# THE CIRCULAR MODEL FOR SHARING THE BLAME FOR STUDENTS' UNDERPERFORMANCE IN MATHEMATICS IN SOUTH AFRICAN SCHOOLS

**Matiki Talwanga**
Central University of Technology
**South Africa**

## ABSTRACT

The students' performance in mathematics is cause for concerns for parents and the state alike. This subject is the one which everyone in the spectrum of any educational system takes in primary and secondary school. There is no doubt of the importance of mathematics in life. Most people would agree that they use daily in their workplace either one or some of the many topics of mathematics including the Phytagorean theorem, fractions, decimals, percentages, ratio, properties of angles, continuity, probabilities, frequency, distribution statistical inference. Beside the highlighted importance of mathematics in future, learners are still failing the subject at a higher rate. This leads to tracing the reasons for the unfortunate situation. While people think we need to blame the learner, since they are at the centre of education for their poor performance; This paper is aiming at showing the manner the blame for the student's underperformance in mathematics in South African schools should be shared among the stakeholders. Unless we understand the origin of the problem and realize that the responsibility to brink about positive changes rely equally on each and every stakeholder; no durable solution to the problem is possible. In our view there are two models in the way blame is passed from one stakeholder to another. A linear or vertical model of blame which assumes there is one party on top of the chain of knowledge and teaching techniques such that blame is just pushed down until it gets to the bottom of the chain. In this way no one accepts blame. In a constructive fashion, success or failure in our education system in general and particularly in mathematics results from a collective and equal task from each member; thus a circular model of sharing blame among stakeholders which implies that blame is equally shared. Each stakeholder lends a hand to solve the problem.

**Keywords**: Teaching of Mathematics, Students' Underperformance in Mathematics, Sharing Blame And Success For Educational Process.

## 1. High Failure rate in mathematics in South African schools

It is recorded that failure in mathematics in the South African schools is unacceptably high ( 6). The schools in the rural areas are the ones performing badly. Most people focus at the matriculation results. In my opinion the trouble starts earlier than that. Is the situation any better in primary school and lower secondary classes? Learners are not to be blamed alone. We must also check other issues around education. These include the manner teachers are being trained, the way mathematics is taught, the deplorable conditions of rural schools etc. According to Angie Motshekga, the Basic Education Minister, the "problem with poor maths marks does not lie with the curriculum, but with how the subject is taught. Is this bad manner of teaching mathematics deliberate? In other words, can we assume that the teachers are qualified but for some reasons they do not teach as they should. Is the bad manner of teaching due to ill-preparation of the mathematics teacher during his/her years of training? With regard to the preparation we have two aspects. One being the knowledge of the content matter; the other is the acquisition of the skill to deliver the

lesson in class. We assume teachers are well trained in both aspects. We deplore however the lack of monitoring of their actions on the ground. I was a teacher and for the entire 15 years of my carrier I was not visited by anyone to check my lesson plans and preparations and the manner I deliver lessons. People in the office deliberately assume class activities are perfect. Their only emphasis is the marks allocated to learners. If the class marks show a 70% pass rate, then it I assumed that good teaching and learning is taking place. The only documents a teacher is asked to produce to officials are the class register, the marks lists, the tests, exams and memorandums. If learners have good marks, that is enough. No one cares how these marks have been obtained. In the week preceding the visit of District Officials for collection of Continuous Assessment (CASS) results, no formal teaching takes place in most schools. Teachers would be busy putting learners' portfolios in order. In this process some marks would be "cooked", dates the task was done is altered to meet requirements. One teacher in the cluster I was the leader of had given one Natural Science test during a term. This test had one question marked out of 5. The marks were multiplied by 5 to show the result out of 25. Later the teacher changed the marks to appear out of 100. This teacher, who was actually a Secondary school Principal expected that I would sign his portfolio for marks to be passed to the district. The statement made by the Minister is referring to such situation. This lack of monitoring of the teaching is known by the department of basic education. In fact in this regard DBE has lost control over the teachers. The teacher's Unions have not been of any help in this matter either. They would rather organize strike to solve their own issue than those concerning learners. Learners are left alone. Teaching and assessment should be monitored, without which no genuine results can be expected. It is worth mentioning the devastating effect of the low passing marks below 50% in practice in schools. Can anyone convince us that a low passing mark of 34% or even 40% has a positive impact in the attitude of hard work a learner is supposed to uphold.

## 2. The Many Faces of Mathematics

Mathematics is like a hammer or screwdriver to the one who uses mathematics for finding lengths, areas, costs and profits. For this category of users mathematics is just but a tool. Mathematics is like the language of creation to the physical or biological universes. Indeed mathematics is a language for the one who studies the laws of gravity or the geometry of chromosomes. Mathematics is like an elephant described by three blind men. The one who touches the trunk may say that the elephant is like a snake. The fellow who touches the ear may conclude that the elephant is like a bat. Upon touching the leg, the third blind man may say that the elephant is like a tree. So there is something for everyone of us in mathematics. Every child should not become Engineer, mathematician, etc…The way the high school is structured suggests that a child needs more than high school to find a carrier. Mathematics literacy which was to be a kind of applied mathematics has not been used as it should to show its usefulness in the curriculum. May be the massive failure in school mathematics is in response to the lack of interest from learners. The kind of mathematics they are subjected is not their choice. High Schools should not have been a general trunk as it is today. Rather schools should be showing an inclination towards a future profession like: High school for nurses, school for technicians(electrical, mechanical, wood work, etc..), School for science, for literature (drama, language), . To each type of school there will be an associated curriculum and an appropriate set of mathematics topics to suit the need (applicability and level of abstraction required) of the learners of that option. Mathematics literacy would become a more applied subject than it is now. Entry at colleges and universities would be guided by the learners'

initial high school choice. For some few case of learners who wish to change their option, the bench mark rule could be applied. In this fashion, mathematics taught in one option is the kind which responds to the need ability of the learner and to the degree of accuracy of abstraction of the profession he/she is being prepared to. Another aspect to consider is the short time allocated to finish the secondary school. An example to illustrate this is taken from system of education in use in Zimbabwe or the one in the Democratic Republic of Congo (DRC). In Zimbabwe they have seven years to complete primary school and six years for High school. In the DRC system there are six years in Primary school and six year of secondary school. There is sufficient time to teach and learn various aspects of mathematics. There is time also to guide a child to the right carrier path.

## 3. One system of education the South Africans schools could consider; The DRC education system.

Tailored with the Belgian educational system in mind, the education system in the Democratic Republic of Congo ( DRC) is made of a six years long program of primary education followed by another six years long secondary or high school studies (1).
The secondary school comprises of a two year cycle d'orientation and a four-year program, called humanite's. The cycle d'orientation (C.O) as the name indicates is where teacher should identify the child's strong abilities and weakness as well, use these to advise and help the child choose the "orientation" which best suits his natural abilities….
The humanities is a specialized training. Learners are advised to choose one of the following options: Scientifiques (math-physics, Bio-chemistry); commercial administrative; "pedagogigue" ; industrial techniques(mechanics, electricity); social science, agriculture and veterinarian, etc…
At the end of a four-year training, a learner graduates as a professional (teacher or electrician , etc… depending which option he/she has taken.
Another aspects concerning secondary schools in DRC is the name given to these schools. The name spells clearly the type of curriculum and orientation the school provides. Names such as " Ecole Technique Superieur d'Agriculture " for Agricultural Technical school; " Lyce'e Pedagogique " for Pedagogical Girls' School; , " Ecole Professionelle Technique " for Technical and Professional school; " Seminaire" for Seminary; "Ecole Literaire " for Language and Literature school; Institut des Techniques Appliquees for Institute for Applied Technologies … are some current names. A learner would have made his/her mind concerning the future carrier when he/she sends the application to a particular school. In the pursuit of their dreams in a certain curriculum, learners , while guided by the school name happen to travel to far places to find the school of their dreams. Once a learner gets access to such a school he/she waists no time to decide what option to take.
The choice of a learner is monitored by the teacher and by the Guidance specialist.

## 4. How can I assist my child getting a good start in mathematics?

In our opinion the first activity a child should develop is the reading ability. Parents can help their children be good readers by reading to them. I always ask the question how possible is it to love mathematics if you fail to read a single novel. The passion and patience one develops while reading a book are the same needed to tackle mathematics.
Here are some useful activities we can practice at home.

- **When Cooking**: Have the children use the measuring cup. The recipe can be adjusted to correspond to the number of people invited to dinner.
- **While Shopping**: Ask children to find out which option would be cheaper. Buying 2l bottle of cooking oil or alternatively buy 3 times 0,75 ml bottles of oil. Buying a 5kg pack of soap or 5 times 1kg packs. We assume here that the money for the purchasing of items is available.
- **When Driving**: Ask them to estimate the amount of left; the distance the car would cover at a given speed. Ask children to point at the map the destination, the shortest route to get there.
- **Organizing Party**: Ask them to count the number of seats available, plan the seating arrangement, etc…

Parents have a role to play in getting children manipulate mathematics at home.

**5.** I never became a governor, but I became a mathematics teacher and later a mathematics lecturer. For the last 37 years, I have surely inspired through my teaching many young people of different countries and races. The little exercise of numbering in my case was the anchor which helped me fix firmly the interest in mathematics. If for a mere governor there is so much care, how much care does the training of future leaders of a country requires?

## 6. The linear model of blame

Concerning the students' performance in mathematics, Lecturers and professors of the post grade tend to blame those in the undergraduate level stating that students get to that higher level without problem-solving skills and hence their bad performance. These one in turn blame the High school teacher whom they allege to have not taught the necessary prerequisite students need. The high school teacher in turn blames the junior secondary teacher. The blame is passed on to the last in the list, the primary school teacher. This is a linear model of blame. Does the primary school teacher accept responsibility of students' failure? Has anyone spot the level of the primary school involvement in the student's underperformance? What measures were put in place to assist these teachers perform at their best? I was a junior school teacher, then a senior high school teacher and now a mathematics lecturer. I do not take blame either for my students past or present underachievement. We teach at the level of our own understanding of the matter. Whatever shortcoming not addressed for an instructor may as well go down to his/her pupils.

## 7. The circular model of blame

Are the professors not the instructors of those who train teachers? Learner must be made aware of his/her central role. Parents are in the next line of duty being the one who have the task to inculcate the sense of responsibility to the child. I suggest a circular model with the learner at the centre, and other stakeholders of the educational system at the circle. As the radii of the circle are equal in length so is the duty of each of us on the chain, now circle, to the learner at the centre.. In this model it is not the question of who did not teach what? Instructors of all levels constitute a club whose task is teaching in the best possible way. Like a knot, the two ends of this circular chain are made to vanish by being fastened together. At this point no one should point at another as being at the origin of the problem. The blame as well as any credit for failure or success respectively is equally shared among all. This requires a two- way line of communication between members on the circle. Teachers who were previously at the receiving end of the blame will benefit of the collaboration of professors to enhance their teaching skills by providing for them the best teaching

methods. It is expected also of them to organize on-going workshops to disseminate new developments in the areas of their expertise Professor would receive feed- back from teachers of the effectiveness of new techniques in class. Unlike the linear model which in a way suggests that actors remain permanent in their positions. The circular model is aware that roles among the actors may change. The next paragraph illustrates how role players in the educational system may change positions.

One Professor told me this story: He taught mathematics to a group of pupils including a boy and a girl. Some years later he taught some undergraduate mathematics modules to the boy and girl at University. Many years later He met them again at Rhodes University. This time they have completed their studies and were employed as mathematics lecturers. A pupil some years ago, a student yesterday, a colleague today, a supervisor tomorrow is the scenario. At this point we may ask ourselves the question how do we get the children involved. This reminds me the tale about the horse at the bank of a stream of water. The process of education is a two-way. Teaching-learning is a reciprocal activity. As such any blame for failure should be equally shared between the instructor and the learner. Much focus in one aspect tends to ignore the other. Learners should be more implicated in matters concerning their education instead of rallying round for issues such as the Palestinian and Israeli politics. To the circle of blames we must add parents. Teachers can predict a pupil's performance by noticing how much the parents are involved. The activities suggested earlier are the kind to help children get to love mathematics.

Allow a student, even a ten years old child to handle a computer, or a new smart -cell phone. Does it take him/her a long time to comprehend how the gadget functions? Not at all. I have experienced two incidents: My topology and functional analysis lecturer, Dr K was still using a typewriter, while there was a new computer installed in his office. My abstract algebra lecturer, Prof T.J Van D had bought a cellular phone. His sister called to request him to read the message she had sent him. After failing to open the message book, he called me for help. I showed him how to do it. He then called Prof Taylor, a statistician to the party. Both had failed earlier and were amazed to realize how easy sending or opening a message was. What do we learn from these cases? We are intimidated by things at their surface. A resolute action will result in demystifying the thing.
Some years ago, I was teaching in the rural area of the Eastern Cape. While I was travelling to school one day I stop at a village to make a telephone call, using a public telephone booth. There I met a young girl standing by the telephone booth. She could be about 15 years old. I took from my pocket a telephone card which had the number to allow me have the air-time. This child smiled at me. I tried to dial the number but could not make the international call I intended. I did it for a number of times, until out of impatience the girl offered to help me. She came closer, removed the card from the slot provided. She asked me to supply her with number I was willing to call. She dialled what seemed to me an unending number, followed by the one I gave her. The contact was made and I was able to speak to my mother on the line. Was it by luck or chance the girl managed to decipher the code which allow her call without credit? It takes the same mind to encrypt a message as to decipher it. Who takes credit for this kind of action? My question is what would make such student fail her mathematics? Computers and computer applications such as computer games are increasingly becoming sophisticated. Yet children quickly find a way of navigating through them. Children love the computers but hate the mathematics which is hidden in these gadgets. The philosophy of teaching mathematics should be devised to accommodate children's adventurous mind.

## 8. Additional members to the circle of blames

In the study done in (6), learners seem to blame the teachers and the lack of resources available as reasons for the failure in mathematics. In the South African educational system other entities are also to be blamed. Based on the report on the training of teachers for the Curriculum Assessment Policy Statement (CAPS) in mathematics by Prof WA Olivier (1), we are in the position to include additional members to the circle of blames. The additional members are the Department of Higher Education and Training (DHET), the Department of Basic Education(DBE),National and Provincial and the Higher Institutions of learning. Each of the additional members has a role to play in the way mathematics is dispensed at school.

In what extend would the blame be attributed to these institutions?

The DHET is responsible for the accreditation of modules taught at the universities. For any module prepared by a college or university to be implemented, an approval from DHET is sought. There are about 24 universities and many colleges under the DHET; each with dozen of programs different from one university to another. One can imagine the complexity of the accreditation task. When it comes to programs and modules of mathematics education, a much careful approach should guide the designer of the program and especially the body of assessors in charge of accreditation. The program designed to train mathematics teachers should devote more time to the mathematics discipline (content and didactics)and little time for the learning of languages . It does not mean we neglect languages. But why would a mathematics teacher spend his training time in learning of additional languages that he/she might not use in classroom. All mathematics assessments in schools and universities are written either in English or in Afrikaans; shouldn't care be devoted in the ability to communicate in these two? Any time spent for learning those rather cumbersome modules not directly related to mathematics or to the teaching of mathematics should be used allocated rather to activities having the potential to strengthen the mathematics content knowledge and teaching ability. Mathematics is important in life, but why the fundamental learning of languages teachers does not include mathematics? Mathematics teachers should be instructed in the language they teach mathematics. It makes sense. The DHET has the duty to clear mathematics education of superfluous modules. We believe also there should not be any difference between what is incorrectly termed as mathematics for education and mathematics. A researcher in mathematics today is a mathematics learner of yesterday. An equal- to- task maths teacher is in the background. It is said that the "one who asks questions and the one who answers them" are at pas. We advocate that the Bachelor of Science students and students of Bachelor in Education Mathematics should have similar mathematics content. We also advocate that students registered for post graduate studies in mathematics education must first have a degree in mathematics. Their research must consist of ways to improve teaching and learning of mathematics compared to the kind of thesis we have seen recently.

This above -mentioned report made by an expert external to Department of Basic Education (DBE) has touched the core problem leading to the pupil and students' underperformance in mathematics. The report is informal and is based on the finding in two provinces only. We presume the situation would be similar in the other provinces. On what basis we would have been led to think otherwise. On page 16 of the said report, referring to the intended CAPS implementation plan, the author mentions that CAPS provides details on what teachers ought to teach and assess…

This is a natural expectation and assumption from the DBE. On **page 20**, the author cites his observations concerning the content pre-knowledge of many teachers being not adequate to **digest** the content of the new CAPS. On the same page, there is mention of un-trained teachers being part of the CAPS training. We may in such case freely replace the verb digest in the above sentence by **chew** without much tempering with the original text. "CAPS" is only a new rearrangement or a delineation of topics found in NCS. We need to find out when did the so-called teachers' inadequacy to "digest" the content start? On **page 21** the author suggests that an appropriate competence test be administered to the officials selected to take charge of CAPS training in districts. We believe that at that stage it is too late to control the damage these people would have caused to the children in particular and to the nation in general. This test should be applied at the recruitment of teachers, but not after they have been raised to the rank of subject advisors. It is not possible to forecast what the DBE would do if a teacher or even a subject advisor fails such test. The author of the report makes also mention of the fact that the teachers who needed the training the most had missed it. In what way they are found to need the CAPS training the most. There is also mention of a core group of skilled and experienced CAPS mathematics specialists who would mentor and assist subject advisors. We applaud this damage control mechanism. Though it calls for duplication of posts and the arrangement puts strain on the budget. Using words from Mujibul Hasan Shidiqui in (3), we may say that it is unreasonable to expect a teacher to take one class, attend one workshop, or read and discuss a few articles and then be an effective agent to disseminate CAPS. Teachers need to see classes taught that model the desired new behaviour and need continued exposure to new strategies and methods of instruction. Only then can they be expected to consistently deliver effective mathematics in classes to their students.

The work integrated learning (WIL) requires that students be trained with the innovative mind for them to be of relevance to the ever changing industry and business requirements. Is the WIL taken in consideration when training mathematics teachers? Putting the same question differently we may ask the following: Does the DBE, the employer of teachers have a say in the way teachers are being trained? The answer to this question is evidently no. The statement made the Minister of DBE tells the story. Secondly why would all DBE workshops address content? Why don't they address the manner to teach CAPS? Even if they would address both content and didactics, How sure are they that it will be implemented in class-room without a monitoring system in place. The DBE seems to know the problem but has failed to address it and therefore take part of the blame.

In an attempt to search for a solution to the above question, we ventured into some Universities sites to get some tips concerning the curriculum they offer to those who will handle the CAPS at schools upon graduation. In (2) we can read the interaction between M Bettman and some members of the public that currently University South Africa (UNISA) College of education is assisting students with the implementation of CAPS through the modules taught for the foundation and FET phases. UNISA is at a transitional phase with regards to practical modules. Does it mean that Colleges teach the future mathematics teachers the DBE curriculum as contents matter? (5) Mathematics is a universal language. There is no mathematics for CAPS and for some other curriculum. We would expect that College of education teach mathematics of a level higher above that of a learner whom one is supposed to handle tomorrow upon graduation. In fact, the DBE expects the teacher to teach CAPS. A level higher than CAPS helps the teacher navigate through the syllabus and adjust should it change in future. Teachers who were once taught Mathematics

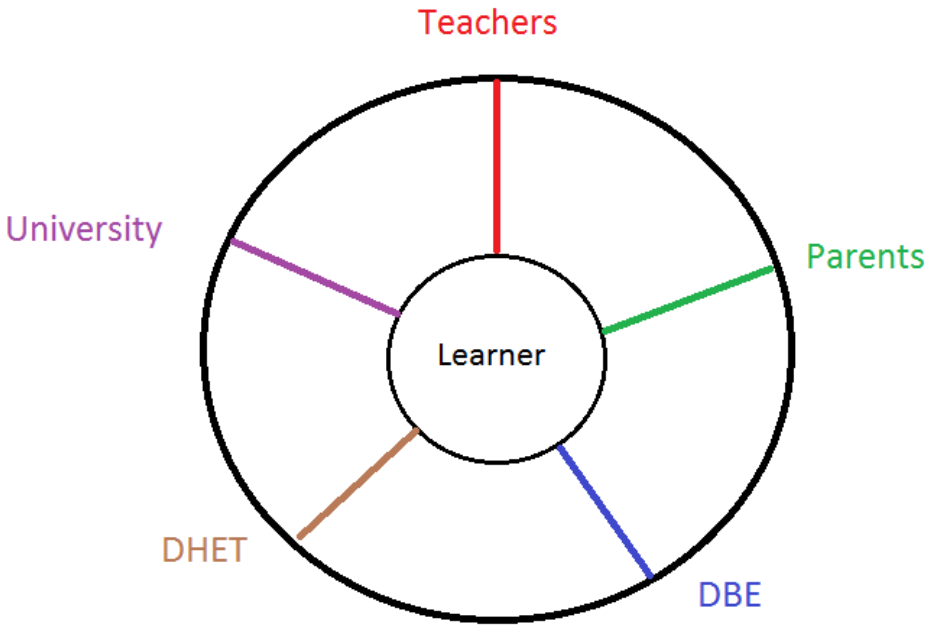
literacy in College instead of pure mathematics found themselves wanting when CAPS was introduced.
Should mathematics teachers not be taught mathematics similar to the BSc student, a level higher than CAPS?
Practical modules should complement the training which includes the techniques of micro-lesson (4). In most Universities' schools of education in South Africa, this technique is not used adequately. Teachers are being trained to teach primary or high school pupils. While it should be have been a routine practice, using the high school learners, instead of College class- mates. Using class mates as learners in a micro-lesson should have been a once off event, but it has become the norm in the universities schools of education. The venue where this lesson is conducted should also have the required equipment. The truncation of the training has the unfortunate effect of the teacher not knowing his/her own strength in questioning and assessing learners' responses. Many workshops organized by the DBE in districts are always content based. This fact points to the root of the problem which is the narrow content training given to teachers during their training. With such undertaking there will always be need to teach contents to existing teachers any time the curriculum is slightly amended as is the case now with NCS and CAPS. Teachers need on-going training in new teaching methods. In mathematics both the one who solve a problem and the one who pose the problem are doing an equal task. In simple terms the researcher in mathematics and the mathematics education instructor are equally important. The latter translates the findings of the first in terms which are accessible to learners and to society in general. For this reason there should not be a type of mathematics for BSc students different for the mathematics education. In other terms the core mathematical content of the BSc and mathematics education should be same at least for the junior degree for the purpose of portability. A junior degree holder in mathematics education should be able to further studies in mathematics science.

We include as annexure the grade 7-12 mathematics curriculum of the educational system of DRC, one of the SADC countries. modules such as logics, group theory, linear algebra, vector space, infinitesimal topology, complex numbers etc…. are being taught in secondary school. How would a teacher with a narrow content training in mathematics be of help to pupils in such educational system?
I have spent an extended number of years of secondary school mathematics, teaching in three different countries of the SADC sub-region, seventeen of which I was posted in the Eastern cape province of South Africa. I had participated in various workshops and was chosen to represent my district to the AMESA conference and to the DINALEDI mathematics and science training held in Pretoria in 2008.
In every workshop I attended the emphasis was on the content matter, the administrative aspect of learners' portfolios management and the nomenclature of new programs. The didactics methods to handle the content of mathematics were never mentioned. One would always wonder why the organizers assume we (teachers) do not have knowledge of the content and therefore need to enhance it.

## Concluding Remarks

An educator teaches at the level of his/her understanding of the subject. In the same manner does a student answers questions of a test. In a sense a learner portrays the teacher's knowledge such that his/her success or failure in a subject can be traced from the teacher's involvement. From the

teacher we can trace the College/University he/she attended. Since Universities develop the DHET accredited programs; then University speaks about an educational system. It is clear that success of learners in a subject such as mathematics results from the effort of the whole system and therefore each stakeholder shares equally the blame for underperformance. The chain of stakeholders is not linear rather it should be circular. The school mathematics syllabus should be enlarged by inclusion of other topics and areas. Different High School options would have different topics addressing the kind of orientation students will follow in future. A body of Inspectors should be empowered to monitor teaching and good practices at school level. This will be able to save money used by DBE for massive workshops . School will once again belong to the DBE unlike the actual situation where they belong to the Unions. Colleges of Education need to adopt or own high schools where teaching practices, including micro-lesson are organised.




CIRCLE OF BLAMES

## REFERENCES

(1): WA. Olivier, reflection on the training of teachers for the CAPS mathematics curriculum
(2) Coetzee. A, 2012. The South African Schools curriculum: from NCS to CAPS, News and Events, College of Education, UNISA, Available from
http://www.Unisa.ac.za/cedu/news/index.php/201/06/the-south-african-schools-curriculum-from-ncs-to-caps/
(3) Siddiqui Mujibul Hasan , teaching of mathematics, New Delhi, 2005
(4) Vala Mavula and Matiki Talwanga, perspectives of strengthening primary and high school teaching practices in South Africa, Journal of Educational and Social Research vol. 5 no.1 January 2015 .
(5) CAPS Mathematics curriculum, Mathematics - Department of Basic Education
*www.education.gov.za/LinkClick.aspx?fileticket...tabid=420...*
(6) **High** Failure **Rate in Mathematics** Examinations **in** Rural