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FROM THE MATHEMATICS CLASSROOM TO THE FUTURE:
THE SOMAFECO EXPERIENCE¹

Paper presented at the Institute of Education in London, on the 3rd of December, 1991, by Alcott Khaliphile Mzwandile Kibi, formerly a mathematics teacher at SOMAFECO.

Ideas that lead to the building of the SOLOMON MAHLANGU FREEDOM COLLEGE have been assimilated by many who worked there, and will serve as a guiding light towards their goals in their endeavours in a future South Africa.

INTRODUCTION

The advent of Bantu Education and the resultant reaction from the oppressed in South Africa has been written about in many a book. The Solomon Mahlangu Freedom College (SOMAFECO), although it was built after the 1976 student uprisings, was a continuation of a policy adopted by the ANC to provide alternative education for the oppressed majority, in defiance of apartheid laws.

It was in 1978 that the ANC drew up an education policy that was to be a foundation stone of SOMAFECO. The general aims of this policy are:

1. To prepare cadres to serve the national liberation struggle of the people of South Africa in the phase of struggle for the seizure of political power and the post-liberation phase.
2. To produce such cadres as will be able to serve the society in all spheres, i.e. political, economic, socio-cultural, educational and scientific. Priorities will be dictated by the needs of the liberatory struggle in the pre- and post-liberation period. (ANC Educational Policy, 1978)

¹ At the beginning of this year I wrote an essay entitled: "Mathematics Teaching/Learning Strategies in SOMAFECO". This essay is intended to be more focused on activities of the mathematics department and avoid other broad historical and political issues touched in that essay.

Principles of the policy are that

- a) it shall be geared towards producing a new type of a South African, dedicated to serve the interests and needs of the South African people as a whole;
- b) it shall be accessible to all, irrespective of race, colour, sex or creed;
- c) it shall draw on the most advanced scientific knowledge and progressive cultural activities of the people of South Africa and the world;
- d) it shall combat within education the division between mental and manual labour as well as the artificial separation of arts and sciences;
- e) while observing the priority to impart basic knowledge at each level in each field, the ANC educational programme shall promote the full creative and democratic participation of students, teachers and the community in all educational activities;
- f) it shall develop in keeping with the demands of the situation in a changing world.

It is interesting to note that in its preamble, the document recognises that "This policy will continuously be enriched through practical, as our struggle develops" (Ibid.). The ANC decided to make English and Mathematics compulsory subjects in the school. We shall therefore interrogate the educational policy through the examination of mathematics teaching practices in SOMAFECO, and hopefully draw lessons for the future policies of a future South Africa.

For the purposes of this essay, I have decided to divide the last twelve years (1979-1991) of Department of Mathematics in SOMAFCO into four stages: the formative, "teething", soul-searching and self-realisation stages. We will interrogate the aims and principles of the educational policy of the ANC using the practices of this department.

SETTING UP A DEPARTMENT

Having a school of exiles is problematic on its own. Any government would like to take absolute control of all learning activities in its territory, from curricula aims to learning outcomes. Any "system of education", as Foucault (1981) writes, "is a political way of maintaining or modifying the appropriation of discourses, along with the knowledges and powers they carry." With the only possible choice, the National Education Council (NEDUC) decided that the school will follow the GCE syllabus and write the same examinations. This decision was taken with full awareness that the curricular aims of the British Government are not the same as those of the ANC².

Due to historical and political reasons, the school had a serious shortage of qualified teachers, especially in mathematics and the natural sciences. A long-term solution was taken to send students to universities abroad to study these disciplines, in order to come back to teach at the school. Up to 1982 the entire staff of

² The ANC, for example, is very sceptical about differentiation on the basis of mathematical "ability". That is why we did not have a differentiated mathematics curriculum. On the contrary, the notion of ability is applied in Britain. This is a contentious issue for an ongoing debate.

the school was composed of ANC members, the majority of whom were not qualified. It was a policy of those in higher levels teaching others at lower levels, a prototype of "Each one teach one". The school was very fortunate that at the beginning some of the members of the staff were very experienced and dedicated teachers, like Muhammad, who tried his level best to put a foundation which proved solid enough for all who followed him to feel at ease.

Muhammad, as head of the department, helped collect teaching aids, including the writing of a handbook for department staff. The help offered by Andrew Masondo, a former prisoner of Robben Island, himself a former mathematics teacher, was also very valuable. It is hard to comment on the teaching and learning techniques employed during this period, nothing is written on that, although it was clear that mathematics was a "monster" for our students. Weekend formal classes were a necessity. The average passing rate at that time was lower than desired, although only those who had showed capability were allowed to write. Muhammad worked himself sick and had to leave the school. By the time he left, the department was functioning fully.

Looking back at those days, one can make the following observations: Most of the old traditions were still in place. Desks were arranged in rows and columns (something that was never changed). Students had to stand when a teacher enters the classroom. Since all teachers were members of the ANC, they were regarded as senior, politically and socially. This gave the

teachers authority over the students in the overall running and administration of the school, including the control of scholarships for further studies.

THE TEETHING PERIOD

By 1982 it became clear that the staffing shortages were unsurmountable. A decision was taken to ask for help from friendly organisations and governments to help provide needed teachers. With the arrival of teachers from different parts of the world, the school was to experience new influences that would shape its future structure and running.

Questions dealing with the relationship between a teacher and a student came to the fore. Here were teachers who were telling students that the demand that they should stand up when they (the teachers) come in is oppressive and outdated, that teachers should eat in the same hall as students, even stand in the same queue for food! Here were teachers who were using minimal frontal teaching, giving more time to students to work on their own. These and other ideas gave an impetus to a questioning of the authority of the teacher by some students in the school.

It was at this period that the role of the student representative organs was enhanced. One of the most outstanding achievements was the inclusion of academic problems as a topic for discussion

during "form meetings"³. The students were also allowed to discuss their feelings about their teachers in all subjects. A committee whose task was to discuss and convey the most pressing of these problems, was set up. It was called the Academic Committee. This committee would invite two teachers to represent the staff in their meetings. Who among the staff members were invited was to their discretion. The task of these staff members was to take the complaints of the students to the administration of the school. The principal of the school was expected to respond, or the teacher(s) in question would be expected to "improve".

The mathematics department was all except one "expatriate". It is interesting to hear people defending their frontal teaching techniques by pointing to the "shortage" of textbooks. These teachers spent their weekends compiling notes, typing stencil papers and producing files of notes for students. Every student, especially those in senior secondary classes, had a file of notes and exercises. There was no question of changing methods of teaching because of the lack of textbooks. This was self-reliance in practice.

It was at this time that the rule on exam writing was changed. All students had to write mathematics O'Level exams, whether they were weak or not. Exam results continued to fall lower and lower. Many students having lost confidence in their ability at

³ These are class meetings held on Mondays once a month or when it is necessary.

mathematics, started raising questions about their lot. Some students were even questioning the validity of having mathematics as a compulsory subject, while some staff members were blaming the "liberal" methods of teachers from abroad. There were students who were running away from mathematics exams, others entering just to write their names on the answer sheets and leave, thereby increasing the percentage of failures. These were known as "vampires".

A PERIOD OF SOUL-SEARCHING

In the mid-80s, until the end of the decade, some of us, who were sent to schools abroad to study, were trickling back to teach in SOMAFCO. Most of us were taught very little about pedagogics and other educational issues. Most were engineers, civil, electrical, mechanical, etc., with very little knowledge of educational issues⁴. There were only two South African mathematics teachers, both with masters' degrees in the subject, but with little or no experience at all. For the mathematics department this was a blessing in disguise. We were susceptible to change. We were eager to learn more. We found many books in the school library, something which proved to be very useful in our work.

We were fortunate to have Andrew Masondo as principal of the secondary school at the time. I had pointed out before, that this man was a mathematics teacher. He was concerned with what he termed "the creation of a mathematical atmosphere" in SOMAFCO.

⁴ During all the years that I was at SOMAFCO, I was the only South African teacher of mathematics, qualified as a teacher, something that, I presume, influenced my being chosen as a head of the department.

We spent weekends reading books of radical educationists and sociologists. Using Paulo Freire's (1970) ideas, we wanted to do away with "an educational practice which failed to offer opportunities for the analysis and debate of problems, or for genuine participation; one which not only did not identify with the trend toward democratization but reinforced our lack of democratic experience." We learnt that "education as the practice of freedom" is not the transfer, or transmission of knowledge or cultures. It is neither the "extension of technical knowledge", nor "the act of depositing reports or facts in the educatee". It is not "the perpetuation of values of a given culture", and not "an attempt to adapt the educatee to the milieu." From Giroux (1989) we found how the structures of society have made it a norm to have passive teachers, and "how dominant educational theory and practice are constructed, sustained, and circulated outside schools."

It was during this time that we were visited by a young, then professor of Material Science from MIT in Boston, US, Gretchen Kalonji, who was bringing a new gospel to us: the use of technology in the teaching of science and mathematics in SOMAFCO. Up to that moment we still regarded computers as machines for use by scientists only. That is how we were using them at varsity also. We would never allow a small kid to even touch a computer!

Gretchen had a proposal with her, explaining in short what the goals were, what technological tools were being proposed for use at the school, and the strategy for implementation of such a

project. It was due to this project that three of us went to the Technical Education Research Centres in Boston, US, in 1989. This was a turning point in the life of the department. We were very honoured to meet and work under people like Sylvia Weir, Tim Barclay, Bob Tinker, etc. We also met Seymour Papert, although for a very short time. It was in the US that I, at that time the head of the maths department in SOMAFCO, came across mathematics educators like Marilyn Frankenstein, Arthur Powell, John Volminck, Jere Confrey, etc. Marilyn introduced me to ethnomathematics⁵ and radical mathematics⁶ in general. Up to this point I had regarded myself a mathematician only. After meeting these educational giants, I changed my mind. I was seeing myself as a teacher!

SELF-REALISATION

On coming back to SOMAFCO, the first thing to do was to reorganise departmental work, putting more emphasis on staff upgrading and discussions. We made contacts with Paulos Gerdes in Mozambique, Ubiratan D'Ambrosio in Brazil, and Mmari in Dar es Salaam. From these we got works by Munir Fasheh, Graham, Schoenfeld, etc. It was through Paulos Gerdes that we heard of and made direct contacts with the Maths Education Project, based at the University of Cape Town. This link was very vital for us.

⁵ It is during this time that we came across the celebrated writings of Ubiratan D'Ambrosio, Paulos Gerdes, Munir Fasheh, etc. Ethnomathematics may be regarded as mathematical anthropology, a powerful tool for mathematics educators.

⁶ This is mathematics that uses ethnomathematics as its base, critically reconstructing pedagogical demands on the basis of an introduction of learners to a rigorous and critical analysis of the socio-economic domain. A book which is a must in this field is by Marilyn Frankenstein, *Relearning Mathematics: A Different Third R - Radical Mathematics*.

For the first time we had contacts with people who were "trying to find a way out" in the fight for educational change in South Africa. We received works of these compatriots on alternative mathematics, open-ended methods of teaching, etc. This type of co-operation had been absent, although everyone was aware that it was vital.

THE MATHS CLUB

Reading works like that of Munir Fasheh (1982) made us realise that our students would benefit more if they would be involved in mathematical activities inside and outside the classroom. We then decided to form a mathematics club. The SOMAFCO Maths Club was formed on the 15th of May, 1990. The constitution of the club is given in the appendix. The club managed to organise a wide range of activities like "academic" classes, where students would discuss problems they are encountering in class and help each other; solving mathematical puzzles and quizzes, organising symposia and organising excursions to factories around Morogoro, and to the Agricultural University in Morogoro. It was unfortunate that the second South African teacher left soon after the club was formed. I was, for all purposes, the only patron of the club. Desmond Radebe, who was the head of the department of Natural Sciences, was a very helpful hand during this period.

The club has a journal, published quarterly. Students compete with writing articles of mathematical interest for the journal. One very popular activity of the club members is to visit our projects in our vicinity. These include the hospital, the farm,

the garage, the carpentry workshop, etc. During these visits, students ask workers about their work. For example, in the hospital laboratory they would ask the technician about the chemical composition of the Gram's stain and why certain bacteria are Gram positive while others are Gram negative. They would ask the hospital administrator to give them their monthly statistics of patients and a breakdown of their illnesses, something which they were never given "of course". These students are also interrogating the general life of our community. One student found that a student who arrives late in the morning, after break, and for studies, loses the same amount of time as a worker who arrives late for work and leaves for home early. If the time lost for each occasion is 30 mins, the total loss in a year is 28 days!

The club was adopted by a group of solidarity workers from Groningen and Emmen in The Netherlands. They have given all the necessary assistance to keep us going. They have helped us with books, calculators, club T-shirts and bags, stickers, a cassette recorder with cassettes, etc. The biggest help they gave us were two photocopy machines which we are using to make copies of all necessary material for students. I think it would be proper to mention the fact that, since its formation, the club has been chaired by a girl, elected by the students themselves without the teachers' influence. We regarded this act as a measure of maturity on the part of our students.

THE JUNIOR ENGINEERS AND TECHNICIANS SOCIETY (JETS)

When we were in the US we were able to collect quite a large amount of technology education material; electric and electronic circuit boards, underwater microphones, an amateur radio, light sensors, small solar batteries, microscopes, etc. To put these to use by students we decided to form a group which we called JETS. This group is mainly made up of junior secondary and few primary pupils. The aim is to give the young ones a Hands-On experience of scientific work. This group spend most of their time in the computer centre, which we will discuss below.

THE COMPUTER CENTRE

After this centre was set up, and after our visit to the Technical Education Research Centers (TERC), we made attempts follow methods pronounced by Seymour Papert (1980) and Sylvia Weir (1986). There have been very serious attempts to use computers as teaching aids in SOMAFCO, especially since the visit to the school by Sylvia Weir. We decided to keep the computer centre as a resource centre, though, so that everybody, even those who are not full-time students. We have managed, in this way, to teach many non-students word processing techniques and the use of integrated software.

Tools available in the computer centre are:

LOGO, used by kids for writing essays and exploring turtle geometry, and its extension, LEGO/LOGO;

Productivity Tools have been used by senior secondary school students, mainly using word processing and data base;

Micro-computer Based Laboratories, especially those dealing with sound, light, motion, temperature, etc.

The biggest problem we have had so far is computer illiteracy among teachers. The majority of teachers at present are Tanzanians, who stay outside our area. They are not able, therefore, to organise their own free time to learn more about using the technological resources available. A problem that we fell into for some time was that "difficult" problems were soon to be solved easily by students, using computers. We soon discovered that we could bypass this problem using ideas in Kilpatrick's (1987) "problem formulating" ideas. This is a very difficult arena, something that we felt was not thoroughly investigated. We comforted ourselves by saying that students will improve as they go to institutions of higher learning, not a very satisfying approach.

The advantages of having the above activities can be seen in the classroom, and in results we had last year.

GOOD CLASSROOM ACTIVITY?

The Nuffield study on lower secondary teachers carried out in the 70's in England classified teachers into three categories: the problem-solvers, the informers and the enquirers. In Nigeria, Oginni (1982, 1984), using Science Interaction Categories, found that a typical lesson consisted of a verbal exposition by the teacher, with students listening and copying out notes. Hacker (1984), doing his studies in Australia, found the same found the same styles as those found by Galton and Eggleston (1979) in Britain. He had three pairs: the Concrete and Abstract Problem-Solvers; the Verifier and Expositor; the Discoverer and

the Heurist. Cusak and Sherwood (1986), also conducting a study in Australia, found that teachers' styles of teaching were to a certain extent influenced by the expectations of the students they teach⁷.

Using the above parameters, I can say that in SOMAFCO we had mainly problem-solvers and informers or expositors. Before judging the teachers concerned, one has to bear in mind that, as in most South African schools, we have students who expect true and trustworthy information from a teacher, and nothing else. As Cusak and Sherwood found, this influences the behaviour of the teacher in the classroom. Students like teachers who "teach well". They even have a term to explain what a "good" teacher does to a subject: "Uyayidabula" which means "S/he tears it apart". Schoenfeld writes that most teachers always solve problems of students correctly and quickly, unaware that they are doing their students no good. He states:

In presenting a polished solution, we often obscure the processes that yielded it, thus giving the impression that things should be easy for people who student the subject matter. In consequence, the give-and-take of problem solving-the false starts, the recoveries from them, the interesting insights, and the ways we capitalize on them, and so on-are all hidden from students. (Schoenfeld, 1987, p. 200)

While recognising this, we have to be aware of the problems faced by most mathematics teachers, who are, in most cases, not mathematicians themselves (Freudenthal, 1973).

⁷ Macdonald, M.A. & Rogan, J.M., Innovation in South African Science Education (Part 1): Science Teaching Observed, in Science Education 72(2): 225-236 (1988).

CHANGES IN THE CLASSROOM

Funny enough, changes in mathematics classroom activities in SOMAFCO were initiated by students themselves. They were imported from extra-curricular activities; the maths club, the jets, and the computer centre activities. Students who were involved in these activities changed their methods in class. They also improved drastically, thereby forcing teachers to respect their views. Mathematics results at the end of the year (1990) were better than in all the previous years. For the first time, our school had a 60% pass in GCE exams. We had gone over the first hurdle. Mathematics was changing from being a "monster", it was fast becoming a "pet".

There is always an anxiety level on the part of the students, which Trown and Leith (1975) found to be a distinguishing factor between those who do or do not benefit from a learner-centred approach. The problem arises when this anxiety is shifted from the students to the teachers. Realising that there were probably conflicts in maths classes, I decided to write a few papers⁸ for discussion by teachers. The aim was to harness the feelings of the teachers, to try and bring in some understanding from the side of the teachers, and thereby avoid a deterioration of students' attitudes. This helped. In the maths department now we have more Expositors, Discoverers and Heurists. Teachers are not afraid to "make mistakes" in front of students. Even genuine

⁸ The first paper, Technology Integration in SOMAFCO (1990), was written to advertise the use of computers in mathematics and science classes. The second, Mathematics Teaching/Learning Strategies in SOMAFCO (1991), was written specifically to influence these changes.

mistakes are acceptable, to be corrected. My students knew me for "distortions"⁹. We also realised that, besides respecting methods and ideas students bring to class, these were very interesting areas of study.

Interestingly, discussions with students were in some way INSET courses for all of us, teachers. We found interesting parallels between our situation and that of Langa High School¹⁰ in Cape Town. Although their experience is based on activities outside the classroom, we found the same approach inside the classroom in SOMAFCO. The teacher stopped being the "Chairperson" of the "meeting". Each period had "revolving chairpersons", with students taking the lead one or more at a time. This is not to say the going was smooth in all classes. I wish to remind the reader that this situation was new to everybody, including the teachers. In such situations, the teacher gets "liberated", in the sense that s/he may make real mistakes and still feel useful, and not only fake mistakes¹¹.

WAY FORWARD

SOMAFCO is now being transformed into an adult training centre, for former guerrillas who are in dire need of education to help

⁹ I would ask them to read a chapter from a book, then I would come the following day and say things which contradicted what they had read, and I would expect them to "correct" me.

¹⁰ This is based on an article we were sent by Chris Breen, entitled: "Teaching at Langa High".

¹¹ Seymour Papert sees this occurring with the proper use of Logo and computers in the classroom, but I think, as our experience has shown, that this is something that can occur whenever the frame in the classroom is weak enough (see Bernstein, 1977).

build South Africa. Students from the secondary school are being transferred to South Africa.

— One would ask; what do we expect to happen to whatever we tried in SOMAFCO? I would answer such a question in the following manner:

The students of SOMAFCO have learnt quite a lot, with all the problems they had. The democratic practices and gains they made will be a beacon in their lives. It is to be expected therefore, that they will make attempts to influence the trend of events in South Africa, however small their numbers are. Former teachers of this school also expect that they will be asked to play a role, however limited, in shaping the path of development of a popular democratic educational policy in South Africa. That explains why most of the former teachers of SOMAFCO are now to be found in higher institutions of learning in many countries of Europe, even though they have first and senior degrees already. There are beliefs among them that with higher qualifications, they stand a better chance of getting satisfying jobs, where they can play a part in the exercise of some control of "the knowledges and the powers". (Diploma disease?)

We are not the only people with this experience. Others have visited SOMAFCO. Much has been written about the school, although many who wrote did not have the same approach as in this essay, or do not agree with some of the ideas put across here. I have hope that future decision-makers will draw on the wealth of experience that the former principals and teachers of this school

have acquired. It is encouraging to note that people like Makhunga Njobe, the ex-founding Principal of Solomon Mahlangu Freedom College is still involved in educational circles. We hope that this trend will continue.

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