What's wrong with mathematics and what needs to be done?

By Mfundo A. Dzanibe – Director at The Maths Club (mfundoa@gmail.com)

The challenges of teaching and learning in mathematics are well articulated and perhaps everyone from university professors to journalists have an expert knowledge of what's wrong with mathematics. At the top of the perceived challenges is the incompetence of educators in the pedagogical content knowledge of the subject particularly at primary school level. This is compounded by the history of education in South Africa and environmental factors that continue to deny most learners the privilege of comprehending the mathematical language.

However, there are many other critical factors that do not get mentioned as widely as contributing to the challenges of teaching and learning of mathematics. Amongst these is the tertiary education of our mathematics educators; the young educators produced by the universities each year. Are these educators adequately prepared to master the pedagogical content and do they have an idea of the classroom and the learner demands they will face when they become teachers? Assuming that the universities prepare the graduates adequately the next question is whether these graduates receive sufficient induction into the roles of teaching, managing and interpreting curriculum and general leadership required for the classroom.

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Another aspect that has a direct influence in the success or failure in the teaching and learning of mathematics is the management of the school and monitoring and evaluation by the district office and general leadership. Poor learning levels in mathematics can be directly linked to poor management in the school and inadequate monitoring and evaluation at district level. In fact, mathematics is the first subject to suffer as a result of poor school management and lack of proper monitoring and evaluation. The schools and districts monitoring and evaluation systems are so poor that there is no instrument to ensure that the required work is covered in time, the quality of the work covered is to the acceptable standards and that the teaching process translates to learning.

Poor performance in mathematics is a manifestation of the lack of leadership at the different levels of the education system. More needs to be done to inspire educators and learners to work harder and smarter to achieve outstanding levels in mathematics, and this is the role for leadership.

Adding to the poor quality of teaching and learning in mathematics is the inferior textbooks used in the classroom which advocate learning inside the classroom and have no or very little support for learning beyond the classroom. The assessment tasks in these textbooks are not designed to feed into the teaching

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and learning process, they seek to measure attainment of the learner and do not propose remediation or provide material for such.

An even deeper challenge is the assumption that the one hour per day allocated for the mathematics period is sufficient for learning mathematics. The time may be adequate for teaching mathematical concepts but it is absolutely inadequate for learners to comprehend the concepts through connections and reflections with prior knowledge, integration with other sections and interpretation of problems. The problem is exacerbated by the expectation that if teaching has taken place then learners have learned. Teaching, coverage of the syllabus is seen as the core process for ensuring that learning takes place. The management of the learning process inside and beyond the classroom does not receive much attention and in mathematics this leaves the majority of learners behind with most eventually becoming indifferent towards the subject. Most learners do not fail mathematics in the examination room but rather give up long before they even have to sit the examinations. In one school where I donated study guides in August the majority of learners returned the guides as they sited that they were of no use anymore as learners that accepted that they had failed mathematics; indeed the school achieved a pass rate of 8,6% in mathematics.

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The challenges of mathematics education can be overcome by strengthening the pedagogical knowledge of educators in the system through in-service programmes that span over a period long enough for educators to not only master the technical aspect of the subject but develop skills to manage the learning process of learners inside and beyond the classroom.

On the other hand we need to strengthen the quality of teacher education in the university through active collaboration between the department of basic education and the department of higher education. The new educators should come into the system with specialist skills including amongst others the above average interpretation of the mathematics curriculum, the ability to develop special learning programmes for remediation and enrichment and the development of specialised materials to enhance the teaching and learning process. Districts must have special induction programmes for the new educators to help them develop into the classroom system and collaborate with experienced educators.

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Schools and districts must develop proactive and real time monitoring and evaluation systems to ensure that teaching and learning of mathematics is accordance with the plan, has the intended impact and yield the required results. These systems must talk to one another and the management must analyse the data on a weekly basis recommending adjustments where necessary. The current setup in which most schools write tests monthly with another month needed to mark the scripts and no interpretation of results feeds into remediation processes renders the system ineffective. Curriculum must be managed proactively with frequent interventions to ensure that the targeted output at the end of the term is achieved. In mathematics if the outcomes in one

week are not achieved and the situation is not remedied then there is a guarantee that the end of the term and the end of the year targets will not be achieved. The visits by district officials must be coordinated and should all seek to establish the state of mathematics curriculum implementation amongst other things irrespective of whether the official is a specialist in the subject or not.

The district and the principals must provide leadership and make sure that all stakeholders understand the challenge of mathematics, what is at stake for the country and the community and what is being done to remedy the situation. There must be concerted effort to inspire those specialising in mathematics to pull all stops to improve teaching and learning of mathematics. Leadership in mathematics education must not be left to the specialists, education managers must play an active role in ensuring that every learner gets a fair chance to succeed.

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In the short term districts must look into the issue of textbooks and study guide choices and establish whether success of certain schools can be matched to certain publications. District subject committees made up of mathematics specialists and lead educators must be given a platform to suggest learning and teaching materials based on what they have used and where necessary research materials that could change the results in the district.

In the long-term the department of education must relook at the specifications for publishers and seek to get publications that stimulate learning and support the learning process beyond the classroom.

To unlock the potential of each and every learner in mathematics it is necessary that there is a paradigm shift such that there is more emphasis on the learning process with teaching seen as the spark to fuel such a process. The imparting and interpretation of information by educators should not be seen as the means to an end but rather the base on which learning should build upon and thrive. Teaching should consistently seek to teach learn how to learn and to want to learn. Learners should be made to understand that learning should not be limited to teaching; learning expands outwardly from the lessons and is unbound. The full responsibility for learning is on learners themselves with management of such learning process a responsibility of educators, school management and the district. It is the responsibility of managers to inspire people, support those who are struggling and carry those who falling by the wayside.

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Mathematics education is the 20 per cent that gives 80 per cent of the problems in the education system; it required 80 per cent of the management time and effort.

‘Quality is never an accident, it is always the result of high intention, sincere effort, intelligent direction, skilful execution; it represents the wise choice of many alternatives’. Willa A Foster