

Exploring Grade R teachers' mathematics curriculum practices and strategies for improvement: Implications for physics teaching

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Abstract

This study sought strategies to improve teachers' professional curriculum practices in a Grade R mathematics class. A phenomenological research design was employed to generate data for the study using a sample of fifteen participants. A semi-structured interview guide was used to collect the data for the study. In this regard, the interview guide was properly validated, and trial tested. Data collected for this study were analysed using a thematic analysis. The findings of the study showed that the strategies for improving teachers' professional curriculum practice in a Grade R mathematics class include: employing adequately qualified Grade R teachers; making available teaching and learning resources; encouraging sufficient parental involvement; encouraging support by authorities; and, using adequate language for teaching and learning. It was therefore concluded that for Grade R teachers to engage learners in Professional Curriculum Practices (PCP), they need to have access to teacher development programmes. This finding implicates physics teaching in the sense that proficiency in mathematics teaching is imperative for physics teaching. Thus, a practical approach to mathematics teaching can as well be deployed in the teaching of physics concepts due to the abstract nature of the subjects (Mathematics and Physics). In order words these identified strategies for mathematics teaching can be used for physics teaching at a higher education level. Thus, it was recommended that the integrated teacher development programme should be implemented to enable teachers to be fully engaged in Grade R mathematics classes.

Keywords: Improvement, Strategies, Teachers' Professional Curriculum Practice, Grade R Mathematics.

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1. Introduction

1.1 Statement of the problem

The teaching and learning of mathematics in South African foundation schools has faced a lot of challenges. This is evident from the poor outcomes in mathematics among learners which has received much attention in recent times (Umugiraneza et al., 2017a). Only 16% of South African Grade 3 children are performing above average while the rest perform below average in mathematics (Spaull & Kotze, 2015). According to the South African Department of Basic Education ([DBE], 2016) as cited in Umugiraneza et al. (2017a), only 20% of Grade 12 learners got 50% and above in a mathematics examination in 2015. In an effort to create a curriculum that can be used to prepare learners to compete in the global economy, the South African curriculum policy landscape has undergone several reviews (Umugiraneza et al., 2018b).

Despite the fact that mathematics is a key subject necessary for the promotion of economic development, South African learners perform poorly in mathematics in comparison with learners of other countries (Bosman & Schulze, 2018). Perez and Alieto (2018) noted that the poor performance of learners in mathematics is as a result of the decisions determining the language of instruction, specifically, in the early years of education. Based on the foregoing, researchers explored strategies to improve teachers' professional curriculum practice in a Grade R mathematics class within the theoretical framework of Vygotsky's Theory of Scaffolding.

1.2 Theoretical background of the study

Vygotsky (1978) developed the Scaffolding Theory which describes social and instructional support for students' learning of new concepts. This theory, in the context of learning, is analogous to the structures erected alongside newly constructed buildings. The role of the scaffolding in this context is to support the introduction of new material and is taken away when the lesson is understood (Vygotsky, 1978). According to Vygotsky, learning depends on the zone of proximal development (ZPD), which is the distance between the actual developmental level as determined by independent problem-solving and the level of potential development as determined through problem-solving in collaboration with more capable peers. Vygotsky believed that before the scaffolding is taken away to fully form an understanding of a concept, the students must be taught the new materials within their ZPD in order to develop a relationship with the materials.

Thus, it is the responsibility of the teacher to provide challenging tasks that are within the learners' ZPD. The inclusion of social interaction as a necessity in learning makes Vygotsky's theory quite different from other theories. Hence, advanced scaffolding involves assigning tasks that are likely challenging to the learners. The sessions should be designed in such a way as to enrich cognitive and social skills. This theory therefore, demands that teachers need to employ different strategies to be able to effectively teach mathematics to different categories of learners. Thus, the researchers adopted this theory in order to explore strategies to improve teachers' professional curriculum practice in a Grade R mathematics classroom.

1.3 Review of related empirical studies

Lynch and Star (2014) found that 71% of the teachers reported that in their own learning, they were not frequently exposed to multiple strategies for solving math problems. Makeleni and Sethusha (2014) highlighted that foundation phase teachers acknowledged the benefits of previous curriculum workshops despite the challenges they encountered in implementing the curriculum.

Interviews with the students on the use of multiple strategies indicated that they preferred instruction with multiple strategies which reduce confusion in their regular instruction (Lynch & Star, 2014b). Classroom observation data analysis showed that the level of enacted mathematical tasks and teachers' questioning strategies influenced teachers' classrooms mathematical communication (Martin et al., 2015).

Ottmar et al. (2015) demonstrated that helping teachers to create a supportive classroom through building social and emotional capacity helps them provide stronger mathematics teaching practices. Broadbent and Poon (2015) revealed that teachers' use of time management, metacognition, effort regulation and critical thinking strategies positively enhanced children's academic outcomes. Blazar (2015) indicated that the use of inquiry-oriented instruction strategy positively influences students' mathematics achievement. Wilkie (2016) found that learners liked teachers' use of multiple strategies in teaching of mathematics.

Use of multiple strategies in the teaching of algebra improved students' learning, suggesting that the approach has promise when used sufficiently often (Star et al., 2016). Bol et al. (2016) indicated that training in self-regulated learning strategy improved mathematics achievement and metacognitive skills. Teachers in inclusive classrooms used different teaching strategies and classroom practices to accommodate students with complex learning and behavioural disabilities (Kaur et al., 2016).

Jacob et al. (2017) revealed that a professional development program had a positive impact on teachers' mathematical knowledge for teaching. McFadden and Roehrig (2017) indicated that instituting curriculum development activities and/or strategies helped in the development of active classroom teachers, thereby improving their mathematics teaching efficacy.

Professional learning communities (PLCs) lead to an increase in teachers' pedagogical content knowledge (PCK) and disciplinary content knowledge (DCK) which in turn facilitate change in teacher practices from traditional to more inquiry-based approaches (Jacob et al., 2017).

Umugiraneza et al. (2018a) revealed that teachers of mathematics had limited knowledge about how they could integrate curriculum documentation in mathematics teaching and learning. Umugiraneza et al. (2018b) revealed that teachers used a single method in teaching statistics, but more than one method for teaching mathematics topics. Perez and Alieto (2018) revealed that proficiency in the mother tongue has a strong positive correlation with the learners' achievement in mathematics.

A parent report of engagement in pre-Grade 1 activities positively relates with learners' achievement at other levels (Visser et al., 2019). The strategy of revising a task and designing of the task successfully helped teachers to develop their own knowledge of content and developing an algebraic expression for a given linearly growing visual pattern (Superfine et al., 2020). Gresham and Burleigh (2019) indicated that teachers' utilisation of various reform-based strategies to teach and model concepts in mathematics was effective in improving their mathematics teaching efficacy beliefs by reducing their mathematics anxiety. Lindenskov and Lindhardt (2020) revealed that teachers who planned lessons with a more concise teacher presentation strategy had a higher probability of arousing individual and group elaboration in an inclusive classroom.

1.4 Gaps in literature

A review of related empirical studies has shown the studies conducted in other countries of the world on the curriculum practices of mathematics teachers at different levels of education especially the foundation phase. The studies showed that mathematics teachers use different curriculum strategies to deliver mathematics instructions. However, the review showed that none of those studies were conducted in South Africa. Furthermore, the review showed that in-service teachers in South Africa had insufficient understanding of the teaching of mathematics and that resulted in poor teaching of mathematics at Grade R classes (Setoromo & Hadebe-Ndlovu, 2020).

Teachers from different contexts in South Africa have similar beliefs about mathematics teaching in Grade R but unfortunately their teaching practices and strategies do not match Grade R teaching (Barnard & Braund, 2016). Those established gaps in literature necessitated the researchers' quest for this research which explored the strategies to improve teachers' professional curriculum practices in a Grade R mathematics classroom.

1.5 Objectives of the study

The study sought to determine the:

1. Strategies to improve teachers' professional curriculum practices (PCP) in a Grade R mathematics classroom.
2. Possible threats to successful implementation of the strategies.

1.6 Research Questions

1. What are the strategies that can improve teachers' professional curriculum practices (PCP) in a Grade R Mathematics classroom?
2. What are the possible threats to successful implementation of the strategies?

2. Methods

2.1 Research approach and design

The researchers adopted a qualitative research approach which relied heavily on verbal descriptions of a particular social context being studied. Further, a phenomenological research design was adopted by the researchers for this study. According to Thwala et al. (2020), phenomenology is appropriate when the aim of the study is to explore a concept loaded with social and cultural meaning. Thus, this design helped the researchers explore the strategies to improve teachers' professional curriculum practice in a Grade R mathematics classroom.

2.2 Participants

The sample for the study was fifteen (15) participants which comprised: 1 Principal, 1 Deputy Chief Education Specialist responsible for Grade R (Provincial Office), 2 School Governing Body members, 1 Head of Department Foundation Phase 1 Subject Advisor responsible for the Foundation Phase (District Office), 2 Grade R Teachers, 2 Practitioners from the community-based sites, 1 Social Development Representative, 2 Union representatives and 2 Parents from the school community. These participants were selected from Motheo District of Free State Province using a purposive sampling technique implying that only the participants who met the demands of the study aims formed the study sample.

2.3 Instrument for data collection and procedure

A semi-structured interview guide was used for data collection. The interview guide was face validated by qualitative research experts to ensure that it measured what it was meant to measure for the credibility of the data collected. The interview guide was also pilot tested to ensure the trustworthiness of the data collected. The length of the interviews and the functionality of the recording device were also tested before the actual interview contact.

The researchers made several visits to the locations of the participants. The first visit was to seek permission from the schools and other agencies to conduct the study. This enabled the researchers the opportunity for a preliminary meeting with the participants which is an important step in a phenomenological study. After that, subsequent visits were for the sole purpose of conducting the interviews with the participants at the various locations. Through participants' interviews, descriptive data were collected, in the participant's own words, to enable the researchers to gain insight into participants' views on the strategies to improve teachers' professional curriculum practices in a Grade R mathematics classroom. The interviews were conducted within an average period of 20-30 minutes for a participant.

2.4 Ethical considerations

The ethical clearance for this research was granted by the University of the Free State Faculty of Education's research ethics committee. The issues of privacy, anonymity, confidentiality, protection of participants' rights and vulnerability were properly explained to the participants. Informed consent forms were given to the participants to read and sign prior to the interview sessions. Further, the researchers assured the participants that the data generated were to be used solely for the research purpose and pseudonyms used for identity purposes while maintaining professionalism.

2.5 Data analysis

The analysis of data obtained from the interviews, was carried out through thematic qualitative data analysis. The raw data collected were organized, prepared and read thoroughly by the researchers in order to extract relevant information from the responses of the participants. In analysing the qualitative data, the researchers had to clarify the themes and patterns linked concepts.

3. Results

The results were presented based on the two major themes that emerged from the thematic qualitative analysis.

3.1 Theme 1: Strategies to improve teachers' PCP in a Grade R mathematics class

Subtheme 1.1: Use of adequately qualified and trained Grade R teachers

On the use of adequately qualified and trained Grade R teachers as a strategy for improving curriculum practices of the teachers, the following excerpts were obtained through the interviews with the participants:

Participants A, B, C, D, E individually had this to say: "Firstly, as members of the education community, we need to be taken step by step on how best we can be equipped in order to be able to engage with PCP in a Grade R class. We feel we are somehow deceived with the proper information by our leaders but with the little information we have, we can be able to use an integrated approach in planning".

Participants F, G, H, I individually had this to say: "Before the training takes place, there is the need for induction in order to introduce Grade R teachers and then help them to understand the teaching in this area and be able to plan appropriately. Later on, a series of teacher development activities should be introduced, equipping us with knowledge and skills that will assist in making the Grade R learners ready for formal school".

Participants J, K, L individually had this to say: "There is the need for workshops for Grade R teachers, which will assist them to understand how to teach and integrate all the Grade R subjects in a daily programme.

Participants M, N, O individually had this to say: "Professional learning communities can help teachers to plan and implement Curriculum and Assessment Policy in Grade R especially in mathematics. Series of teacher development activities, should be introduced, equipping us with knowledge and skills that will assist in making sure the Grade R learners are ready for formal school".

Subtheme 1.2: Making teaching and learning resources available

Teaching and learning depend on sufficient teaching and learning resources, including age-appropriate outdoor equipment, furnishings, well-structured facilities and good infrastructure for young children to learn optimally. Below are the responses of the participants:

Teacher participants individually had this to say: "We have learned something that assists us to engage with PCP, especially when teaching number operations and relationships as an important area in mathematics. As teachers, we are struggling to introduce these mathematical concepts, such as counting, to our Grade R learners. Firstly, we need to ensure that our teaching and learning resources range from concrete, and pictorial, to abstract. For example [demonstrating], when teaching counting and a number from 1 to 5, teach your learners to count real objects. This can start with what they brought to school. Keep on emphasising the numbers. Also, teach them that the number stays the same regardless of its position. This is a good idea. We also use a CPA approach to teach them the same concept but using a game approach [demonstrating]. We requested our learners to play bowling in the class using self-made empty toilet paper rolls as well as putting one roll on top of the other and count them. Our intention with these games was to develop their counting skills, eye-hand coordination and fine-motor skills, and balancing. The equipment illustrated in the figures below were used to introduce counting and numbers, for example, how many big and small, how many red, yellow or green tyres, how many times the learners crawled through the tyres, how

many scoops of sands does the learner pour into the bucket. Numbers were introduced using self-made teaching and learning resources”.



Figure 1: Concrete, pictorial and abstract in the Grade R class. Counting and introducing a number using self-made teaching and learning resources.



Figure 2. A Grade R teacher uses the carpet as teaching corner to counteract the shortage of furniture for teaching and learning.



Figure 3. Concrete, pictorial and abstract that can be used in and outside the Grade R mathematics class.



Figure 4: Demonstrating using indigenous games to teach counting in mathematics.

Subtheme 1.3: Adequate parental involvement

This view is evident in the following extracts obtained during interview session:

Participants had this to say: “[A, B, C, D, E] It is a high time that as parents and teachers we should support each other and work as a team like an athlete, chasing batons. We should take responsibility as parents and have a stake in the education of our children. [F, G, H, J] We need to support and work together with the school in developing guidelines on how we can assist our children with their schoolwork at home and beyond as part of decision makers. Remember unity is a strength. [I, K, L, M, N, O] We should be able to help our children with their schoolwork at home especially in mathematics. We should always use our indigenous knowledge by playing with them diketo and kgati, morabaraba, hopscotch and hula-hoop to inculcate and enhance their counting skill. These will improve their performance, especially in mathematics”.

Subtheme 1.4: Support by authorities

For education decentralisation to function, sufficient support and monitoring is required at the school level to achieve quality education. This implies that the district should ensure that there is adequate support for schools. During the interview sessions, the following extracts emerged;

Participants had this to say: “[A, B, C, D, E, F] We think it is the responsibility of the district office to ensure that there is effective support and monitoring of the school governance as well as the implementation of PCP for quality education but if there is no district support team to coordinate this functions, this is really not possible for us to succeed. [G, H, I, J, K] We cannot wait for the district to establish or send a supporting structure to our school, as they are aware that is their responsibility to monitor and support the schools. In the meantime, we will suggest that we form a structure with them, which will assist us, especially in engaging with learners. [L, M, N, O] Equal distribution of workload among the circuit managers and subject advisors as they are responsible for different areas at the schools. This will contribute to quality management, assurance as well as the quality implementation of the curriculum in schools”.

Subtheme 1.5: Use of adequate language of teaching and learning in Grade R

Using mother tongue in the classroom enhances learners' participation and increases learners' engagement in teaching and learning, especially in mathematics. Literature reviewed confirms that effective, learner-centred learning requires that learning takes place in the language of the learner. The following extracts were obtained from the individual interviews with the participants:

Teacher participants had this to say: “We always encourage using home language in the mathematics class. We design simple activities using a concrete material such as blocks, counters, beads and buttons to help them with counting, classification, sequencing and they should be able to give reason for doing those mathematical activities. This helps them to grasp basic mathematics concepts in their home language through experimentation and manipulation. Stories, songs and poems work brilliantly for us as we teach them songs in our home language to count and build numbers and these activities help them to understand numbers and their representation at home. We involve them in sharing their story or poem and talk about their ideas in our language and this increases their vocabulary. We plan lessons that include numbers operations and relationships to engage our learners in a variety of mathematical games inside and outside the classroom and we always use their mother tongue to give them instructions. We also walk around the school to identify different geometrical shapes and observe shapes and basic colours on them”.

3.2 Theme 2: Possible threats to successful implementation of the strategies

Subtheme 2:1 Unqualified Grade R teachers

During the interview session, the issue of unqualified teachers was identified as a challenge that could hamper the curriculum practices of mathematics teachers. The following comments by the participants confirmed that teachers who are not qualified pose a threat in relation to engaging with PCP in Grade R mathematics classes:

Participants had this to say: “We should understand that as long as we still have teachers who are not qualified in the system, the education of our children really in trouble. We should also remember that we should have a minimum requirement to teach in Grade R. There is the need for any teacher to obtain the required qualification for teaching in a Grade R class. This is not a threat to our learners only but to our society, we need to be quick to decide what can be done in the meantime. This is why in most cases our learners are hitting the rock when coming to mathematic in higher grades”.

Subtheme 2.2: Shortage of teaching and learning resources

Provisioning of quality teaching and learning resources is very important for supporting learners during their engagement with PCP in a Grade R mathematics class. Below are extracts of comments by the participants, indicating their fears with regard to shortages of teaching and learning resources:

“Our fear is that with the limited resources that we have at our disposal, we do not know how we use them economically as we are even not sure whether they will be supplemented by our leaders. We think stories work effectively in teaching mathematical concepts, the challenge is that our young children learn better if they see and touch teaching and learning resources. How are they going to be able to do that as they are not enough for the whole class? Really, the education department does not have cooperation with the host community, they forget that this learner belongs to the society and they need to be properly educated”.

Subtheme 2.3: Lack of parental involvement

Parents play a major role in the education of their children. If there is no relationship or cooperation between parents and the school, learners are likely to perform poorly in all aspects of teaching and learning. Below are the participants' views on the issue:

Participants had this to say, “In most cases, teachers are not informing us when they want things to be done at the school. They treat us as if we are not part of them. What is very sad is that the schools want us to assist and be involved in the education of our children, but they do not train us as parents. They do not give us new information on the new trends of curriculum matters, really there is no transparency in the school as such. In most cases, the school is not communicating with us constantly, they want things to be done with immediate effect without being negotiating with us as a parent. So how can we support them?”

Subtheme 2.4: Insufficient support by authorities

One important means of ensuring effective engagement of learners with PCP is to provide comprehensive support and to monitor the support. The excerpts below indicate the threats that were discussed by the participants:

Teacher participants had this to say: “These people, they do not involve us when they develop their training schedules and their monitoring sites visits. The problem is that they always convene a meeting which they do not even pitch up the next thing they will tell us about the other engagement they had to attend to, it makes us lose interest. Our subject advisor is ever cancelling her visit to our school, from there she will take a decade to come and monitor our performance. They really lack interpersonal skills to deal with people”.

Subtheme 2.5: Inadequate language of teaching and learning in a Grade R Classroom

If teachers communicate in a language that is unknown to learners, the learners are prevented from communicating and sharing mathematical concepts with other learners, and even from participating in mathematics activities. The following excerpts demonstrated the participant's fears regarding inadequate language of teaching and learning in the Grade R classroom:

Participants had this to say: “At times we ask ourselves whether our children will ever be able to express themselves in their home language as they mix different languages when they try to explain some activities in mathematics. We also fail to understand why the school is using difficult words for us to understand when they write to us. This means it is worse when they are teaching our children in the class, they must keep instructions simple”.

Parents' participants had this to say: "Even sometimes when we attend the meeting, we always keep quiet because the level of language usage is too high for us to understand and make some contributions".

4. Discussions

The findings of this study showed that the strategies for improving the curriculum practices of Grade R mathematics teachers include the use of adequately qualified teachers, provision of adequate teaching and learning resources, adequate parental involvement and adequate use of language the environment in teaching and learning of mathematics. The study also found that the possible threats to the effective implementation of curriculum practices include involvement of unqualified teachers in the teaching of Grade R mathematics, lack of teaching and learning resources, inadequate use of mother tongue during mathematics instruction and lack of parental involvement.

Explaining these findings, Grade R teachers' qualifications and specialisation in the Early Childhood Development (ECD) field influence the quality of teaching and learning in this class. In South Africa, the recently registered qualification, National Diploma in Grade R Teaching, is the proposed initial qualification (Department of Basic Education, 2013:3). However, the revised policy for teachers argues that all the applicants intending to become teachers in the Foundation Phase, including Grade R, should register for a B.Ed. in Foundation Phase (Republic of South Africa, 2015:49). The current status is that many Grade R teachers are not qualified, which might result in them being unable to engage with PCP in Grade R mathematics classes.

Buttressing these findings, Sibley et al. (2015:4) advised that the mandatory quality standard requires teachers to have at least a three-year degree in early childhood education. The findings of the Policy Framework for Universal Access to Grade R indicate that part of the challenge of improving the quality of Grade R lies in capacity building directed at teachers and a gradual improvement of the level of formal qualifications of teachers (Department of Basic Education, 2013:1). This implies, for Grade R teachers to be able to engage with PCP, there is a need for extensive teacher professional and academic development. Research indicates that many teachers report that they need more and consistent support for implementing standards-based mathematic pedagogies (Polly et al., 2017). In order to improve the quality of teaching and learning, continuous monitoring and support is therefore essential and should be done timeously by education authorities.

Gomez et al. (2018:3) argue that changing practice requires a carefully designed learning environment for teachers that meets certain criteria of quality. Taking this argument further, research found that it is the responsibility of the district office and school management team to ensure that teacher development takes place at schools (Department of Basic Education, 2013:13). Gogoi (2015) asserts that young children need teaching and learning resources that are appropriate in size, ideas, and feeling; so that learners can learn manually and verbally and also learn lessons of life from both people and objects.

It is recognised internationally that parents are the first teachers of their children, and that it is the parents' responsibility to promote their children's development and well-being (Republic of South Africa, 2015:25). In this regard, the research confirms that children's achievement improves when parents are engaged in the education of their children. From a social practice perspective, this demonstrates negative influence of teachers over parents; teachers treat parents as objects, and not partners. This treatment places parents in a difficult situation, they seem to feel worthless and unwelcome in the education community. Wasserman and Zwebner (2017:1) confirm that parent involvement occurs in a positive manner when there is continuous and efficient communication between parents and teachers.

This does not only benefit the children's achievement, but also creates a safe and secure environment for both teachers and learners (Park, Stone & Holloway, 2017:196). The research shows that using the language spoken by the child at home significantly enhances learning outcomes, compared to when the teacher uses a language of instruction that the child does not speak (Trudell, 2016:3). Using mother tongue in the classroom enhances participation and increases the likelihood of family and community involvement in the learning of the child (Trudell, 2016:3). This claim is confirmed by Siyepu and Ralarala (2014:327) who state that proficiency in the language of

teaching and learning is a prerequisite for understanding and making sense of the language of mathematics. Furthermore, the literature indicates that language should serve as a tool for mediating between the learner and what the learner is doing (Mntunjani, 2016:35). Elszadeh et al. (2017:296) report that contributions to a conversation about classroom practices should provide space for children to talk about and draw from indigenous knowledge and cultural practices.

Jacob et al. (2017) revealed that professional development programs had positive impacts on teachers' mathematical knowledge for teaching. McFadden and Roehrig (2017) indicated that instituting curriculum development activities and/or strategies help in the development of active classroom teachers thereby improving their mathematics teaching efficacy. Professional learning communities (PLCs) lead to increase in teachers' pedagogical content knowledge (PCK) and disciplinary content knowledge (DCK) which in turn facilitate the change in teacher practices from traditional into more inquiry-based approaches (Jacob et al., 2017). Perez and Alieto (2018) revealed that proficiency in the mother tongue has a strong positive correlation with the learners' achievement in mathematics.

A parent report of engagement in pre-Grade 1 activities positively relates with learners' achievement at other level (Visser et al., 2019). The strategy of revising a task and designing of the task successfully helped teachers to develop their own knowledge of content and developing an algebraic expression for a given linearly growing visual pattern (Superfine et al., 2020). Gresham and Burleigh (2019) indicated that teachers' utilisation of various reform-based strategies to teach and model concepts in mathematics was effective in improving their mathematics teaching efficacy beliefs by reducing their mathematics anxiety. Lindenskov and Lindhardt (2020) revealed that teachers who planned lessons with more concise teacher presentation strategy had higher probability of arousing individual and group elaboration in an inclusive classroom.

This finding implicates physics teaching in the sense that good knowledge of mathematics teaching is imperative for physics teaching. Thus, a practical approach to mathematics teaching can as well be deployed in the teaching of physics concepts due to the abstract nature of the subjects (Mathematics and Physics). In order words, these identified strategies for mathematics teaching can be used for proper physics teaching at the higher education level.

4.1 Limitations of the study

The study was conducted in one of the schools in a township in Motheo District, one of the five districts in the Free State. It was difficult for the researchers to meet with the participants weekly because most of the participants were adult students, who were busy with their assignments and other matters related to their studies. Furthermore, in most cases, some of the participants had to leave early, before the scheduled time for the interview, in order to attend to personal family matters. Thus, the researchers suggested that this study can be replicated in other districts in Free State because of the shortcomings of this study.

4.2 Conclusion and recommendations

Based on the findings of the study, the researchers concluded that teachers' professional curriculum practices in a Grade R mathematics class can be improved by making effective use of qualified teachers; adequate provisioning of teaching and learning resources as well as administrative supports for the teachers; adequate engagement of parents; and use of the mother tongue in teaching and learning of mathematics. Furthermore, the inclusion of indigenous games, which are contributed by parents, introduces an element of teamwork to the relationship between the school and the parents. Based on the foregoing, the researchers recommended that:

1. Recruitment of mathematics teachers should be based on adequate qualifications and nothing else.
2. There should be adequate provision of teaching and learning resources for the Grade R teachers.
3. Policy on the effective engagement of parents in school activities of their children should be enacted by the South African Department of Education.
4. Teachers should be encouraged to make use of language of the immediate environment during teaching as the need arises.

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