A Comparison of South African and Zimbabwean Secondary School Mathematics Teacher Education Programs: Insight from Theoretical Expositions of Programmes

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Abstract
The purpose of the study was to compare mathematics teacher education programmes of South Africa and Zimbabwe in an endeavour to improve the teacher training programmes. Data for the study was obtained from the University of South Africa (UNISA) and Bindura University of Science Education (BUSE) and a comparison was made. These two universities are the main ones offering teacher education programmes in the respective countries. UNISA is said to produce 55% of South African teachers due to its open and distance education programmes that enrolment numbers are not restricted by physical space and resources whilst BUSE is the official state university in Zimbabwe responsible for the national mathematics and science education in the country.

Background to the study

Performance in mathematics attracts attention from all walks of life creating constant search for improving mathematics education (Grevholm& Goodchild, 2007).Lianghuo, Seng, Yan,Yee, (2005) see teacher competence as a factor that plays a significant role in learner achievement in mathematics, and that a large number of mathematics teachers experience difficulty when teaching mathematics. Successful teaching is influenced by sufficient teacher expertise of content knowledge in mathematics domains. The issues of what kind of knowledge is adequate for making effective instructional decisions or designing appropriate learning environments are on the agenda of current research world-wide (Ball, Lubinski & Mewborn, 2001; Lehtinen, 2008). For South Africa, the unsatisfactory teaching competencies of some mathematics teachers are attributed to weak content knowledge. The weak content knowledge arises from poor teacher education programmes offered in the former colleges of education where the majority of the teachers received training. Another factor that is often attributed to the South Africa teachers' unsatisfactory content knowledge is the perception that the majority of the teachers practicing now were among the students who were largely involved in the struggle against apartheid in the 1970s. Due to the numerous class boycotts resisting the apartheid system the students of this period are assumed to have received inadequate content during their studies as they were pre-occupied with solving the social system of the day. However anecdote data suggest that many of the Zimbabwean teachers are more confident in the teaching of mathematics than their South African counterparts. To this end, what makes Zimbabwean mathematics teachers show more competencies than their South African counterparts? After a decade of political upheavals resulting in economic melt-down, has teacher education remained the same or it has deteriorated in quality? How does the current

teacher education goals in the two countries compare? These and more questions motivated us to explore teacher education in the two countries.

Mathematics Education

Mathematics is vital for technological advancement (Hendrikz, 1986). To cope with new technologies and to sustain the wealth of a country, people require a sound mathematical background. Mathematics is highly valued across nations, with Tecla (2007) emphasizing that, in our match towards scientific and technological advancement, we need nothing short of good performance in mathematics at all levels of schooling. Unfortunately, performance of students in mathematics at the end of secondary education has not improved in the past decade, (Tecla, 2007). According to the NCTM (2000), teachers should understand deeply the mathematics they teach so that they become capable to teach it in a hierarchical form. Ma (1999) as cited in (NCTM, 2000) argues that it is important for teachers to understand big ideas of mathematics. In that case teachers may be able to represent the ideas as a coherent and connected enterprise. They may be able to select tasks that will enable learners to solve problems using school concepts in mathematics and reflect on the problems. Ball, Lubiniski, and Mewborn, (2001) are of the opinion that teachers need to understand concepts and procedures themselves in order to select and construct fruitful tasks and activities for their learners as well as flexibly interpret and appraise their ideas. These tasks that are chosen may help learners to understand concepts in mathematics and build bridges between what the learners know and the new concepts under review. In line with this Hill and Ball, (2004) have developed a model called mathematics knowledge of teaching (M.K.T). The model has three knowledge domains most central to mathematics teaching that include common knowledge of mathematics, specialized knowledge of content and knowledge of students and their ways of thinking. The report to UNESCO of the international Commission on education for the twenty first century (1999:146) purports that the teacher:

to be effective, must draw upon a broad range of teaching skills, as well as human qualities of empathy, patience and humility, as a complement to authority. When a child's or adult's first teacher is poorly trained and poorly motivated, the very foundations on which all subsequent learning will be built will be unsound.

This statement shows that in any system, teachers are the most important resources that can drive the success of the education of learners. No education system can be better than its teachers and, therefore teacher education has to thrive to produce high caliber teachers who can offer effective teaching. It is in this regard that the mathematics teacher education of neighboring two countries, South Africa and Zimbabwe is compared with a view to exchange notes on how to improve the mathematics education systems of the two countries. The teacher education systems of the two countries are presented separately to enable readers to frame their understanding then compared in a section on discussion. First the teacher education of Zimbabwe is presented followed by that of South Africa.

Mathematics teacher education in Zimbabwe

At independence in 1980, education was declared a basic right to every Zimbabwean school going age child. The first ten years of independence focused on building new schools so that most learners could have access to schools in their neighborhoods (Kapungu, 2007). The quantitative number of schools was not matched by the quality of education offered. For instance, people without teaching qualifications were hired as temporary teachers to man the numerous schools that opened their doors. During the second decade of independence policy makers realized that access of educational facilities was not matched with equity of educational resources such as teacher quality. Drastic efforts were made to improve teacher quality in the country. The Zimbabwe-Cuba teacher education program where school

leavers were recruited to go to Cuba for a four-year teacher education program was the initial step to increase teacher quality in the country by attempting to staff schools with qualified teachers. Local initiatives to improve teacher quality in the country were started. Among them were the Degree in Mathematics Education, increase of enrollments in the Graduate Certificate in Education and the Science Education In-service Teacher Training (SEITT) offered at the University of Zimbabwe. Decisions were also taken to have a university in each of the ten provinces of the country to complement the existing teachers' colleges. Though the universities produced graduates who ended up teaching in schools each university was mandated for a specific goal such as technology, science education, arts and language education, agriculture, commerce and industry. The Bindura University of Science Education replaced the Cuba-Zimbabwe program and became a university mandated with the responsibility of providing the nation's mathematics and science teachers in the country. Given the autonomy of universities and their needs to diversify programs other universities are involved in teacher education programs involving commercial, humanities and science and mathematics education. To reduce competitions with the new universities, the University of Zimbabwe transformed itself into a post graduate centre offering post graduate diplomas, Masters and PhD studies in order to produce academic staff to man the new universities. Due to the mandated specializations of universities the present paper focuses on mathematics teacher education programs offered by BUSE because the university is the official one for the programs.

According to BUSE's strategic plan (2009-2015), the university exists to contribute to the development of Zimbabwe through the advancement of knowledge and skills in science education. It seeks to produce innovative, highly acclaimed graduates equipped with research, entrepreneurial and technical skills for the benefit of the nation and the international community in the fields of geography, mathematics, chemistry, biology and physics (Faculty of Education Brochure, 2011, page3).

In line with its vision BUSE offers three different programs, namely, Bachelor of Science Education (BScEd), Diploma in Education (DipEd),and Masters' in Science Education (MScEd). These programmes are offered on full time basis, block release as well as through Virtual and Open Distance Learning (VODL), except for the MSced which is offered through block release. Each of these programs is briefly described below.

The BScEd program

Three programs, namely, a three year and four-year pre-service and a two-year in-service characterize the BScEd program. Eligibility to enroll for the two-year program is possession of a certificate/diploma in Education from an acceptable institution where mathematics was strongly represented, at least two years of approved teaching experience at an institution recognized by the university, a pass in 'A' Level mathematics, and at least five 'O' Level passes including mathematics and English. On the other hand, to enroll for the four-year BScEd program a candidate must possess at least two passes in 'A' Level subjects so that of the two subjects one will be studied as a major and the other one as a minor subject. For the three year programme, a student must have a pass at A'Level mathematics and will specialize in mathematics only.

Two-year, three year and the four-year BScEd students sit in the same content courses but different professional courses. The rationale for the courses is that in-service teachers need the same amount of content courses as pre-service teachers on the program for them to be able to effectively teach 'A' Level content. The in-service teachers' pedagogical knowledge obtained during initial teacher education and teaching experience after qualifying is recognized. At least 24 content courses must be passed in order to be considered to have passed the mathematics content

component of the program. Students on the two-year program and those on the three ,four-year program need to pass four and six major professional courses respectively (taking one professional course per semester) for them to be considered to have passed the professional component of the program. Students from both programs also study auxiliary courses in communication skills, HIV/Aids, conflict management among others which combine with professional courses to add up to six and eleven respectively for the two and four-year programs respectively. Unique in the professional courses offered in the three-year program is a course on the History and Philosophy of Science where the mature students study the epistemological and ontological basis of scientific and mathematical knowledge.

Action research is considered a very important skill that teachers should develop during teacher education programs. Students from both programs are required by their respective programs to write, submit and pass a mini-dissertation on a topic of their choices in the major subject that they study at the university. The students on the three year programme do not submit a mini-dissertation.

Pre-service student go for teaching practice, termed Applied Science Education (ASE), for thirteen weeks during the first semester of the fourth and final year. The in-service students go for ASE during the vacation separating two academic years for five weeks teaching the A' Level students. The university prefers to call teaching practice ASE because it believes that the school experience gives students opportunities to put into practice (apply) the content and pedagogical knowledge that they gain in the concurrent content and pedagogy program.

The Diploma in Education program

A four-year DipEd program for pre-service teachers is on offer at BUSE. To be eligible for the program the prospective students must have at least five 'O' level passes including mathematics, English and a science subject. In the department

of education, the university has a block release, conventional students as well as virtual open and distance learning. The Diploma courses are divided into the following clusters:

1. Biology, Geography and Physics.
2. Biology, Agriculture and Geography.
3. Mathematics, computer Science and Physics.

At least 12 content courses must be passed in order to be considered to have passed the mathematics content component of the program. Specialization of the subjects will be done after one and a half years.

Teaching practice is one of fundamental components in teacher education. During teaching practice students put into practice theories of instruction and learning acquired during the programme. At Diploma Level, teaching practice is referred to as Practicum (PC008). This is done over a period of two terms. However the prerequisites for teaching practice is (PC007) which is a pre-praticum and this is examined through course work and given activities, and Pedagogical course (PC005) which is a method course.

A minimum qualification of a diploma/certificate in education was considered desirable as such teaching qualification ensured that the teacher possessed enough mathematics content and skills for teaching (Hill, Schilling and Ball; 2004).

The Virtual and Open Distance Learning program

Due to the dwindling number of students enrolled on the BScEd and DipEd programs a new program that was tested in 12 African countries including Zimbabwe by the African Virtual University was introduced at BUSE in 2010. The programme attracted a significant number of responses in the country. The faculty of science education had faced a decline due to low enrolment in science education programmes. The enrollment went down to unsustainable levels especially in 2008. However since BUSE carries the mandate of science education, large numbers

of trained teachers that the nation needs cannot be achieved through the conventional way of training, hence VODL was launched. The programmes were meant to address the problems of the practicing teachers who had no access to university education because of high university fees as well as the working class who could not afford time to attend conventional classes.

The faculty of education target relief teachers in Mashonaland central. In August 2010, four centres were opened but later the centres were reduced to three duringh the April to May 2012 block. In August 2012, three more centres were opened in Manicaland, Matebeleland South and Matebeleland North. More than 1000 students are involved in the programme.

The Masters in Science Education program

BUSE offers a two-year Masters of Science Education (MScED) degree program in mathematics education. To be eligible for the programme, a BScEd in Mathematics or a Bsc General in Mathematics plus a Grad CE or PGDE is required. A minimum of two years post professional training experience is required. As from 2011, the programme was put on block release. The programme consists of two components, namely, a professional component and a content component. The two components are taught concurrently during the first year of the program and a student must have passed at least nine courses and this is done in one and a half years and the last six months is reserved for the dissertation. All the taught courses in mathematics are examined through course work, which carries a weighting of 25% and a final examination of 75%.

The mathematics teacher education in South Africa is discussed next.

Mathematics Teacher Education in South Africa
The teaching and learning of mathematics, especially for the majority of the population in South Africa, does not come from history that the country is proud of. When the Nationalist party came to power in South Africa in 1948 one of the tools they used to entrench apartheid in this country was the introduction of Bantu Education in 1954. It was not out of the ordinary but expected for a government bent on excluding other sections of the population from essential resources as well as everything else of economic importance that one of the main architects of apartheid, Dr Hendrik Verwoerd said:

There is no place for [the Bantu] in the European community above the level of certain forms of labour ... What is the use of teaching the Bantu child mathematics when it cannot use it in practice? That is quite absurd. Education must train people in accordance with their opportunities in life, according to the sphere in which they live.http://africanhistory.about.com/od/apartheid/qt/ApartheidQts1.htm

The fact that Verwoerd chose to mention no other subject but mathematics to ensure the exclusion of the marginalised majority in the country is significant in bringing to prominence the role that is played by mathematics in empowering people to accessing their own development and opening up even greater opportunities for themselves. The quality of mathematics teaching in black schools has, as a consequence, always been of a low standard. The deliberate decisions by the apartheid government to deny blacks access to mathematics resulted in a shortage of adequately trained secondary school level mathematics teachers. The aftermath of those circumstances were teachers who had to contend with learners who had increasing deficits in mathematical knowledge and skills, low numbers of schools taking mathematics as a subject, low number of schools offering mathematics at secondary level and even more disturbing, a low pass rate of those learners who took mathematics as one of their subjects (Khuzwayo, 2000).

Teacher education under the apartheid system was racially stratified with separate teacher education colleges for Whites, Coloured, Indian, and Africans. Driven by the 'homelands' policy in the early 1960s, each 'self-governing' and later

'independent' African homeland had their own teacher education creating partial, multiple, and separate pathways to teacher education in the country. For Africans in then 'white areas', teacher education colleges fell under the jurisdiction of the Department of Bantu Education, which came to be known in1979 as the Department of Education and Training. By 1994 there were 19 education departments responsible for teacher education, with 32 autonomous universities and technikons, and about 105 colleges of educationscattered throughout the country. The bulk of training in black colleges and universities was limited to the humanities and arts subjects resulting in the underdevelopment of mathematics, science and technology in the secondary school system for the black population (Sayed, 2002).

The election of a new democratic government in 1994 brought about new hope for the majority of people in South Africa not only in terms of opportunities and access to a credible education but to mathematics that is understandable to the majority as well. It paved a way for dealing with a deeply divided and fragmented system of provision of teacher education. The National Education Policy Act (DoE, 1996), which addressed issues of democracy, equity, redress, and transparency, captured the intentions of the post-apartheid government in this regard.The adoption of the Constitution of the Republic of South Africa (Act 108 of 1996) provided a basis for curriculum transformation and development. Among the transformations that took place in post democratic South Africa was expansion of educational opportunities to all races. Creating educational opportunities for all citizens was hoped to improve their quality of life and give opportunities each person the potential to actively participate in the civic, economic, technological and industrial development of the country. Furthermore, education became the democratic government's responsibility to "lay the foundations for a democratic and open society in which government is based on the will of the

people and every citizen is equally protected by law" (DoE, 2003: 1).

At the beginning of 2000, there were approximately 82 public institutions providing teacher education in SA where colleges were originally intended to focus on primary teacher training, while universities concentrated on secondary teachers. A programme of rationalisation of teacher education was initiated in 2001 such that all colleges were amalgamated with universities (Sayed, 2002). At the heart of this rationalisation process was the vision that all teachers in South Africa should hold a bachelor's degree. The National Policy Framework for Teacher Development in South Africa (DoE, 2007) identifies the Initial Professional Education of Teachers (IPET) and Continuing Professional Teachers Development (CPTD) as underpinning the system of teacher development in the country. At present two IPET pathways for professional teacher qualifications are the 480-credit Bachelor of Education (BEd) degree and the 360-credit first bachelor's degree followed by a Postgraduate Certificate in Education (PGCE). The latter will be replaced with the 120-credit Advanced Diploma in Education (ADE) in the near future. In terms of the CPTD, the National Professional Diploma in Education (NPDE) was introduced 2000 as a short-term measure to deal with teachers who were below the approved norm of teacher qualifications while for further development the Advanced Certificate in Education was offered to those at Relative Education Qualification Value (REQV) 13. While the NPDE programmes have been discontinued and are only offered to pipeline students, the ACE programmes are also on their last legs as they will be replaced by ADE and Advanced Certificate in Teaching (ACT) qualifications.

The major problems encountered in the education system were that the teachers who were educated during the apartheid era found it difficult to deliver school mathematics curriculum that encouraged mathematical reasoning and critical thinking. This was attributed to the poor content

knowledge received during the apartheid era as a result of inadequate training received at the teacher training colleges. The content of teacher education provision under the post-apartheid government was the commitment to an outcomes-based education system, which emphasised learning areas rather than discrete and separate subjects. This was an epistemological shift from teacher-centred to learner–centred approaches in terms of the identification of different types of competencies that learners were expected to achieve and the different roles that teachers had to fulfil. It was a welcome shift away from the rote and transmission-orientated learning approach.

The University of South Africa (UNISA), a major part in teacher education in South Africa is believed to produce 55% of the teachers in the country. UNISA is offering the following teacher education programmes.

- Advanced Certificate in Education in either Natural Science or Mathematics at Intermediate and Senior phases. These qualifications seek to improve content knowledge of teachers in possession of a teacher's qualification that is a basic in service qualification and no practical teaching experience is required for these students. Students have to complete five modules in these qualifications where the subject content knowledge as well as the pedagogical content knowledge (PCK) in these disciplines is covered.

- Bachelor of Education. This four year qualification is comprised of forty modules covering various disciplines of education with methodology of teaching. The programme comprises of fundamental, core and elective modules which cover communication, literacy, teaching and learning, child development, education systems, curriculum andas well as school specialisation subject andincludes an equivalent of a year's supervised practical teaching experience.Prospective mathematics teachers have to complete

eight undergraduate mathematics modules which should be inclusive of those that are at second year level.

- Postgraduate Certificate in Education (PGC). This one year qualification is taken by students who have completed a bachelor's degree and wish to qualify as professional teachers. The programme comprises of ten modules which include educational themes such as leadership and assessment as well as subject didactics in the specialisation discipline.A practical teaching experience is also undertaken in the same year.

- Honours, Masters and Doctoral degrees are offered to students who wish to gain in-depth knowledge and skills in the disciplines that they teach. Although dissertations are submitted by Masters and Doctoral students, the Honours student have to complete five modules inclusive of the one in which they have to do a mini-research project in their specialisation subject.

The similarities and differences between South Africa and Zimbabwe mathematics teacher education

Historically both South Africa and Zimbabwe mathematics teacher education suffered from racial discrimination and segregation in favour of the whites. Both were affected by conflict and used race as a filter for access to quality education under settler regime. The main challenges and imbalances in mathematics education were felt more in South Africa than in Zimbabwe and there was more political instability in South Africa as compared to Zimbabwe up until 1994. In Zimbabwe the imbalances dated back from the 1890s to 1980, whereas in South Africa they have persisted up to date in some parts of the country. The education system in Zimbabwe was characterized by an unequal provision of education between the white and the black communities (Kapungu, 2007) and this was no different in South Africa.

There are several colleges and universities in Zimbabwe and South Africa. Bindura University offers a greater number of science education programmes in Zimbabwe and UNISA remains the largest Open Distance Education in South Africa and on the African continent. The two universities offer pre-service and in-service training. The in-service programmes provide an opportunity for teachers to become professionally qualified and create access to further education opportunities.

The first two are the following pre service courses:

1. a three year general formative degree followed by a professional post graduate certificate in education (PGCE).
2. A four year undergraduate bachelor of education (B.Ed). The academic and the professional components are integrated.

The second one is the National Professional Teachers Diploma (NPDE) which is a basic in-service qualification.

It can be seen that Bindura University offers more courses than its counterpart. These courses are done as full time courses, block release or through virtual open and distance learning. The courses at UNISA are done through distance learning only. In all the courses that are done at Bindura University, the professional component and the academic part is done concurrently whereas UNISA offers a Post Graduate Certificate in Education as one of its courses.

South Africa has a university based system whilst Zimbabwe has a system of teachers' colleges and universities. The entry qualification when entering the colleges and the universities is not the same in the two countries. In Zimbabwe the entry qualification at primary colleges is 5 Ordinary levels and a pass in English and mathematics. This shows that all the primary school teachers in Zimbabwe have the basic prerequisite of mastery of mathematics concepts. At Secondary level the colleges consider those with a pass at Advanced level mathematics and at least 5 Ordinary levels

including mathematics and English or at least 5 Ordinary levels and a pass in English and Mathematics. In order to enter the university one should have passed mathematics at Advanced level or has a diploma in education at secondary from a recognizable university in Zimbabwe. Bindura University offers BscEd(hons) as a pre-service course for 4 years or 3 years for in-service course. This shows that the Zimbabwean student enters the colleges and the universities with a strong mastery of mathematics concepts. At Bindura University they incorporate content and professional studies through out the programme as well as the teachers colleges in Zimbabwe. The Zimbabwean teacher education is more powerful because the professional component emphasis on problem solving, communication, reasoning and it influences what goes into the classroom. The practical aspect, that is teaching practice, is done for thirteen weeks at Bindura University by the pre-service students and 4 weeks for the in-service training. Supervision is done by mentors, head of departments as well as the faculty members. Micro teaching is done at the college before going into the field. The philosophy, psychology and sociology contribute immensely to the development of the mathematics teacher in Zimbabwe.

However, Parker (2006) cited by Adler, Kazima, Mwakapenda, Nyabanyaba, and Xolo, (2007) argues that in South Africa the entry requirements for the training varies with universities and colleges. Some institutions enrol students who passed mathematics with a minimum of a standard grade D. Some institutions enrol some students who would not have necessarily passed but have only attempted matric mathematics. This shows a low entry requirement as compared to Zimbabwe. This is different from the university that requires matric mathematics pass with a higher grade that is D or C.

There is lack of teacher competence due to lack of adequate training at lower level in South Africa as compared to Zimbabwe. The rule in South Africa is that a secondary teacher needs mathematics up

to first year university level to teach grade ten and up to second year university to teach grade 12. Setati, Parker and Snyders cited in Adler (2007) said that the content of the university mathematics syllabi is not necessarily relevant for teachers. There is no agreement on the content and the form of mathematics teacher education in South Africa. Some of the institutions teach mathematics courses that are not specifically designed for teachers. Even after independence there is no agreement in South Africa relating to the content and form of education teachers will be given. In Zimbabwe those with first degree can teach mathematics up to Advanced Level and those who are trained in teachers' colleges are eligible to teach mathematics only up to Ordinary level.

It can be seen that the main challenges facing the education system in the two countries has to do with the quality of the mathematics teacher education. Most schools in both South Africa and Zimbabwe lack sufficient number of well experienced mathematics teachers. Morrow (2008) pointed out that all the countries in the world are experiencing the most severe shortage of teachers, of which South Africa and Zimbabwe are not an exception.

Discussion on the mathematics teacher education in South Africa and Zimbabwe

To ensure quality mathematics teacher education and improved participation of mathematicians in the education programmes, the following could be the way forward;

Mtetwa et al (2007) cited in Adler (2007) argued that the education for mathematics teachers in Zimbabwe concentrates on the mastery of content and pedagogical theories. This is also in agreement with Hill and Ball (2004) who outlined that the main challenges facing the education system have to do with the quality of mathematics teacher education. He purports that this challenge is not only experienced in South Africa, but in other countries also. However, Nziramasanga (1999) is of the opinion that mathematics should be taught experimentally like science. The

classroom should be a kind of a mathematics laboratory and should be inspiring and a stimulating place for all pupils. The colleges should produce lecturers who can participate in action research. The teachers must be role models and be able to use computer based programmes. Calculators can be used starting from primary school and relate mathematics to the pupils daily experiences. They should enhance quality education and strengthen school management and try to be as resourceful as the primary school teacher were in every corner of the classroom you expect to see corner shop.

Shulman (1986) also identified three aspects of knowledge for teaching, viz. pedagogical content knowledge, curriculum knowledge and subject matter content knowledge. The pedagogical content knowledge was considered specifically for the teaching and understanding of mathematics. Both the pre-service and in-service teachers are expected to develop technical skills necessary for them to achieve professional competence when teaching mathematics.

Nziramasanga (1999:42) added that the teacher training programme should among other things aim to;

- develop a student teacher's understanding of mathematical and psychology of learning mathematics and the degree he/she can help others.
- deepen their interest in mathematics.
- enable students to gain a deeper understanding and appreciation of the applicability of mathematics.
- develop skills of motivating pupils to enjoy learning and doing mathematics for both recreational and functional purposes.
- help students see and appreciate the beauty of mathematics.

Macfarlane et al (1990) outlined some of the problems faced with mathematicians which have to do with:

- lack of curricular designed and teaching materials specifically designed for African

needs. Mathematics should be taught like science.

- A teaching force with inadequate skills to cope with the problems in mathematics.
- A general shortage of resources.

It can also be argued that the teacher training curriculum should not only prepare the graduates for advance to masters degree level in mathematics. They should emphasise on the aspects of the work that is done at primary school, at Ordinary level and at Advanced level depending on what the student teacher is being trained for. For those inadequately trained, for example, those trained during the apartheid era and those who do not perform well and are already in the field, more programmes should be put into place to train them further. Colleges should try to find ways of attracting capable students in mathematics and try to sustain them during the training.

Based on the expositions given to teachers, the following skills are developed

- Being student centred – knowing what the students want to learn in
- each session
- Assessing prior knowledge – check what the students know already
- Asking questions – keeping questions straightforward and trying to probe
- deeper levels of knowledge.
- Checking understanding – making sure that the pitch and pace of the session
- is right.
- Using visual aids and flip charts and OHPs wherever possible.
- Setting homework vital to promote life-long learning and checking learning
- objectives and learning strategy are reasonable and ask students to present
- their work.
- Computer literate & confident with the programmes available in school
- Communication skills, listening effectively, writing essays and reports.

- Understanding of pupils' personal as well as academic needs & to treat the pupils with respect
- Recognise the need for stability & therefore taking on tasks which can be maintained.
- Willingness to update skills/qualifications
- Competent record keeping
- Skill to empower children to access all areas of the curriculum & to achieve their maximum potential.
- Research skills, identifying themes and analysing data.
- Delegating tasks, guiding activities and having responsibility for meeting objectives of a department.
- Interaction, resolving conflicts, offering support and establishing good rapport with students.
- Evaluate, examine, assess performance and interpreting test results.

The skills described above regard students as active participants in knowledge construction. Thus the pedagogical implications of constructivism are that teachers should act as facilitates who provide appropriate activities and support for students to personally construct meaning, rather than receive them ready made from the teacher.

Conclusion

From the above discussion it is important that the teachers who teach mathematics must receive the most effective initial training. The fundamentals of basic mathematics are of utmost important to every learner. If the learner achieves the basic mathematical skills, there are high hopes of them continuing with the study of mathematics. Thus mathematicians must collaborate and be involved in all the process of mathematics teacher education as they are responsible and providers of mathematical knowledge.

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