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| **Foundation Phase Multilingual Mathematics Materials for Learners**  **A paper prepared by Ingrid Sapire**  **SAERA Conference Panel Presentation**  **Systemic Instructional improvement: High quality learning materials**  **15 August 2014** |

**Background to the GPLMS project**

The GPLMS (Gauteng Primary Literacy and Mathematic Strategy) is an on-going strategic plan aimed at improving the quality of language and mathematics teaching in the Gauteng province of South Africa. The strategy is “aligned to the Gauteng Department of Education Five Year Strategic Plan 2009-2014, Gauteng Mathematics, Science and Technology Education Improvement Plan 2009-2014 and existing and emerging national and provincial policies and priorities” (GDE, 2012). In order to achieve the goal of improving the quality of mathematics teaching in the province, the GPLMS team was conscious of the need for a paradigm shift. A shift away from an attitude of general negativity and hopelessness towards mathematics teaching and achievement in schools. It was thought that coaching and mentoring could contribute towards bringing about the shift in the attitude towards the subject. In addition to this, curricular support was offered to support a shift in day-to-day classroom practice. During the 2009-2014, the mathematics component of the project focused on supporting teachers in two ways: through the development and delivery of high quality materials and by implementing personal coaching of teachers in the use of the mathematics materials. This paper reports on the curricular support offered through the GPLMS Foundation Phase (FP) mathematics materials development process to some 700 priority schools identified in Gauteng as needing this intervention.

**Materials support – GPLMS FP mathematics**

Mathematics is a subject which is learnt through repeated exposure to concepts, practice and finally generalisation (internalisation) of the mathematical knowledge and skills on the part of the learner. Not all learners follow the same route to gaining this mathematical knowledge. Thus provision should be made for multiple access routes to the concepts that need to be taught. While the lesson plans of the GPLMS provide the content to support the teaching of mathematics through multiple opportunities on the part of learners, they also assume fundamental professionalism on the part of teachers. Through long-term exposure to the lesson plans (supported by coaching) it was hoped that teachers would become more confident in the knowledge and skills needed for implementing improved teaching and learning experiences for the learners in their classes. The GPLMS FP Maths team’s message to teachers through the coaches was consistently that the lesson plans (and accompanying material) are sufficient for curriculum coverage, but that teachers should make it their own and add to it should they wish to. They should aim to provide an optimal learning experience for learners in their classes. The message was given to teachers that they should prepare well. They should teach themselves the content of the day if necessary when they do their advance preparation for the lessons.

Curricular support is needed for both teaching and assessment. High quality material which included all content that teachers need to cover when they teach their learners was provided. The particular instructional design chosen for the lesson plans ensured that this content was logically and sequentially introduced. Methodological steps were incorporated into the instructional design to further support the teachers. Assessment on an on-going basis was designed into the instructional programme to provide further support for teachers. In the FP there is provision for continuous assessment, in line with policy and the needs of FP learners. Once teachers become more confident with the mathematics curricular content that they have to teach and how to assess it, their professional judgement should improve and with it teaching confidence and quality.

Following sound principles for the teaching of mathematics in an effective manner, the methodology of the mathematics lesson plans incorporates the use of concrete material in appropriate ways to assist learners to grasp mathematical concepts. This is more so in the FP where most of the mathematical learning that takes place is conceptual. The CAPS content (which is now tested annually in the Annual National Assessments or ANA) demands that certain varied procedures are learned. The GPLMS FP Mathematics lesson plans included teaching on a variety of procedures essential to cope with current curriculum demands while attempting to ensure long-term meaningful learning of mathematics.

The balance between procedural and conceptual content in the mathematics programme was informed by research into the teaching of mathematics using a variety of materials. In addition to this, there was powerful evidence from the materials experiment (Fleisch, Taylor, Herholdt & Sapire, 2011) in which it was shown that materials which are both procedurally and conceptually rich, optimally improve the quality of learning using intensive teaching and exposure to materials.

**Challenges faced in the project**

There was a general lack of confidence on the part of teachers in relation to mathematics teaching. The poor levels of subject content mastery has been well documented. Additionally, many teachers also lack the necessary mathematics teaching skills. This was addressed through the provision of lesson plans and coaching. Another challenge resulted from the legacy of OBE (Outcomes Based Education) – primarily in the way it affected curriculum pacing. This was identified as a key issue that needed to be address in order to change attitudes towards the teaching of mathematics in schools. In the OBE approach, pacing was often determined by the weakest learners rather than by an annual curricular requirement. This suited some teachers who got into a habit of teaching mathematics at a leisurely pace. An approach that also enabled teachers to omit the parts of the curriculum which they did not wish (or were not able) to teach (Carnoy, Chisholm & Chilisa, 2012). The GPLMS tried to counteract this ingrained practice, by supporting teachers to cover all the core curriculum work that was necessary to provide the learners with the best chance of success in their mathematics learning.

Additionally, the CAPS Language Policy also raised further considerations. These were in regard to the importance of implementing mathematics content in the learner’s home language in the FP. The GPLMS team therefore took up the challenge and all the teaching and learning materials were versioned (translated) into all official South African languages, in line with the multilingual approach promoted in policy.

**GPLMS FP mathematics materials development processes and timelines**

The FP mathematics materials development process started in 2012 and continues to date (September 2014). Initially lesson plans were developed for teachers but later learner material was also included in the package. From the outset it was decided that the lesson plans should include all of the necessary content to be covered in a particular lesson as well as teaching guidelines to support implementation. The lesson plans included worked examples for active teaching, explanations of content and activities for independent learner work.

A reference team comprising GDE head office and district officials as well as selected FP mathematics teachers and GPLMS coaches was set up. The reference team met each term to review the lesson plans and the learner and assessment materials. Input from the reference team was then fed back to the development team for refinement purposes. Once the materials were finalised, they were printed and distributed to the relevant schools in time for implementation. This however, did create a very tight turnaround time, which made the development highly pressurised and not always ideal.

The following table summarises the activities and time lines that applied to the development and review of the GPLMS FP Mathematics material.

**Table 1: GPLMS FP Mathematics Materials Development Time Line**

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| **Year** | **GPLMS FP Mathematics Materials** | **Methodology** | **Review input related to** |
| 2012  Terms 2-3 | Lesson plans for teachers including sufficient support required to teach FP Mathematics on a day-to-day basis. | Group teaching.  Learner activities incorporated in group work.  Provision for continuous assessment. | * Appropriate methodology in context. * Complexity of lesson plans – improvement of instructional design. |
| 2012  Term 4 | Lesson plans for teachers including sufficient support required to teach FP Mathematics on a day-to-day basis.  Classwork and homework exercises for learners included in the lesson plan set. | Whole class teaching with opportunities for group teaching.  Provision for written assessment. | * Implementation of continuous assessment * Nature of learner material needed. * Improvement of instructional design. |
| 2013  Term 1 | Lesson plans for teachers including sufficient support required to teach FP Mathematics on a day-to-day basis.  Classwork and homework exercises for learners included in the lesson plan set (English medium only).  Some printable learner material. | Whole class teaching with opportunities for group teaching.  Provision for continuous assessment – oral, practical and written. | * Responding to burden of writing all learner activities on the board /photocopying. * Language policy issues – material cannot only by in English medium. |
| 2013  Terms 2-4 | Lesson plans for teachers including sufficient support required to teach FP Mathematics on a day-to-day basis.  Classwork and homework exercises for learners included in the lesson plan set.  Classwork and homework activities versioned into all 10 languages spoken in GPLMS schools. | Whole class teaching with opportunities for group teaching.  Provision for continuous assessment – oral, practical and written. | * Burden of writing all learner activities on the board/photocopying. * Necessity for independent learner material not just teacher material. * Honing CAPS alignment. * Cluster topics. |
| 2014  Terms1-4 | Lesson plans for teachers including sufficient support required to teach FP Mathematics on a day-to-day basis.  Classwork and homework exercises for learners in multilingual learner activity books. | Whole class teaching with opportunities for group teaching.  Provision for continuous assessment – oral, practical and written. | * Honing CAPS alignment and coverage across grades and the phase. * General revision and improvement. |

An iterative, developmental process was followed over the two year period (mid 2012 to mid-2014). From the table above it is clear that as the materials development process unfolded, new issues emerged and were continually addressed in an effort to strengthen the lesson plans and learner materials. This served to greatly strengthening the overall intervention.

**GPLMS FP learner materials: Choices**

Early in the materials development process, it became evident that teachers also wanted sets of teaching and learning resources to support the implementation of the lesson plans. In the following section, the short comings of both the DBE mathematics workbooks and the available textbooks is highlighted.

**National workbooks**: These have been provided to all schools (and the GPLMS team made a point of explicitly linking its lesson plans to the workbooks) these workbooks were found to be insufficient. According to the *National Education Evaluation and Development Unit (NEEDU)* *National Report 2012,* the workbooks have been mandated for use “supplementary to the textbooks purchased annually by schools” (NEEDU, 2013, p.43). Hence they are not seen as a primary resource. A primary resource needed to be found for GPLMS schools.

**Textbooks:** In 2012 the GPLMS team screened all the textbooks listed in the DBE catalogue that schools use in order to purchase their Learning and Teaching Support Materials (LTSM). This process revealed that the quality of the listed textbooks for FP was below par. The two main issues identified were, the poor quality of curriculum coverage and poor quality of home language translations. The screening process showed a number of inadequacies in the DBE selected FP mathematics textbooks (Sapire, 2012). Findings include:

* Only one book in the Foundation Phase catalogue was deemed to be of high enough quality but it was only available in an English version.
* Overall, a key cause for concern was the poor coverage of the CAPS curriculum. Topics were covered broadly and lacked depth and substance.
* The use of inaccurate mathematical language which could lead to inadequate generalization of mathematical terminology and concepts by learners.
* The range of examples provided were inadequate to meet the requirements of the CAPS topics. The nature of examples provided was not consistent across text books, and some books simply lacked sufficient examples.
* There was a general lack of careful sequencing of topics needed build up learner knowledge and understanding.
* The quality of translation from English into the other official languages was generally problematic. Errors of translation of mathematical terms, missing explanations of terms (only terms given without explanation), general language errors (e.g. activity instructions) and faulty layout of mathematical exercises (errors after translation) were found.

In addition to the above, the NEEDU Report(May 2013), notes that there is still resistance to the *use* of textbooks, particularly in the FP (p.43). NEEDU found that, “[t]here was a consensus across the schools evaluated that maths textbooks as such, were not appropriate in the FP.” (2013, p.43). Yet in the GPLMS schools, teachers were calling for more extensive support in the form of printed learner material.

Since it was found that there were no suitable mathematics resources for FP learners to use in the GPLMS schools, the lesson plans developed as part of the GPLMS needed to include all the necessary LTSM. The following were therefore developed: Classwork and homework activities, enrichment activities, mental maths activities and a glossary of mathematics terms which were intended to support the learners ’conceptual understanding the mathematics lessons.

Initially, the learner activities were not provided per learner, rather, they were provided as part of the teacher’s resource packs. This was not ideal, as it mean that the teachers and learners had to write out all of the activities before they could work through them in the lesson. This significantly slowed down the lesson. The decision was therefore taken to produce stand alone learner material for each learner.

As already stated above, all the LTSM was versioned (translated) into the various official languages so that the selected Language of Learning and Teaching (LoLT) of each school could be implemented. The decision was taken to develop and print learner material in all of the languages present in GPLMS schools using a multi-bilingual format. In other words, all the learner material was prepared in bilingual format e.g. English- Setswana; English- isiZulu etc. This format was selected to support best practice for learning and teaching in the South African multilingual context.

The need for good quality multilingual mathematics material for FP learners is supported by academic research as well as grass-roots project activities which have been carried out in South Africa over a period of at least 20 years. Learners and teachers in the FP in South African schools are often faced with a dilemma in mathematics classes as a result of multiple languages present in their classes and a dearth of good quality materials for the support of learning and teaching in these languages. According to policy learners should be taught mathematics in their home language. Schools are free to nominate their LoLT and they may have more than one LoLT. But policy does not accommodate the multiple languages that are spoken within classes notwithstanding the chosen LoLT(s) of these schools. Experience of teachers in the field indicates a need for an interpretation of policy that would optimise learning of mathematics on the part of the child. This interpretation is supported by a multilingual approach to teaching. The Home Language Project (HLP) has shown both through research and project practice that:

The education of the majority of SA scholars is negatively affected by language inequality. *Multi-bilingualism* is offered as an appropriate post-apartheid approach that can counter the disadvantage of having to use a second language as a medium of instruction. It involves the use of two languages for learning (a common medium plus every learner’s home language), irrespective of the number of language groups in the class. (2012, p1)

Adler has identified interplay between three dynamics present in a mathematics classroom. The first is language of teaching and learning, the second is mathematical register and the third is social diversity and social relations in the classroom (1995, p.256). Many others have written about the tensions present when mathematics is taught in multilingual contexts (Adler, 2001, Setati, 2007, Setati & Duma, 2009).

Prof Setati-Phakeng introduced and concluded a powerful address to Gauteng Primary Literacy and Mathematics Strategy (GPLMS) coaches and district officials with the following quotation:

*“Mathematics education begins in language, it advances and stumbles because of language, and its outcomes are often assessed in language”* (Durkin, 1991).

This quotation sums up the inextricable manner in which mathematics is tied up with language – and hence points to the need for the development of material which would provide both mathematical instruction as well as language development simultaneously. Prof Setati-Phakeng’s address, entitled *Mathematics in Multilingual Classrooms: From Understanding the Problem to Exploring Possible Solutions* (May 2013, Linder Auditorium, University of the Witwatersrand, Johannesburg) suggested that multilingual material is required for multilingual classrooms. The gist of her presentation was that if a purist, or mono-lingual approach is adhered to, a mathematics lesson can become a language lesson when one spends the whole lesson drilling the word names for things with no concern for mathematical content development, only vocabulary building. Language should be a tool in the mathematics class - and the learning focus should remain mathematics. But mathematics teachers find themselves in a difficult position if they want to adopt a multilingual approach in their classrooms as there is a sever lack of good quality material to support this practice.

The current language policy for FP schools is supportive of a multilingual culture but does not adequately provide for bridging the transition between home language mathematics instruction and the move to learning mathematics in English once learners move into the Intermediate Phase (Grades 4-6). Evidence of the difficulty learners experience in grade 4 can be seen in the large drop in performance on the ANA between grades 3 and 4 (DoE, 2013). There are many factors that contribute to these achievement figures, but in Grade 4, language difficulty must be a key factor. Multi-bilingual materials would pave the way to later mathematics learning, since the support of the “common language” of learning and teaching from early grades would allow learners to be exposed both to the terminology and the conceptual discussions in their home language and in English (Setati & Duma, 2009, Sapire & Khembo, 2013). This could help to alleviate the situation in the Intermediate Phase where:

“*when children begin to be taught in English full time, they spent most of their time trying to catch up instead of grasping what they are being taught*”

(Mail & Guardian Newspaper, 2012).

**Multilingual mathematics in the FP phase**

The majority of GPLMS schools have a multilingual population. In line with the FP language policy and also with research into teaching and learning mathematics it was decided to provide multi-bilingual materials for learners. The GPLMS FP mathematics materials ultimately (by the end of 2013 and for the duration of 2014) consisted of a package of lesson plans for teachers that run parallel to a learner activity pack which includes classwork and homework activities. The learner activity pack is available in all 11 official South African languages although only ten of these are used in GPLMS schools. Other supporting material for grades 1, 2 and 3, also available in all 11 official South African languages, consists of mental mathematics activity cards, enrichment activity cards, CAPS-aligned assessments per term and a multi-bilingual glossary of mathematical terminology used in the GPLMS FP Mathematics material.

The English materials are unilingual. The other ten sets are presented in bilingual parallel format. The materials are printed in black-and-white for GPLMS schools. To differentiate between the two languages which run parallel the English text is grey and the other text is black. The mental mathematics activity cards and assessments are presented using the same parallel language format. The excerpt below from a classwork activity illustrates the layout:

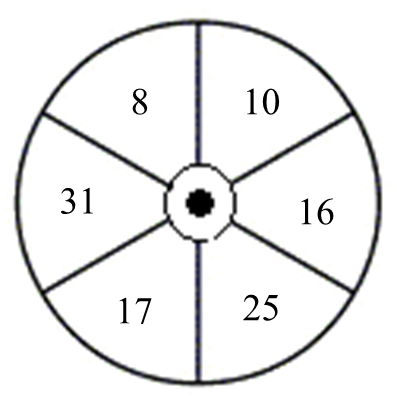
**Figure 1: Learner activity – Grade 2 Term 3 (English/IsiZulu version)**

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| 1. Write down the numbers 70 – 75 and do the following:   Bhala phansi izinombolo 70 – 75 bese wenza lokhu okulandelayo:   1. Colour the second number in red.   Faka umbala obomvu enombolweni yesibili.   1. Colour the sixth number in yellow.   Faka umbala ophuzi enombolweni yesithupha.   1. Colour the third number in blue.   Faka umbala osasibhakabhaka enombolweni yesithathu. |

Support for enrichment was initially in the form of activity ideas for teachers which were given as one of the components of the lesson plans. Feedback from teachers led the team to rather development a set of enrichment cards which could be used independently by learners who had completed the work earlier than their peers. Solution cards accompany the activity cards facilitate independent learner work, but teachers were encouraged to interact as needed (and as time allowed) with learners who were working on the enrichment activities. The format and layout of the enrichment activity cards militates against parallel or bilingual layout and so these cards are unilingual. Teachers all receive the English version of the cards as well as the versions of the LoLT(s) of their school and so they are able to create bilingual cards (and answer cards) by pasting two cards of different languages back-to-back.

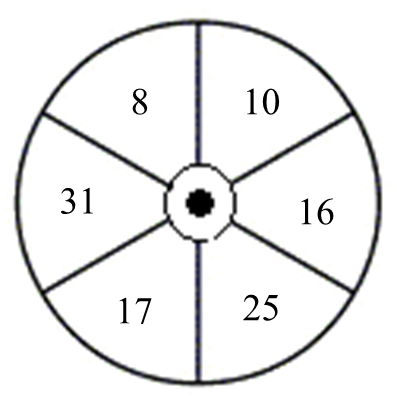
**Figure 2: Grade 3 enrichment activity card (English/Setswana versions).**

**Enrichment Activity 13.2**

Playing darts  


1. What is the highest score using 3 darts? \_\_\_\_\_
2. Ben’s score is 49. Which three numbers did he get? \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.
3. Sipho’s score is 34. Two darts hit the same number. Which number did he get? \_\_\_\_\_

**Tirwana tsa Khumiso 13.2**

Go tshameka didatshe  


1. Sekoro (Dino) se se kwa godimodimo fa o dirisa didatshe di le 3 ke sefe? \_\_\_\_\_

2. Sekoro sa ga Ben ke 49. Ke dipalo dife tse tharo tse a di boneng? \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

3. Sekoro sa ga Sipho ke 34. Didatshe tse pedi di thutse palo e e tshwanang. O bone palo efe? \_\_\_\_\_

**Evaluation of the materials**

The lists of words to be included in the multi-bilingual dictionaries was drawn up by highlighting mathematical terms used in the sequence of work as it is presented in the lesson plans (and accompanying learner material). There is a separate dictionaries for each grade since although many words are common across all grades there is a progression in the content taught over the three years from Grade 1 to Grade 3.

The layout of the dictionaries allows for a parallel presentation of English and the Home Language. This allows for easy reading and cross reference to the definitions, explanations and illustrations. These dictionaries are intended for use by both teachers and learners. The idea is that the teachers could use them to encourage learners to “look up” words for themselves as soon as their independent reading ability would allow them to do so. This offers teachers support in relation to differentiation. The excerpt below illustrates the layout of the multilingual glossaries (reduced to fit a portrait orientation).

**Figure 3: Grade 1 bilingual glossary (English/Ndebele version)**

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| **Maths word** | **Diagram/explanation** | **Igama leembalo** | **Umfanekiso/ihlathululo** |
| flat | Something which is not curved. A 3-D object can have flat sides (faces). E.g. the faces (sides) of this cube are all flat. | sipara | Into engazombiko. Into yamahlangothi amathathu i-3-D ingaba namahlangothi asipara (ubuso) bamakhyubhu la busipara. |
| next | The one that comes after. e.g. 13 comes next after 14. | eqadi | Lokho okuza ngemva . isib. I-13 iza ngemva kwe-14. |

The whole materials package is therefore considerable. Teachers were supported by coaches to understand the ways in which the components of the package could be used together to offer learners meaningful learning opportunities within the CAPS curriculum content on a day-by-day basis.

**Training of coaches**

The coaches were offered training and support which differed over the period during which the lessons were developed and refined (2012-2014). In 2013 the training was carried out each term. There was a full day of training for coaches which was planned and executed by the GPLMS FP Mathematics materials development team. The training included guidance on implementation of the lesson plans, focusing each term on core components of the lesson plans. It also highlighted any revisions that had been made as the year progressed, since feedback and input was taken into consideration throughout the development process. A third component of the lesson plan focussed on mathematical content. Since time was limited this input was also limited, but input was given on selected core mathematical topics and offered in support of coaches and teachers. It was expected that coaches, would, at their discretion, offer support to the teachers for whom they were responsible. When giving this support they could draw on the training given to them by the GPLMS team.

**Implementation**

The Mathematics packages comprised lesson plans and learner materials for 40 lessons per term (corresponding to the CAPS content specification for 40 lessons per term). In reality a term will have more than 40 days (sometimes there are up to 55 days in a term) and so the lesson plan design gave some allowance for flexibility of implementation. Although the plans were dated, teachers were guided by their coaches to pace the use of the lesson plans according to their particular contexts and learner needs. The pacing was to be individualised but not at the expense of content coverage. Teachers were asked to indicate the date on which a lesson had been taught so that coaches could see how coverage was being managed. The lesson plan introductory notes also included guidance to teachers using the plans. With regard to pacing and sequencing of the lesson plans the following note was made:

*The content in each lesson has been carefully sequenced, it is therefore important that lessons are not skipped. Should you miss a mathematics lesson for any reason, you should continue the next day from where you last left off. Do not miss a lesson.* ***You may need to speed up the pace of delivery to catch up the lesson schedule*** *– by covering the lesson concept content of two consecutive days in one day. To do this you could cut out or cut back on some of routine activities like mental maths or homework reflection to save time until you are back on track with the dated delivery of the plans.* (GPLMS Grade 1 Term 4, 2013, p.6)

While coaches supported the teachers in their preparation for their mathematics lessons they also monitored the use of the lesson plans and encouraged teachers to complete the lessons each term. Coaches were trained to stress to teachers the importance of proper planning and preparation for each lesson. The lesson plan on its own was not sufficient to turn them into expert teachers. Each teacher had to do the necessary work to make the lesson plans their own. The guide to the lesson plans emphasised that:

*The lesson plans provide a detailed lesson design for you to follow. However, to deliver the lessons successfully* ***you must do the necessary preparation yourself****. This entails a number of key steps that range from ensuring that you have a good understanding of the term focus through to checking the detailed preparation of resources needed for every lesson*. (GPLMS Grade 1 Term 4, 2013, p.6)

Teachers were encouraged to reflect daily on their teaching. At the end of every lesson plan a prompt for this was included – “*Reflection on lesson*”. Coaches were asked to engage the teachers in the reflection process and the teachers were asked to prepare short notes on how the lesson had gone, what could be done differently etc. It was intended that these notes would form the basis of a meaningful discussion between coach and teacher. Additionally the development team hoped to use these reflections to feedback into the lesson plan development process, however, the team did not get much of this sort of feedback.

**Evaluation of the materials**

A formal external evaluation of the GPLMS FP Mathematics materials was commissioned and it is hoped that it will shed light on the strengths and the weakness; on what worked and what may need to change so that these lessons can be used to inform and strengthen mathematics teaching and learning in the future. The development of the GPLMS FP multilingual mathematics materials is an attempt to equip teachers with the necessary skills to teach mathematics at the Foundation Phase level and to help learners better understand and engage with mathematics. The evaluation will address the following questions in order to assess the quality and level of support experienced by teachers in GPLMS schools through the multilingual materials:

* To what extent is the multilingual approach adopted in the GPLMS schools enabling or constraining the teaching and learning of mathematics to multilingual learners in the Foundation Phase?
* What obstacles exist for teachers and learners in using the GPLMS materials and how may these be addressed?
* In what way(s) can the GPLMS materials be refined to improve their efficacy (in mediating learners understanding of mathematics) and their effective use by the teachers?
* In what way(s) can the teachers be supported in order that they can use the GPLMS materials more effectively?

Anecdotal reports from teachers whose learners have used the material indicate that the chosen format is user-friendly, that the teachers appreciate it and that it has assisted teachers to keep up with the pace of the lesson plans. It has also been observed that the lesson plans support teachers to cover content which may otherwise have been left untaught due to the teacher’s own lack of content knowledge. Findings from the evaluation will add substantially to this anecdotal evidence and can be used, amongst other things, to refine the materials.

**Conclusion**

While the GPLMS FP Mathematics material was initially developed as part of the Gauteng Department of Education’s strategic plan to strengthen mathematics teaching and learning in underperforming schools, the lesson plans and learner materials can be used by any Foundation Phase teacher in any Foundation Phase classroom in South Africa. To this extent the lesson plans produced and the learner support material has the potential to help many teachers and learners throughout the country. In fact this material is already been adapted by the PILO project (part of the NECT) to support better PF mathematics teaching and learning in Kwa Zulu Natal and in the Northern Cape. It is also been used in selected schools in Limpopo province.

Materials development, as it is has been exemplified in this paper, is an iterative process. The model of the GPLMS is one of sharing and building on existing materials to refine and improve what exists. The refinement leads to ever-improving materials which can be offered in the support of teachers who find themselves in difficult and complex classroom contexts. It is hoped that in time, the materials will be used and further developed and that they will continue to be used to support teachers in multilingual classes all over South Africa.

For free access to these materials, contact the Gauteng Department of Education.

**References**

Adler, J. (2001). *Teaching Mathematics in Multilingual Classrooms*. Dordrecht: Kluwer Academic Publishers.

Carnoy, M., Chisholm, L., & Chilisa, B. (Eds.) (2012). *The low achievement trap: Comparing schooling in Botswana and South Africa*. Pretoria, South Africa: Human Sciences Research Council.).

Fleisch, B., Taylor, N., Herholdt, R., & Sapire, I. (2011). Evaluation of *Back to Basics* Mathematics Workbooks: A Randomised Control Trial of the Primary Mathematics Research Project. *South African Journal of Education*, 31(4) pp.488-504.

GDE, (2012). *Gauteng Primary Literacy and Mathematics Strategy, 2010-2014. Draft 2*, 17 March 2012.

Mail and Guardian, 27 July 2013, *Language policy lets pupils down*, Bridge Seminar reported on by Lethabo-Thabo Royds and Barbara Dale-Jones.

National Education Evaluation and Development Unit (NEEDU) National Report 2012. *The state of Literacy Teaching and Learning in the Foundation Phase.* (May 2013)

Owen-Smith, M. (2012), *A set of multi-bilingual methodologies to address some current problems in education*. “Strategies to overcome poverty and inequality: Towards Carnegie 111”, UCT conference 3-7 September, supported by the National Planning Commission

Sapire, I. (2012). Gauteng Primary Literacy and Mathematics Strategy Textbook screening report. Unpublished report. Johannesburg.

Sapire, I., & Khembo, E. (2013). A Report on the Foundation Phase Mathematics CAPS Textbooks: Commissioned by the Advisory Committee on Mathematics (ACM)

Setati, M., & Duma, B. (2009). When language is transparent: supporting Mathematics learning multilingual contexts page 235 – 241. AMESA Congress 2009 proceedings

Setati-Phakeng, M. (2013). *Mathematics in Multilingual Classrooms: From Understanding the Problem to Exploring Possible Solutions.* Address given at the Linder Auditorium, University of the Witwatersrand, 30 May 2013, Johannesburg.