancing the development of mathematics skills. In this regard, teachers argued that parents believe that mathematics is a difficult subject. Therefore, they are not interested in it. This resulted in more focus on other skills, such as reading, at the expense of mathematics. While teachers directed much of their claim to parents, this was contrary

to parents and head teachers. Both teachers and parents strike a balance by attaching a negative attitude towards Mathematics. Thus, some of the teachers also had a negative attitude towards Mathematics and doubted parents' capacity to help their children learn Mathematics. For instance, parents reported that teachers also seem to lose interest in providing mathematics homework as compared to reading and writing activities. In support of the teachers' view, one parent had the following comment during FGD:

In many instances, I always see children coming back home with writing assignments. I have never seen a child coming back home with mathematics homework. I don't know why teachers don't give the children mathematics homework? If they would be giving the children mathematics homework, perhaps we would have been helping them at home. (FGD with the parent at school D, 2023)

Likewise, one head teacher from school G had the following observation with regard to parents' negative attitude towards mathematics.

Other parents have a negative attitude towards mathematics. They used to say that it is a difficult subject. Therefore, they do not take it into consideration compared to other subjects such as reading and writing. (Interview with the head teacher from school G, 2023)

With reference to the two verbatim quotes above, one could conclude that teachers' and parents' views on Mathematics are negative. Such attitudes hamper their collaboration in improving pupils' learning of mathematics skills, which subsequently affects the pupils' ability to learn mathematics. Therefore, there is a pressing need for both parents and teachers to develop a positive attitude towards Mathematics in order to smoothen their collaboration and improve the pupils' learning of Mathematics.

Further, parents' mathematics knowledge and self-efficacy were also reported as being the factors that affect parents' involvement in the development of mathematics skills among pupils. While all class and head teachers held the view that the parents had limited knowledge of Mathematics, only parents reported mathematics self-efficacy. Low education and old age constituted the concerns which were raised regarding mathematics knowledge among most parents. It was reported that most of the parents had either completed Standard VII education or did not attend the school at all. So, it was difficult for the parents to help their children in Mathematics sufficiently. However, parents' views did not focus much on their mathematics knowledge but focused on self-efficacy. In a discussion with the parents, they revealed that they could rely on other siblings at home to help their children with mathematics skills. However, the negative attitude towards Mathematics affected parents' readiness to engage themselves in students' mathematics learning. For example, one of the parents had the following to share during the FGD:

Some parents are afraid of Mathematics because they think that they cannot help their children with simple operations. Other parents are even

afraid of Mathematics teachers because they do not know a good way to communicate with them regarding the development of their children. (FGD with the parent school in school C, 2023)

On the other hand, the teacher from school G had the following comment:

Some of the parents lack knowledge of helping their children at home. There are other parents who tell you that they don't understand when told to help their children because they are not educated. Other parents say that Mathematics is difficult and that it could be better if it could be reading skills. (Interview with the teacher from school G, 2023)

The verbatim responses above by informants reveal that mathematics knowledge is related to mathematics efficacy. If parents have positive efficacy toward mathematics, they will easily help their children develop mathematics skills. This is based on the fact that the mathematics operations learnt at lower grades do not require complicated knowledge of mathematics.

3.3 Parents-related challenges

The study findings show that respondents shared various perspectives on the challenges that affect teacher-parent collaboration. The limited parents' awareness, readiness and socio-economic status constitute the shared perspectives regarding the parents-related challenges. The most frequently reported challenges, as identified by most of the respondents, comprised limited parents' awareness and readiness. The interviewees ascribed that difficulty in collaborative activities, such as helping with homework and poor attendance at school meetings, is attributed to low awareness among parents with regard to the importance of collaboration in children's mathematics learning. What was most noticeable in the parents' data constituted their attribution to other factors, such as low education and the misguided perception that the teaching role is handled by the teacher alone. For example, during the FGD at school C, one of the parents noted how daunting it is for parents, especially when they fail to respond to mathematics questions. Therefore, the solution was to stay away from their pupil's mathematics learning. For instance, one of the parents at school A had the following comment during FGD:

I think that teaching is the responsibility of the teacher. Therefore, I cannot interfere with the teaching because they may think that I am taking their responsibilities. After all, teachers are paid the salaries for teaching our children and my duty is to ensure that the child has exercise books and school uniform. (FGD with parent at school A, 2023)

With reference to the verbatim response above, the parent related their socio-economic status, which involves parents' occupation and income with mathematics teaching. An overwhelming majority of respondents reported that parents with high socio-economic status are more likely to be involved in their pupils'

learning of mathematics compared to parents from low economic status. In line with this argument, teachers revealed that families with high socio-economic status can buy mathematics books for their children and can have ample time to help their children learn mathematics at home. While parents from well-off families could get more time, another category was considered to be busy with searching for family demands, thus denying them time to concentrate on mathematics learning among their children. For instance, one teacher from school E had the following opinion:

Parents who belong to high socio-economic families are more involved in their pupils' learning. They provide their children with learning materials such as books compared to their counterparts from low socio-economic status. I also see them coming to school and make follow-up on their children's progress. (Interview with the teacher from school E, 2023)

However, there were contrasting views by parents regarding the parents' socio-economic status and its effects on teacher-parent collaboration in mathematics learning among the pupils. While some parents argued that they are affected by their economic conditions, some of them were against this view. Those who supported this view argued that they spend much time searching for family needs and, therefore, they cannot afford to get time to help their children at home. On the contrary, other parents were of the view that they could still offer collaboration despite the family's socio-economic status because helping is willingness and readiness. For instance, one parent at school C had the following observation during FGD:

So, we are unable to help the children since we are at work most of the time. We lack time due to the economic situation. We are looking for food to feed our children. (FGD with the parents at school C, 2023)

In contrast, one parent substantiated that:

I used to sell small fish in the evening but when I arrive at home, I must ask my children to show me what they have learnt at school. If I see any challenge, I contact the teacher in the next day. Researcher (informed called), "does this need to have money?". (FGD with the parents at school C, 2023)

The above verbatim responses by the parents may imply that the parents' socio-economic status may impact the effective parent's involvement in the pupil's development of mathematics skills. However, the parents' willingness, readiness and time setting can help in developing collaboration in helping children the learning of mathematics among pupils. Therefore, the parents need to have correct guidance on how to balance their work time and supervision of children's learning at home.

3.4 Teacher-related challenges

The study findings revealed that teachers also greatly affect parents' involvement in pupils' mathematics learning. The head teachers and parents reported that some teachers are irresponsible while others are not respectful. For instance, some of the head teachers noted that other teachers do not take any initiative to involve the parents in children's learning. This implies that they do not conduct the class meetings with parents. They neither communicated with the parents nor offered the mathematics homework. In this regard, it was difficult for parents to engage themselves in their children's learning.

Apart from the head teachers, parents noted that teachers do not much respect them. This results in hesitation in participating in both school activities and children's learning. On a specific note, parents reported that teachers think that they do not know anything. Therefore, they cannot assist their children at home. Others went further by saying that the teachers looked down upon them. The teachers do not accord them the required respect and ask them how they can cooperate with people who do not respect them.

Nowadays, the teachers are not like those who used to teach us. They do not do their jobs as it is required. You find out that the child is not taught and the teacher does not accord cooperation. He tells you that you should not teach her/him how to work. Truly, they lack discipline; hence, another fearful parent must be afraid to ask the teacher. (FGD with parents at school E, 2023)

The expression above shows that some parents may be afraid of cooperating with teachers due to disrespect for the parent. Ultimately, this affects parental involvement in children's learning. It is, therefore, suggested that the teachers and parents must respect each other for effective parental engagement in children's learning of mathematics skills.

3.5 Policy-related challenges

Policy-related challenges were also reported as one of the challenges that affect parental involvement in enhancing the development of mathematics skills among standard two pupils. Specifically, the shortage of mathematics books, large number of pupils and shortage of teachers were reported to affect the nature of collaboration. For instance, the shortage of mathematics books denied the parents the opportunity to borrow the books at school to help their children. Conversely, teachers could not lend them to parents. Therefore, parents' needs were not easily fulfilled, and teachers' ambitions were also not easily achieved. For instance, the head teacher from school H had the following observation:

We really have a few books because we don't buy books nowadays. They are, instead, supplied by the government. Therefore, the books that they bring are very limited and they are, sometimes, sufficient for pupils only. Therefore, we cannot manage to lend books to parents. (Interview with the head teacher from school H, 2023)

Further, the shortage of teachers and many pupils in class comprises two twin factors that affect the teacher-parent collaboration for standard two pupils' development of mathematics skills. The factors were considered to be twins since they worked along with each other. The teachers reported that they had many pupils in the class and, therefore, it could be challenging to make individual consultations with their parents. In addition, teachers reported difficulty in providing the homework because it could be difficult to mark them or make close follow-ups. With this situation, one can learn that teachers will have a manageable number of pupils in class if there are sufficient teachers, and such teachers can provide individual assistance, including parents' involvement.

3.6 Strategies for enhancing parental involvement in the development of mathematics skills among grade two pupils

The study findings revealed several strategies for enhancing parental involvement in the development of mathematics skills among standard two pupils. The findings revealed the shared perspectives on the effective strategies for parent involvement in enhancing mathematics learning. All respondents suggested mathematics homework supervision as an effective strategy to foster parental involvement in enhancing the development of mathematics skills among standard two pupils. Moreover, educating parents, regular parent meetings and developing positive teacher-parent relationships were minimally reported, as revealed in table 1.

Table 1. Effective strategies for parental involvement in enhancing the development of mathematics skills among standard two pupils (field data).

Suggested strategy	Teachers	HTs	Parents
Interactive mathematics homework supervision	26 (63.4%)	19 (61.2%)	28 (63.6%)
Educating parents	10 (24.3%)	9 (19.3%)	13 (29.5%)
Parents meetings	3 (7.3%)	3 (12.9%)	2 (4.8%)
Developing positive relationships	2 (4.8%)		1 (2.4%)
<i>Total</i>	41 (100%)	31 (100%)	44 (100%)

3.7 Interactive mathematics homework supervision

Respondents reported interactive mathematics homework (IMH) supervision as one of the effective strategies for fostering parental involvement in the development of mathematics skills among standard two pupils. IMH could also enhance pupils' learning of mathematics skills. It was observed that parents were anxious about children's learning at home. For instance, some parents reported that schools should give books to pupils and guidelines on the questions to be performed daily. Others suggested that pupils should be given questions to do every day while at home. Equally important, the teachers and head teachers revealed

that IMH is an effective strategy as the pupils develop more attachment to their parents. Other reasons were substantiated as the reasons for considering IMH as an effective strategy. Firstly, it was noted that pupils get an opportunity to make revisions and exercises at home. Secondly, parents should become familiar with the school curriculum and syllabus. Thirdly, parents should set time for helping and interacting with their children as stipulated guidelines. Fourthly, it helps to monitor pupils' attendance and learning. One teacher from school I had the following view with regard to the effectiveness of IMH during the interview:

Without doing more exercise, it is, to some extent, difficult to know mathematics effectively. Therefore, children must do more exercises at home because we have a fixed timetable at school. Their parents can help the pupils while at home and they should contact us in case they face difficulties. (Interview with the teacher from school I, 2023)

With regard to IMH, one of the parents at school H:

Our children often don't come to school. They end up hiding in the streets instead. However, since they know that there is homework, they will come to school because they know that we shall ask them about the assignment for discussion. Therefore, they know that if they miss the classes for two consecutive days, we shall inquire from the teacher about what is happening. If they abscond from school, you will know. (FGD with parents at school H, 2023)

The expressions from the teacher and parents suggest that the provision of IMH enables pupils to get an opportunity to practice more, and parents get in touch with their children by helping them in case of complex concepts. This implies that IMH provides the pupils with increased opportunities to participate in mathematics exercises at home, thus developing their mathematics skills. Furthermore, parents get an opportunity to know whether their children attend the school or not and be able to make follow up. Therefore, they can make more effort to communicate with the teacher in order to know the reality.

3.8 Educating parents

Another strategy which the respondents reported involved educating the parents on the importance of participating in children's learning at home. The study findings show that most parents consider teaching to be the teacher's duty; hence, they are not responsible. It is worth noting that most of the teachers suggested raising parents' awareness by educating them. Several mechanisms for educating the parents were pointed out. One of the mechanisms is about conducting school and class meetings. The second mechanism is about conducting workshops and training among the parents. Some of the teachers reported that conducting the meetings with the parents could inform them about the importance of engaging parents in children's learning of mathematics skills. However, some of them had different views that parent meetings might not be an effective means as parents

rarely attend the meetings. For example, one teacher from school D had the following comment:

Meetings are good but I doubt whether this can help or not taking into consideration the parents' tendency towards school meetings. Unless we use other means, such as a workshop, the meetings won't help. When parents hear that there is a workshop or seminar, they know that it is something new, and so they come in a big number. (Interview with the teacher from school D, 2023)

Furthermore, educating parents was considered to be an effective strategy because it offers the parents an opportunity to develop some skills in handling children's learning. It was argued that some parents cannot handle children during learning. Such parents reported that they do not have pedagogical knowledge since they are not teachers. In support of this opinion, some parents have reported that they are harsh when guiding their children in their learning. In such a hostile environment, the children develop fear instead of learning, and they fail to learn effectively. In this regard, the parents can create common knowledge if given training. Further, the parents and teachers should establish complementary communication. In support of the argument at hand, one of the parents had the following comment during FGD at school G:

As parents, we don't have methods to teach children. We don't guide children step by step but we treat them as adults. Some of the parents are too strict to the extent that the child starts crying when he/she sees his/her parent with a book. (FGD with a parent at school G, 2023)

The expression by the parent implies that they lack sufficient skills to help their children learn mathematics skills.

3.9 Developing positive relationship

The study findings showed that establishing positive relationships among teachers and parents constitutes one of the effective strategies. On the contrary, teachers and parents minimally noted the development of positive relationships. For instance, it was reported that working with parents needs to build rapport and trust. In this view, the teachers suggested that they need to show genuine respect and empathy for the parents and their perspectives. On the other hand, it was reported that the parents also need to respect the teachers, appreciate their work, and motivate them to collaborate effectively. In support of the argument at hand, the teacher from school C had the following to say during the interview:

For the parents to collaborate with you, you must acknowledge their strengths and contributions. If you ignore their contributions, don't think that they can give you a positive shoulder. Your language must be welcoming and positive. (Interview with the teacher from school C, 2023)

Another teacher added:

The parents must appreciate that we are working to ensure that their children learn well. Therefore, they should respect us when they come to school. They should not insult us in front of our pupils or discuss us negatively when they are at home. (Interview with the teacher from school G, 2023)

Based on the suggestions of both teachers and parents, it is evident that a positive relationship based on respect and trust between teachers and parents constitutes an effective strategy for ensuring teacher-parent collaboration. When trust and respect are guaranteed, each party feels free, valued, and ready to collaborate in any engagement.

4 Discussion of the findings

The study findings revealed several challenges that affect parental collaboration in enhancing the development of mathematics skills among grade two pupils, including parents' mathematics knowledge, socio-economic status, and mathematics self-efficacy. Similar to the current study findings, Hanafin and Lynch [21] and O'Donoghue [49] observed that parents' education level determines whether parents will be actively involved in children's mathematics work or not. As it was viewed in the current study, parents with high levels of education were regarded as more effective and active in engaging themselves in their pupil's mathematics learning than their counterparts with low levels of education. The limited engagement of the parents with low education was attributed to low self-efficacy. Papadakis et al. [50] had similar findings in that less-educated parents seem unable to adapt appropriately to rapid technological progress and thus cannot effectively exploit the advantages that mobile learning technologies have to offer to children. In supporting the arguments in question, Hamlin and Flessa [20] found out that many parents with low education suffer from low self-esteem, and others do not experience success in school themselves; hence, they lack the knowledge and confidence to help their children. Further, Mwase et al. [44] propose that parents with low self-efficacy are more likely to avoid contact with schools.

Different from low level of education, parents' socio-economic status was also viewed as a detrimental factor towards successful parental involvement in the development of mathematics skills among grade two pupils. In this regard, Đurišić and Bunijevac [63] report that the parents' socio-economic status influences parental involvement in children's learning and school activities. Đurišić and Bunijevac [63] further assert that parents from lower socio-economic backgrounds face many more barriers to involvement, including non-flexible work schedules, lack of resources, transportation problems and stress due to residing in disadvantaged neighbourhoods. Additionally, Hunt and Hu [25] point out that the feelings of inadequacy and preoccupation with necessities prevent parents from other forms of collaboration, such as communicating with schools.

The findings of the current study revealed that parents with low socio-economic status spend more time seeking family demands. Therefore, they face difficulty participating in their children's classroom activities, attending meetings, or providing assistance in mathematics learning activities.

While the study findings and reviewed literature show the challenges that mainly focus on the subject itself and parents, the issues related to policy may serve as the means to mitigate the challenges. As viewed in the current study, there is a likelihood of improving teacher-parent collaboration if sufficient teachers and books are available. Martin et al. [36] and Sobayi [56] substantiate that the parents can easily engage in their children's learning as they can borrow some books from a school where there are sufficient books. While the availability of mathematics books is highly acknowledged, this has been a challenge in developing countries as it affects parents' involvement in children's teaching [37]. Therefore, if the shortage of books and teachers is not addressed accordingly, such a situation will continuously impact teacher-parent collaboration. However, if there are sufficient teachers, they will be able to offer individualised pupils' assistance and provide mathematics homework activities for children's learning.

Furthermore, the findings highlight the significance of IMH, thus emphasising its importance in ensuring that children do not solely concentrate on playing during post-school hours. Kerawalla et al. [28] report that when children are engaged in mathematics homework activities, they develop a level of self-responsibility and independence in mathematics activities. This implies that when children have their homework, they learn self-management skills through balancing playing and learning time. Further, Moore and Ronau [42] and Xu [67] reveal that when children are provided with interactive homework, they learn how to manage their home chores and develop self-efficacy skills and provide parents with an opportunity to interact with their children. This implies that they will engage in various household tasks while allocating time to complete their homework and foster essential self-management skills in addition to academic proficiency.

While IMH was highly capitalised on in this study, the review of the literature presents varied perceptions regarding the effectiveness of IMH on children's learning. For instance, the studies on the assessment of the relationship between academic achievement and mathematics homework focus on three main variables, which comprise the amount of homework assigned, time spent on homework and amount of homework actually completed [61, 69]. The general findings reveal that the variables in question remained inconclusive because most of them revealed a limited association between homework and academic achievement in elementary school. However, other studies such as those by Cooper et al. [12] and Moore and Ronau [42] found out that the most potent factor affecting achievement was the amount of homework that the student actually completed as opposed to the amount of homework that was assigned. Therefore, Moore and Ronau [42] suggest that the children in elementary schools also perform better if the homework provided is relevant in terms of amount and time spent.

Another issue which gained attention involved the creation of mutual relationships between teachers and parents. Similar to the findings of the current

study, a study by Wellner [65] shows that building trustful relationships between the teacher and parent involves the school's openness and trust in each other, thus building connectedness and trust between parents and teachers. Equally important, Karakuş and Savaş [27] investigated the effects of parental involvement, teachers' trust in parents and students and teachers' pupil control ideology on conflict management strategies. The study revealed that the teachers develop trust in parents and their students as the parents are more involved. Based on such findings, parental involvement in the development of mathematics skills can be enhanced if there is a positive pattern among teachers and parents. While trust was spotted in literature [38], it also presents the fundamental aspect of raising parents' awareness through organising training and workshops for the families, as was also noted in the current study. With regard to this view, parents will be able to collaborate with teachers effectively if they are aware of their role in the children's mathematics learning.

5 Conclusion and recommendations

The current study identifies the predominant challenges in parental involvement in children's mathematics learning as being related to the mathematics subject itself and the parents' attitudes and knowledge. The aforementioned challenges are likely to result in poor pupils' learning of mathematics skills and subsequently result in poor mathematics skills performance. This can lead to impairment in learning other subjects and other executive functions. The study, therefore, concludes that for effective enhancement of early-grade pupils' mathematics skills, it is fundamental to foster parents' positive attitudes towards mathematics. Further, schools should develop effective mechanisms in an attempt to raise the parents' awareness and readiness for involvement in pupils' mathematics learning. Furthermore, it can be concluded from the study findings that in order to improve parental involvement in pupils' development of mathematics skills, schools need to design and provide interactive mathematics homework, educate parents through meetings and workshops, and foster positive relationships. However, designing and providing interactive homework facilitates the rest. It is therefore recommended that schools should design and provide interactive homework in order to improve the teacher-parent partnership and enhance mathematics skills among grade two pupils. Additionally, since the current study focused on early-grade learners, especially grade two pupils, it is recommended that other studies be done in upper grades to determine the effectiveness of parental involvement in enhancing mathematics skills development.

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