EDUCATION IN NAMIBIA

A Collection of Essays

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EXAMINATIONS AND ASSESSMENT AT TERTIARY LEVEL: A CASE STUDY OF CONTINUOUS ASSESSMENT AND THE ROLE OF EXTERNAL EXAMINERS AT TWO UNIVERSITIES IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY (SADC) REGION

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A PAPER PRESENTED AT THE WORLD CONGRESS OF COMPARATIVE EDUCATION SOCIETIES, CAPE TOWN, JULY 12 - 17, 1998.

Abstract

This study is a case study of Continuous Assessment and External Examiners' reports in two universities in the Southern African Development Community (SADC). The paper defines the term Continuous Assessment. The first part of the presentation then examines the conduct of Continuous Assessment at the two universities under study. The concerns in Continuous Assessment addressed are: Number of Continuous Assessment test/assignments to be given per course; Absenteeism/ late/ non-submission of tests or assignments; Security of tests/assignments for continuous assessment; and Plagiarism. Advantages and disadvantages of Continuous Assessment schemes are briefly discussed. The second part of the paper examines the roles of External Examiners at the two Universities. The findings presented indicate that basically external examiners' roles revolve around five verbs. They do one or more of the following: expose; impose; suppose; endorse and propose. The paper concludes by affirming the power of examination. Examinations are here to stay.

BACKGROUND

There is no dispute over the fact that assessment of students' attainment is an integral part of any educational process, and that every teacher, at whatever level she/he teaches, is called upon to test her/his students. In order to function effectively, teachers require information concerning the level of attainment achieved by their students.

Methods of measuring student attainment vary from personal judgement made by teachers to tests which have national or international recognition. Thus, general course work, practical work, oral tests, project work, and examinations can all have their places in assessment of students' attainment.

There are many issues to talk about in the area of examinations and assessment at tertiary level. Life at tertiary level is governed and ruled by a King and Queen called examinations and assessments. That examinations rule university life is clearly documented in the Universities Daily Calendar of activities and handbooks year after year. For example, in the University of Namibia Calendar of activities for 1998 there are 86 examination related entries out of 361 entries. This constitutes approximately 24% of all the entries. This study is a case study of the conduct and roles of external examiners at two universities in the SADC region.

This paper addresses two issues which have been of concern to the authors while working at tertiary institutions. First, we would like to talk about Continuous Assessment; and second the system of External Examiners, a procedure at tertiary institutions in the SADC, a legacy in the Commonwealth Universities, which is used in an attempt to minimise conflict of interests and to maintain standards.

THE CONCEPT OF CONTINUOUS ASSESSMENT (CA)

Any paper on continuous assessment in Africa that does not refer to Mwalimu Julius Nyerere is incomplete. He was one of the pioneers in announcing the use of Continuous Assessment in Secondary schools as a component to contribute to the final mark for certification in Africa (Nyerere, 1967).

It is through participation in Continuous Assessment at Secondary school level in Tanzania in the early 1970s that one of us got to appreciate the philosophical and psychological perspective of the role of Continuous Assessment in an educational setting. In some cases assessment of

course work has been used synonymously to continuous assessment. The definition assigned to Continuous Assessment (CA), and adopted as an operational one in the rest of this section is:

> A continuous assessment scheme (CA), is one which involves a systematic collection of marks or grades by the teacher (or lecturer) over a period of time and the consolidation of the marks or grades into a final score taken into account in deciding the candidate's final grades. The most distinctive feature of Continuous Assessment, in general, is that it is a cumulative process, developing as the pupil develops and reflecting his/her changes in response to the course. (Njabili, 1985; 1987; 1988; 1989).

Several examination systems in the region, both at Senior Secondary and in particular at Institutions of higher learning use continuous assessment to evaluate learning outcomes. For example in the SADC Region the following countries use CA as a component for certification: Botswana at JCE in Arts, Design and Technology, Agriculture, and Home Economics; Namibia at IGCSE and H/IGCSE as compulsory work in some examinable subjects such as Development Studies, Design and Technology; Tanzania in all examinable subjects at O-levels and A-levels; in West Africa as part of requirement in all subjects for the West African School Certificate Examination and in England as part fulfilment in all GCSE subjects.

That continuous assessment has been widely used in educational practice other than the cases listed above is unquestionable. The use of CA for certification has been reported by Awomolo (1992), Ojerinde (1985), Njabili (1985), Rossiter (1986), and Broadfoot (1985). The use of CA as one of the tools for the evaluation of achievement of curriculum goals and student competencies has been reported in a number of studies, (Simmons, 1993; Thorogood, 1992; Hitt, 1987; McGreevy, 1986; Bryce & Robertson, 1985; Ganiel & Hofstein, 1982; and Beckner, 1987).

Furthermore, all universities in the SADC region have a CA component attached to all course evaluation. However, if CA or any other mode of assessment is to complement and /or replace formal examination, it has to constitute a unique mode of assessment.

CONTINUOUS ASSESSMENT AT TERTIARY LEVEL

Prior to the 1970s many Universities in the region and the University of East Africa in particular had no formal system of conducting Continuous Assessment in the manner that it happens today in the many Universities in the SADC region. In fact, Continuous Assessment is a new innovation in education that has won wide acceptance in all universities in the SADC region and beyond. To date, in almost all the Universities in the world, including those in the countries of the

Eastern and Southern Africa, there is an element of continuous assessment, which constitutes a percentage component of the final assessment for certification. In some of these institutions, the number of assignments and tests are clearly documented in university regulations while in others this is left to the discretion of the lecturer. Further, in some of these institutions there are a number of courses, particularly at the Masters Degree level, which are wholly assessed by means of continuous assessment.

The main purpose of having a continuous assessment scheme as an integral component of assessment procedures is to eliminate and or to minimise the element of risk associated with a single examination, and to give a valid indication of student achievement (Njabili, 1987). Nyerere (1967) called this single dose examination, normally done only at the end of a year or course 'ambush' examinations. CA can therefore, be said to be one way of avoiding such ambushes and often it rewards the consistently hard working student.

Continuous assessment is a unique mode of assessment (Njabili, 1985; 1988), just like there is a theoretical mode of performance and a practical mode of performance (Head, 1996; Kelly and Lister, 1969; Tamir, 1972; Hoste, 1982). If Continuous Assessment is not abused, it can give a true reflection of what students have achieved and are capable of doing.

The use of continuous assessment should be taken as an attempt to recognise that validity and reliability of judgement about complex performance by and large should depend upon many pieces of information gained over several different performances. Therefore, proper conduction and management of a continuous assessment scheme is time and labour intensive. If Continuous Assessment is not properly handled the whole exercise can reduce teaching to testing.

Issues of concern in Continuous Assessment

Doing a good job in continuous assessment demands skills that many teachers and other educators lack. Good continuous assessment requires work that sometimes makes teaching uncomfortable. Constructing and marking tests, assignments and examinations is an art. Some find it difficult to start with, but as one sets and marks more and more tests and assignments, experience including 'tactics' to combat the heavy demands that CA exerts on both students and lectures are gained. Indeed, this is one of those cases in which the saying, practice makes perfect holds true.

There are, however, several issues of concern with regard to continuous assessment, which we

think should be given thought to, to justify the use of continuous assessment as a component of the final grade for certification. The most burning issues, according to our experience, which can impinge on the quality of Continuous Assessment marks are:

- Number of CA tests / assignments to be given per course;
- Absenteeism/late/non-submission of tests or assignments;
- Security of tests / assignments for continuous assessment; and
- Plagiarism

Number of CA tests / assignments per course

The number of tests and assignments to be given depends by and large on the length of the course. We observed that in the two Universities studied, the length of the individual courses varied from faculty to faculty, and even within departments in the same faculty. In one of the Universities there were three types of courses namely: trimester courses running for 10-12 weeks; semester courses running for approximately 16 weeks; and year long courses running for approximately 30 - 32 weeks. In the trimesters cases there could be the possibility of rushing through to abide with institutional and or departmental regulations governing the use of continuous assessment.

The concern that we have with regard to the number of CA tests and assignments to be given is with respect to the management of large classes particularly in courses which run for a trimester or semester. We have observed that in large classes, more than often, only one test and or assignment is given. One assignment or test clearly defeats the motivational, guidance and counselling purposes of continuous assessment. Students' interests are basically governed by the need to obtain pass marks because the destination and interest is to pass the course(s) and to be certified, as will be reflected in later sections of this paper. If there are no stipulated minimum numbers of tests and /or assignments to be given to students depending on the length of the course, a continuous assessment scheme can be misused and abused.

Absenteeism from tests / Late or Non-submission of assignments

Practical administration of a CA scheme at tertiary level has not always been as smooth as it may theoretically sound. Absenteeism, and late and/or non-submission of CA work have been potential factors that have consistently undermined the validity and reliability of CA scores. Absenteeism, for legitimate or other reasons, impose an unnecessary burden on the lecturers because construction of a good test is time consuming, particularly if appropriate objective type test items, aimed at assessing higher levels of thinking are used. Absenteeism also introduces

testing irregularities, which may render results unreliable because there is always a problem of constructing an alternative test, which is equivalent to the original test.

In the ideal situation the use of alternative tests / assignments for continuous assessment should be kept to a minimum or completely avoided. However, in the real situation, it is difficult to completely control for absenteeism from tests and or late or non-submission of assignments because all sorts of excuses are presented. We have known cases where fake death certificates and fake doctors `excuse duty' certificates have been presented as evidence for absence from tests / late submission of assignments. Some of these certificates have been presented many days after the test and or due date for assignments. The most classic example that we have come across is a case where the assignment, which was due in April was handed to one of the authors in October, six months after the due date! Likewise there are cases of similar nature, which often land in the hands of the Dean of students and or student counsellors. Genuine cases never go that far, for they are always dealt with by the lecturers in the most humane way. If such practices are not carefully handled, again the purpose of having a continuous assessment scheme to reward consistently hard working and deserving students shall be defeated.

Security of tests / assignments for CA

Universities try their level best to prevent malpractice in tests and examinations to the extent that the strongest rooms, other than the safes where money stays, are the rooms where examinations are kept. Entering such strong rooms is often not easy. Do you remember the nursery rhyme about Noah's Ark, which basically say that the animals entered Noah's Ark two by two? At most Universities those entrusted with examinations sometimes end up abusing that trust to the extent that, in some institutions, to get something from these strong examination rooms during examination periods, entrance has to be in twos the way the animals entered Noah's Ark.

At the two Universities studied we observed that it is not unusual to find continuous assessment tests and assignments recycled or re-used by lecturers in assessing the same course year in and year after. Such a practice is risky and could be a source of lack of reliability in student scores because it is possible for students to gain access to the tests and even already marked works submitted for Continuous Assessment in previous years.

Furthermore, saving time and labour has become a paramount feature in test construction. Thus the use of item types such as true-false, matching, and multiple choice has become the order of the day. Such tests are 're-cycled'. Test items intended for re-cycling normally belong to an

item-bank of individual lecturers.

We recall a true incidence when one lecturer had a heated debate with his students over the return of a continuous assessment test. The lecturer had used multiple-choice items in one section of the test paper and had retained that section telling the students that the items he had used belonged to his item bank. The students wrote a letter of appeal to the Dean of the Faculty of Education at that University, demanding for the return of their answer scripts. The major paragraph of that appeal read as follows: "We have been at this university for 5 years to-date. We have never seen this `item bank' on campus. Neither have we ever heard of it before in this country. We are requesting your kind office to tell him to return our multiple choice scripts immediately. "Justice delayed is justice denied". It is therefore strongly recommended that continuous assessment test materials and assignments should not be re-used in their original form at any given time from one year to the next to avoid instances of this nature.

Question banking has sometimes been used as a tool to ensure uniformity in standards. Unfortunately, however, such banks can be misused particularly where teaching and learning is examination oriented. Teachers have used questions from such banks to drill students to the extent of dictating sample answers to those questions. In such cases, teaching is reduced to testing. The worst we have seen of re-cycling of continuous assessment items is the exact repeat of such items in the final examinations. Maybe the major reason that we can use to explain the repetition of CA items in the final examination is the fact that, in both Universities studied, external examiners are often only presented with final examination scripts and not CA scripts.

Plagiarism

In this presentation plagiarism is used to mean taking and using another person's writings as one's own without due acknowledgement. Our observation from the two Universities show that plagiarism in connection with continuous assessment takes three forms:

- Copying from text(s) without acknowledging authorship;
- Copying from other students; and
- Copying from re-cycled tests and assignments, when a lecturer gives the same continuous assessment work year after year.

In our view this is one of the weakest areas to control since paraphrasing sometimes camouflages the degree of plagiarism.

Advantages and Disadvantages of Continuous Assessment Schemes

The positive effects of CA have been reported in several studies. For example by Carswell (1987), Lawless (1982), Clennell (1984), Ganiel and Hofstein (1982), Johnstone (1981), Cockburn and Ross (1980); while negative effects have been reported by Tan (1992), Johnstone (1981), Rossiter (1986), Cockburn and Ross (1980), Lonsdale and Williamson (1980) to name but a few.

These effects of continuous assessment can be summarized under three separate categories: effects on students, effects on teachers or lecturers, and effects on the curriculum.

Through continuous assessment, students become informed of their continuous progress throughout the course. This seems to suggest that students who are assessed continuously should obtain better results than those of equal ability, who are assessed only at the end of the course through a single examination (Hoste and Bloomfield, 1975).

Further more, in case of ill health at the time of Final Examination (FE), Continuous Assessment contributes in reducing the ambush effect students experience when fate is based only on one criterion - the Final Examination (Njabili, 1987; 1988). However, continuous assessment may lead to disjointed comprehension, teaching and learning if topics already assessed are not to appear in later assessments.

The potential use of continuous assessment for curriculum evaluation can best be summarised by the words of Eggleston and Kerr (1969), who, when talking of continuous assessment in Nuffield Sciences, pointed out that the refinement of assessment procedures might play a wider role in curriculum development than merely as a means of measuring a pupil's attainment at the end of a course, provided the assessments arise directly from an adequate specification of the educational objectives.

The most obvious disadvantage is increased workload on both teachers or lecturers and particularly students. On the part of the teachers/lecturers, continuous assessment demands extra careful preparation of tests, organising, supervising, marking and recording of results (Chalmers and Stark, 1968).

Below is an analysis of the workload for two semesters at one of the Universities studied for a lecturer teaching 3 half-courses each semester; and a student taking on the average 7

half-courses for one semester as is typical for the Post Graduate Diploma in Education (PGDE) programme.

Table 1: Lecturer's CA Load

Semester	Courses Per Semester	Tests/ Assignments Per Course	Total
I	3	3	9
II	3	3	9
TOTAL	**6**		***18**

*Tests/Assignments constructed and marked = 18.

Table 2: Student's CA Load

Semester	Courses Per Semester	Tests/ Assignments Per Course	Total
I	7	3	21
II	7	3	21
TOTAL	**14**		***42**

*Tests/Assignments written = 42.

Young (1970) commenting on the increased workload noted that:

> The student is under continuous tension, never quite free from worry until the course is completed though ideally, he keeps up with his work schedule and progresses steadily. Furthermore when a teacher (or lecturer), has to prepare several examinations during a year, he may tend to get a bit hurried and write poorly phrased questions which not even he could answer satisfactorily (Young, 1970).

Regardless of the difficulties, many teachers or lecturers regard continuous assessment as being extremely valuable educationally, in that it enables due weight to be attached to some aspects of the course which cannot be assessed by written examinations (Cohen and Deale, 1977). Also it is to be expected that the validity of an examination will be enhanced if there is an element of teacher assessment in the aggregated results (Sands and Forest, 1981). In support of the CA scheme, some students at one of the Universities studied have nicknamed continuous assessment the necessary evil.

To conclude this section one can comfortably say continuous assessment can be an alternative to the traditional forms of assessment which currently is gaining wide recognition at almost all levels of education. But before opting for CA for certification one should be aware of the concerns raised above.

THE ROLE OF EXTERNAL EXAMINERS AT TERTIARY INSTITUTIONS

In British institutions, and in higher institutions in the former British colonies there exists a system of external examiners. The concept of external examiners is a legacy of colonialism that still remains to be uprooted in post-British colonies. External examiners are like legal guardians. They are said to be a tool for maintaining standards. Attempts to minimise or abolish external examination tend to provoke academic debate and outcry under the cover, 'there is need to maintain standards'. Whose standards? Do institutional assessments tell much about standards? Gipps (1988) has written that: "Standards in education are hard to define, partisan in the setting, and have a complex relationship to testing" (Gipps, 1988).

Following on directly we would like to state that standards are created and not inherited. Once created they can be improved, remain the same or deteriorate. Therefore, the need to have External Examiners, how often, and what should be their role, should be carefully considered by any tertiary institution.

Whose interest do External Examiners mostly serve? Who do External Examiners represent, - the subject disciplines, the lecturers, the institutions offering these disciplines, parents, future employers, society at large, or the students? Are External Examiners neutral referees while on the playground?

In order to come up with some points to help make the inference(s), Njabili (1993) analyzed 284 External Examiners' reports presented to University A. In a repeat of the study using 196 External Examiners' reports presented to University B we basically confirmed the 1993 findings.

The basic findings were that the reports greatly varied in content, length and depth, and general quality. Furthermore, in the course of analysis of the reports it was, according to our interpretation, reflected that external examiners basically do five things. They Expose, Impose, Suppose, Endorse, and Propose. Further observations made from the analyses of the reports showed that External Examiners definitely play one or more of the above five roles each time they are at play. Below follows an elaboration of each of the five roles:

Expose

In this study `to expose' means to leave unprotected or leave to perish.
Four types of exposures were detected in the external examiners' reports:

a). To expose gaps in the curriculum.

In this area external examiners complained of:

- lack of course outlines during question moderation and script moderation;
- where course outlines were available they complained of lack of reading lists, other than prescribed textbooks;
- lack of practical examples in CA exercise and examinations; and
- inclusion of out-of-date materials in the course content using comments like, `...the topic appears in fields no longer of current importance'. The reason for including somewhat esoteric themes in this course is not clear'. Our limited vocabulary forced us to seek help from the dictionary for the meaning of `esoteric'. We found that the word means: 'restricted to and intended for an enlightened and initiated minority; difficult to understand; abstruse; not openly admitted; private' (The Collins Dictionary and Thesaurus in one volume, 1987). Unfortunately this report did not specify the specific themes, which were considered to be 'esoteric'.
- Some topics were not for students who are in their first year study'.

b). To expose teaching deficiencies.

Teaching deficiencies that the external examiners exposed included aspects like:

- quality of setting questions. A typical statement was: 'I was concerned about the degree of difficulty of these papers, which, in my opinion, was very low: there were numerous low cognitive-based questions, e.g.: identify, explain, describe etc., there were also multiple choice questions which I thought really lowered the standard of fourth year level';
- loosing candidate's scripts and or misplacing scripts;
- quality of marking;
- quality of continuous assessment assignments;
- format of questions and question papers;
- generous choice offered to candidates. For example where candidates were given 6 or 8 questions and asked to answer 3 or 4 of the questions. This was pointed out to be common in a number of courses, leading to some questions not being chosen;

- lack of marking guides/marking schemes; and
- heavy reliance on recall based items.

c). To expose student weaknesses.

In our analysis we found that almost all of the external examiners complained about:

- lack of language mastery in grammar, spelling, expressions, etc;
- lack of mastery of subject content;
- poor organization of work (particularly projects, etc);
- general quality of student responses;
- lack of indication of reference materials;
- heavy dependence on lecture notes;
- students failure to apply theory into practice; and
- others, for example here is one unique comment that we came across:

'Apart from handing in an answer book with torn pages, what he scribbled in those pages raises questions about his well being physically and mentally at the time of the examinations. Or could it be that he had just started learning using the English language?' (External Examiner).

Student weaknesses can be a reflection of the curriculum, teaching, learning and even the examinations themselves. When external examiners expose students' weaknesses, who is being left to perish, the teacher, the student, the curriculum, or the examinations?

d). To expose institutional weaknesses

These included:

- time management;
- observation of general procedures;
- lack of clarity of regulations in some programmes;
- lack of clarity in assessment procedures and general grading procedures;
- level of clear communication of regulations to students;
- examination postage procedures; and
- others: `I was not met at the airport, the remuneration is inadequate' etc.

Impose

To impose in this context is specifically used to mean to purposely 'exert influence'. We observed

that External Examiners have shared their personal experiences with colleagues at both Universities during Departmental Board meetings and by giving summaries of their observations and/or seminars. They have done so by:

- narrating examples of practices as they occur elsewhere, e.g. exam item formats, marking procedures, spread of marks, etc;
- narrating administrative procedures including making demands on how they should be treated and paid;
- expressing what they like and dislike using statements like, `I am not in favour of multiple choice items';
- pointing out alternative teaching approaches; sometimes most of the suggested approaches are based on theoretical concepts which have never worked anywhere before except maybe in their own institutions; and
- pointing out possible alternatives for textbooks.

Often the alternative teaching procedures and textbooks are mostly those that these external examiners use and have come across in the course of their own learning or teaching and are familiar with. Often they have not heard of some of the textbooks being used by others.

Who should be blamed for lack of new textbook editions in libraries? After all, for one reason or another, particularly economic reasons, especially in the SADC region, some of the libraries have not seen new orders for some time. If there have been new orders, these books / journals, etc have disappeared from the shelves as fast and as soon as they were shelved. They never come back.

In so doing external examiners have managed, directly or indirectly, to perpetuate their cherished ideas, concepts, and principles. This is reflected in some of the reports through the use of words like: "I strongly urge marks to be distributed in the normal curve"; "Each paper should show the following words 'END Of PAPER' at the end of the examination paper".

One of us recalls an incident that happened in one of these institutions of higher learning where one of the authors worked. There was a heated debate between one of the external examiners and the internal examiner. The internal examiner had marked the scripts and there was no single red mark in the script except for the marks allocated to each question and part question. The external examiner demanded that the internal marker should have made extensive comments in the scripts for 'feedback'. The internal marker argued that there was no need to make comments as the examination was not for feedback. Furthermore he argued that the students were not in any case going to see the comments.

In many institutions of higher learning students are not officially allowed to see their examination scripts after they have been marked. In fact in some institutions they are immediately burnt. Most universities in the SADC region keep them for at least two to four years. As the number of students grows, bigger rooms will have to be built to accommodate the large number of scripts particularly with the introduction of modular examinations in one of the studied Universities and the leniency to allow for supplementary examinations, ad hoc special examinations, including a constant demand for re-marking of scripts.

Wiggins (1993), while talking about authenticity of assessment systems which ought to be based on 'known, clear, public, non-arbitrary standards and criteria' condemn the tradition of confidentiality that is accorded to marked examination scripts by saying: "This unfortunate and deadly tradition is a legacy of tests used as mere gatekeepers or as punishment/reward system and not as empowering and educative experiences designed for displaying all that a student knows" (Wiggins,1993:51).

Suppose

In this study "to suppose" means to assume for the purpose of argument. Do external examiners assume that what is in the `course outline' was covered?
If yes, what does poor performance in the examination mean? Does it mean:

- poor performance in the examination is the students' fault?
- poor performance in the examinations is a reflection of teacher ineffectiveness?
- does poor performance reflect inherent difficulties in particular content areas? OR
- In the case of a question not being chosen by any candidate, does this reflect topic not covered? If not covered, could this mean poor performance in the examination could be the fault of the teacher?

By assuming certain conditions were fulfilled, External Examiners have advised on choice index, student performance and teacher effectiveness.

Endorse

In this study `to endorse' means to confirm statements, opinions; approve documents, ideas, etc.

From the reports, we observed three types of endorsement are evident:

a). Endorsement without reference to originator of statement, opinion, idea or document. This happens when what is being endorsed is in agreement with the external examiner's views. For example, most of the reports studied agreed with:

- the format and contents of course outlines;
- marking scheme;
- marks awarded;
- recommended textbooks, reading lists, assignments,
- good teaching using comments like: `I think your students received thorough teaching'.

b). Endorsement due to request from an individual lecturer whose suggestions/ opinions/ ideas/ procedures, etc., have not wholly been accepted by colleagues, BUT would like, after conferring with the external examiner to be documented favourably and the external examiners' report to be a source to further justify the approval of the argument, for example the wish to introduce new programmes and/or individual courses.

c). Endorsement of Departmental views and wishes due to requests from the department as a whole, if the external examiner is in agreement with the proposed concept. For example, the wish to split a big department into two or more departments;
the wish to start new courses and programmes, also mentioned above.

Propose

`To propose' is at the heart of it all, while external examiners expose, impose, suppose and endorse they seem to all the time be **proposing** alternatives for consideration. The question is should the whole essence of external examining be to endorse and or to propose? That is:

- to endorse good practice which needs to be continued; and
- to propose alternatives in the process of exposing, imposing, supposing and opposing.
- used to mean to put forward proposals/ alternatives?

Table 3 attempts to summarize the roles of external examiners as observed from the 480 reports that were analysed.

Table 3: Roles of External Examiners as Observed from Reports Submitted to Two Independent Universities

Labelled Role of External Examiner	University A	University B	Total Cases reported
Expose	284	196	480
Impose	124	94	218
Suppose	280	195	475
Endorse	211	163	374
Propose	260	187	447

We would like to conclude this section by pointing out that through external examination there is indeed an element of sharing ideas on standards. Nonetheless, there is need to clearly spell out:

1. The roles of External Examiners that our institutions should endorse
2. To clearly delineate guidelines for external examiners. For example:
    - What should be sent to external examiners during questions and paper moderation?
    - What should be presented to external examiners during actual script moderation?
    - How often should external examining be carried out at tertiary institution?
    - What should be the content of external examiners' reports, including length?

THE POWERS OF ASSESSMENT AND EXAMINATIONS

The power that examinations have had over curriculum in many parts of the world is enormous. Rowntree observed that: "Examinations are `used as weapons in a struggle for dominance between groups with conflicting interests', that is, the discipline or profession, parents, employer (society) over another group, the students" (Rowntree, 1977: 3). Studies by Little (1987) have clearly documented the power that examinations have in the teaching learning process in India and Sri Lanka. She notes that in India: "The dominance of the examinations has relegated every other function of the educational institution into the background" (Little, 1987: 76). Further more, Heyneman states:

> In those countries where test items are made public, in Japan and the UK for example, the effect is to generate `examination students', that is, students who spend a great deal of time studying portions of the subject likely to be examined and methods of response likely to elicit a good score (Heyneman, 1988: 204).

In support of Heyneman's observation Njabili states that:

> It is not only in Japan and the UK that examination students are to be found. In most Universities in the SADC region, such students are plenty. They spend a lot of their time, particularly near examination time, knocking from one office door to the other, requesting and sometimes demanding for the so called scope of the examination they are to sit for in different subjects (Njabili, 1998).

High dependence on examinations for certification will continue for many years to come. Dole (1974) put it this way:

> In the absence of other bases of evaluation, employers have largely depended upon the certification function of examinations for selecting individuals for the occupational hierarchy. It is believed that the certificate is the proxy measure for various other attributes that the individual possesses for job success.

Likewise the dependence on possession of certificates for employment is very prominent in most SADC countries. Njabili (1998), in a simple study of jobs advertised in The Namibian issue of Friday 13th April 1998, from 36 public and private institutions appear to support the importance of examinations for certification (Table 4). The advertised jobs varied from Mining Foreman to General Manager.

Table 4: Job Qualification Analysis of 70 Vacancies Advertised in The Namibian of Friday 13th April 1998.

Minimum Qualification or Certificate	Number of Vacancies
Grade 10	6
Grade 12 + some formal training	28
Diplomas or equivalent	10
Bachelors Degree or Equivalent	18
Masters Degree	4
PhD	1
Not Specified	3
Total	**70**

Therefore, examinations and certification are what schooling is about, and their absence would not be tolerated. Conrad goes on to state:

> Examinations define the nature of schooling, not solely in the technical sense as we

logically expect, but in a social sense that is even more persuasive and influential than a technical adjustment. All aspects of the system remain robust and resistant to long-term reform, and the examinations lie at the heart of this robustness (Conrad, 1997: v).

In conclusion, it must therefore be acknowledged that national education systems will always need to monitor levels of performance for the purposes of planning and accountability. One tool that will definitely continue to be useful in this sphere is the public examination. This is due to the fact that the results from such examinations are usually more transparent than the institutions in which they are done.

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EDUCATION IN AFRICA: POST COLONIALISM AND GLOBALISATION IN SCIENCE AND MATHEMATICS EDUCATION: THE CASE OF NAMIBIA AND ZAMBIA

C. D. KASANDA

Abstract

The paper briefly introduces the reader to the Education systems of Namibia and Zambia before independence and the globalization in science and mathematics education.

This is followed by an analysis of mathematics and science education in Namibia and Zambia. Both the colonial era and post independence situations are analysed. That science and mathematics education was given little priority during the colonial era is clearly pointed out. Efforts towards improving the situation after independence are then delineated.

Problems hindering a more effective development of the teaching of mathematics and science education are discussed. These include among others lack of adequate qualified teachers, lack of laboratory space and laboratory equipment, lack of textbooks and other teaching materials, teacher centred teaching methods and inadequate funding of the education enterprise.

Towards the end, the paper further discusses through examples, practical approaches which have been taken by Namibia and Zambia to improve the teaching and learning of science and mathematics in schools. The role of in-service training is underscored.

A PAPER PRESENTED AT THE SOUTHERN AFRICA COMPARATIVE AND HISTORY OF EDUCATION SOCIETY (SACHES) CONFERENCE, SETTLERS INN, GRAHAMSTOWN, 25 – 27 OCTOBER 1995

INTRODUCTION

Both Namibia and Zambia have been under colonial rule at one time or another in their history. Zambia has enjoyed independence for 31 years while Namibia has been independent for only five years.

Nonetheless, for both countries the education system was segregated by the colonialists. In the case of Zambia, the system was mainly segregated on racial lines, in that the education system was run by two different authorities. The white students were catered for by the European Education Authority, while the Native Education Authorities took care of the non white education.

The same set up operated in Namibia. Except in this case, the education system was not only based upon racial lines but, on ethnicity as well. Each Tribal Administration ran its own education system. Accordingly, there were about 11 Educational Administrations in all, catering for the educational needs of a different ethnic group, and a total population of less than 1.5 million people.

In both countries the education under the white administration was much more superior to that of the indigenous people. The school structures were often of superior quality; the teachers highly qualified and had more teaching and learning materials than was needed, often for a very small number of learners. The contrary was true for the other Administrations even though they catered for a larger segment of the population. In both countries less emphasis was placed upon mathematics and science education.

Science and mathematics education play an important role in the social and economic development of any given country (Angula, 1989). It has been observed that many highly developed and technologically advanced countries spend more money on science, mathematics and other related subjects. Without such infusion of funding from both public coffers and private individuals little could have been achieved in terms of real social and economic development.

The scarcity of science teachers the world over has been documented by Turner (1990) among others. Indeed, even those countries with strong science and mathematics education systems complain about the dwindling numbers of teachers of these subjects in their classrooms. Consequently, countries are being forced to put in place ways and means that could keep these teachers in the classroom.

In this paper the current practices in the preparation of teachers for science and mathematics and the teaching of these subjects in the two countries will be addressed. In addition, emphasis will be placed on the plans for the improvement of the teaching of these subjects in the two countries.

GLOBALISATION IN SCIENCE AND MATHEMATICS EDUCATION

Science and mathematics education play an important role in the social and economic development of any given country (Angula, 1989). Mshigeni et al (1993) observed that developed countries spend more money on science and its related subjects including mathematics and technology than developing countries. Without such infusion of funds little could have been achieved in terms of real development.

The scarcity of science and mathematics teachers the world over has been documented (Turner, 1990; Mshigeni etal, 1993; Omari, 1991). Omari (1991) cites Canada, the USA, the UK, and Sweden as some of these developed countries, which lack teachers in the sciences and mathematics. Indeed, even those countries with strong science and mathematics systems complain about the dwindling numbers of teachers of these subjects in their classrooms. Consequently, countries are being forced to put in place ways and means that could keep these teachers in the classroom. Science and mathematics teachers are often in high demand in industry and since schools cannot compete on an equal basis as far as remuneration is concerned, teachers are leaving the classroom in large numbers for the private sector (Mshigeni et al, 1993).

Lack of laboratory equipment, chemicals and textbooks are other causes of ineffective and theoretical treatment of science and mathematics subjects in developing countries. This contributes to teacher frustration leading to the mass exodus of teachers from the teaching profession (Kasanda and Nkosi, 1994). Mshigeni at al (1993) describe the lack of equipment, facilities, textbooks etc., as a major hindrance affecting teaching of these subjects in SADC countries. Kitchen (1995) identifies almost the same factors as affecting the delivery of effective introduction in a Guatemalan school.

The quest and concern for effective teaching of science worldwide is probably better reflected by the Maryland State Department of Education (1991). They have initiated the Building Effective Teaching through Educational Research (BETTER) project in science. They have summarized current research findings in non-technical, and non-threatening language, thereby enabling classroom practitioners to make use of it. This shows that better instruction in science and

science related subjects is not the concern of developing countries only, but by all countries in order to achieve economic and technological advancement.

MATHEMATICS AND SCIENCE EDUCATION: THE CASE OF NAMIBIA AND ZAMBIA

Namibia and Zambia have both been under colonial rule just like most countries in Africa. Zambia became independent from the British rule in 1964, while Namibia attained hers in 1990 from South Africa. Both countries have experienced separate development in one form or another. Since separate development was part and parcel of the colonial rule, every aspect of life was affected, including education.

EDUCATION DURING THE COLONIAL ERA

Prior to independence in March 1990, Namibia was regarded as part of South Africa. Since apartheid was a way of life in South Africa, it was also regarded as such in Namibia or South West Africa as it was known.

Separate development entailed peoples of different races living separately from each other and having their own facilities etc. Accordingly on the eve of independence Namibia inherited an education system that was segregated on both racial and ethnic basis. Indeed, there were eleven educational authorities in the country. Such a fragmented education system did not cater in reality to the educational needs of the majority of the Namibian people nor for an independent Namibia (Angula, 1993). It was also wasteful in terms of human and material resources. It failed in educating the majority of black Namibians to such an extent that 50% to 65% of the black Namibian adults were illiterate (WUS, undated; Mshigeni et al, 1993).

Zambia also inherited an education system that was segregated on racial basis. There were two main education systems in existence. These were the European and Native educational authorities.

The European education authority catered for the non - black student educational needs in the country. Inevitably, since the whites were in power the European schools had better facilities and infrastructure and well qualified human resources. This was not the same with the schools under the native educational authorities.

It should be noted here that in both countries the white or European education authorities catered for fewer students than the other authorities. As such it provided better quality education, which encouraged the study of mathematics, science and other science related subjects.

SCIENCE AND MATHEMATICS EDUCATION DURING THE COLONIAL PERIOD

A number of writers have described the state of mathematics and science education in Namibia prior to independence (Clegg, 1989; Hoey, 1989; Turner 1990; 1991). They describe the teaching and learning of science and mathematics subjects as boring and uninspiring. Rote learning was the norm rather than the exception for both learners and teachers. Cunnington (1989) observed that the training of teachers in existence in Namibia did not engender creativity in the student teachers, rather reinforced the chalk and talk strategy.

The majority of schools in northern Namibia (comprising more than half the population) did not offer all science or mathematics subjects to students. Clegg (1989) noted that the lack of emphasis on science and mathematics subjects during this period was due to the implicit assumption by the colonial authorities that these subjects were inherently difficult for blacks. The high failure rates among the few blacks taking these subjects appeared to confirm this, even though several factors contributed greatly to this state of affairs in the majority of these black schools. Nevertheless, this view would be said to have been the colonialists' way of keeping blacks in an inferior position and as easily available unskilled labour (WUS, Undated).

Further, these subjects were simply not on offer in black schools even though they were in theory (Clegg, 1989). The lack of adequately prepared indigenous science and mathematics teachers and poorly equipped laboratories made it even more difficult for black Namibians to study mathematics and science to any higher levels. Kasanda (1995) notes that this mixture of passive and active discouragement of blacks to take mathematics and science subjects up to matriculation level contributed to the unpopularity of science and mathematics education in the country.

The Zambian situation was not different from that described above for Namibia. The Native schools had poor infrastructure, lacked proper laboratories and other teaching and learning requisites. The colonialists were not thinking of preparing black Zambian scientists or mathematicians. They were, as was the case for their Namibian counterparts, being prepared to become effective junior clerks and messengers. The idea was to have an indigenous Zambian who would serve the interests of the white settler without questioning.

Accordingly fewer black Zambians studied science and mathematics subjects than their white counterparts. The lack of facilities, laboratory equipment, chemicals, etc., further contributed to the view of these subjects as for the intelligent student, who often happened to be a white one.

EDUCATION PRACTICE AFTER INDEPENDENCE

Education systems in the two countries

At present both Namibia and Zambia are following a seven, three and two education model. That is in both countries the primary level lasts for seven years (grades 1-7). This is followed by a three-year junior secondary education (grades 8-10) and then a two-year senior secondary education (grades 11-12), after which an individual may secure university admission.

In Namibia basic education consists of 10 years of schooling, and the government has the responsibility of providing education to all its citizens up to this level (MEC, 1993). Senior secondary education is not regarded as a priority.

There is no leaving examination at the end of grade 7 for admission to grade 8. A junior school leaving examination though is administered at the end of grade 10, with the successful candidates continuing their studies through grades 11 and 12. At the beginning of senior secondary school, candidates select and follow subjects leading to the International General Certificate of Secondary Education (IGCSE) or the Higher International General Certificate of Secondary Education (HIGCSE). The IGCSE and HIGCSE have replaced the Cape Matriculation Board Examination at grade 12, because it was viewed as elitist in nature and of little relevance to the needs of the newly independent Namibia (Angula, 1993; West, 1995). Candidates attain entry to the University of Namibia (UNAM) on the basis of their performance in these examinations.

The study of science and mathematics subjects is compulsory up to grade 10 in Namibia. After grade 10 students are allowed to make selections of fields of study, which may not necessarily include a science or a mathematics subject.

The Zambian situation differs slightly from the Namibian one. All candidates sit for a selection national examination at the end of grade 7. Only those candidates who have done well proceed to grade 8 due to the limited places in grade 8.

The UNESCO Addis Ababa conference on education recommended among other things,

the Universal Primary Education (UPE) and a progression rate for those completing primary education (i.e., from grade 7 to 8) of 30 per cent (Mwanakatwe, 1968). Even though Zambia faced economic difficulties, effort has been made to provide primary education to the majority of the Zambian children and has managed to maintain progression rates of 20.1% (1979/80), 22.4% (1982/83) and 24.5% (1987/1988) (Mshigeni et al, 1993).

In Zambia, students are expected to continue studying mathematics and science subjects through grade 10. After grade 10 they may choose not to offer these subjects. Nonetheless, those candidates who opt not to study science and mathematics subjects at the senior secondary level, just as their Namibian counterparts select themselves out of science related career fields. This is due to the fact that passes at the senior secondary in science and mathematics subjects are pre-requisites to the further study of science and mathematics subjects at the University. Without passes in these subjects a student will often not be admitted to Science Faculties even though he/she obtained higher grades in their "O" level or (H)IGCSE examinations.

The two-year senior secondary education culminates in sitting for the General Certificate of Education (GCE) ordinary level. This enables candidates who have passed the "O" levels with relatively high grades to attain admission to the University of Zambia.

SCIENCE AND MATHEMATICS EDUCATION AFTER INDEPENDENCE.

Both countries appear to have assigned the study of science and mathematics education high priority on the education agenda. Indeed, this has resulted in the establishment of Ministries of Higher Education; The Ministry of Higher Education, Vocational Training, Science and Technology (MHEVTST) and the Ministry of Higher Education Science and Technology (MHEST) for Namibia and Zambia respectively . These have been attempts to popularise the study of these subjects to those nationals who were denied the chance to try their hand at these subjects. In Namibia, the establishment of the President's Endowment Fund Bursary Scheme for the study of science and technology at the tertiary level for deserving candidates is a further testimony of the importance the country attaches to the study of science and mathematics subjects.

While in the past candidates were not encouraged to study science and mathematics subjects at secondary level, the situation has changed in both countries. The study of mathematics and science subjects from primary to the end of junior secondary education has become compulsory, and a reality for most indigenous peoples of the two countries.

As a consequence of this deliberate policy of encouraging the study of science and mathematics subjects in secondary schools, the number of candidates offering science subjects has increased. For example, while only 1188 and 726 candidates offered mathematics and physical science at grade 10 in Namibia in 1988, these figures increased to 23 983 in 1993 in both subjects. The same trend is also observable in the Zambian case for grade 10 students (all junior secondary school students are required to offer science subjects and mathematics). In 1984 the figure was 31406 and this increased to 56000 in 1988. These increases are a reflection of the two countries dedication to the study of science and mathematics.

But, the amount of money and effort being spent on the study of science and mathematics education in the two countries notwithstanding, the effectiveness of science and mathematics education in these countries continues to be adversely affected by a number of factors. These will be dealt with later. Nonetheless, suffice it to indicate here that the unprecedented large numbers of students offering science and mathematics subjects at secondary level has also contributed to the unsatisfactory teaching of these subjects in schools. Some of the effects include:

(1) a corresponding demand for more laboratory space equipment, chemicals and other teaching requisites to cater for the increased population of students;

(2) a demand for more science and mathematics teachers. These are unfortunately, not being trained fast enough and in large numbers by teacher training institutions to satisfy the school needs;

(3) the large number of students in some class setting, has resulted in teachers utilizing teaching methods, which do not encourage learner participation.

Accordingly, the demands for, and of education in the two countries are such that, the two governments are finding it extremely difficult to satisfy. The end result is that funds often get diverted from other needful service areas in the country to pay for education. It is a price the two countries appear to have accepted to pay for their social and economic development.

Pre-service training of teachers of science and mathematics subjects.

The preparation of science and mathematics teachers in Zambia takes place at two levels. These are the Teachers' Colleges and the University of Zambia (UNZA).

The Teachers' Colleges prepare teachers for the junior secondary level referred to earlier. Nkrumah Teacher's College prepares teachers for the whole range of school subjects offered at the junior level including science and mathematics. Each potential teacher is expected to take two teaching subjects.

On the other hand, the Copperbelt Secondary Teacher's College (COSETCO) was specifically established for the preparation of science, mathematics and home economics teachers. The latter often being over subscribed by female students. Students accepted at the COSETCO take only one teaching subject for the two years of study at the college as compared to their counterparts at the other Teachers' College.

The establishment of the COSETCO was due to the desire by the Zambian government to train and provide schools with indigenous mathematics and science teachers. It should be pointed out that for a long time after, and during independence Zambia lacked indigenous science and mathematics teachers and had to rely on expatriate teachers.

The duration of the teacher preparation programmes at the two Teachers' Colleges is two years. In each case graduates are expected to serve the nation in any part of the country where a need has arisen for their expertise. Candidates are asked to choose areas in which they would like to serve, but the final decision lays with the employer, in this case the government.

The University prepares teachers for the senior grades (i.e. grades 11 and 12) in all school subjects. Students pursuing the Bachelor of Science with Education follow the same courses offered for the B. Sc general candidates except for a number of professional courses. After four years these "teachers" graduate with either a major and minor combination or a double major in science school subjects. Like their counterparts graduating from the Teachers' Colleges, they are posted by the government to parts of the country where their services are required.

The University of Zambia has been in existence for the past 29 years. In all these years it has graduated science and mathematics teachers each year. But it has not been able to satisfy the need for such teachers in the country for a number of reasons. These will be addressed later.

A similar arrangement for the preparation of teachers for the junior and senior secondary levels exists in Namibia. One major difference though exists to the practice described above. In the Namibian case, the teacher-training programme at the Colleges is of three years duration and upon graduation, these teachers are expected to teach in the basic education programme which is up to grade 10.

In Namibia, teacher training for basic education takes place at the four Colleges of Education (three of these are situated in the densely populated North East, North and the Caprivi regions, and the fourth is in Windhoek).

The candidates at the four Teacher's Colleges follow a three year Basic Education Teacher Diploma (BETD), which was started in 1993. The first graduates of this programme are due at the end of this year.

During the three years of study candidates are generally required to follow common foundation studies in the first year with mathematics and integrated natural science each accounting for 12.5% of the learning time. In the third term of the second year, the students are expected to select a subject area of specialization related to the chosen phase of Basic Education (grades 1-7 or 5-10). During this period mathematics/science takes up 45% of the study time. Unfortunately, this area of specialization is optional. Accordingly, a number of candidates opt not to specialize in science/mathematics subjects. In the third year, candidates continue with the specialization started in the second year. In this third year of study, the specialization subject now accounts for 50% of the time. This is to enable the "teachers to know and understand their teaching subjects thoroughly" (MEC, 1994). Even though the documents boldly state the above, the teachers who graduate with the BETD are expected to teach either grades 1-7 or grades 5-10, yet their "in-depth knowledge" is for grades 5-7 (MEC, 1994).

Since these graduates are expected to provide the backbone in popularising science and mathematics education at the primary and junior secondary levels, their "in-depth knowledge" does not seem adequate for the task. This observation is based on the amount of science and mathematics content they are to learn. One would have expected such teachers to have been exposed to higher science and mathematics content, not just that for grade 5-7, for them to be effective teachers of these subjects at the junior secondary level.

It is hoped these BETD graduate teachers, specializing in science and mathematics subjects will undergo further studies or in-service training to make them more effective and confident teachers of these subjects. It is the teachers with adequate content grasp and confidence in their ability to teach science and mathematics who will popularise these subjects in our schools through effective teaching.

The University of Namibia (UNAM) prepares teachers for the senior secondary level as mandated by the Ministry of Education and Culture (1993). In the past the University as one of the three legs of the Academy (the other two being the Technicon and the College for Out of School Training) prepared teachers for the primary level also. The Ministry's mandate to the University of Namibia to prepare teachers for the senior secondary levels (grades 11 and 12) only implies that there will be no more degree graduate teachers for this level, unless the mandate is changed.

At UNAM, the task of the professional preparation of science and mathematics teachers is being spear-headed by the Department of Science and Mathematics Education which came into existence in 1994, two years after the establishment of the University of Namibia as a separate entity.

The University is currently involved in laying the groundwork for the launching in 1996, of the four-year Bachelor of Education (B. Ed) programme for the preparation of senior secondary school teachers. The preparation of B. Ed science and mathematics qualified teachers will mark a concerted and sustained effort in providing Namibia with a highly qualified and prepared cadre of science and mathematics teachers. This it is hoped will help break the vicious cycle of poor teaching in the classroom as shown in figure 1 below. It is also hoped the B. Ed programme will cater for a larger number of students, which has not been the case before.

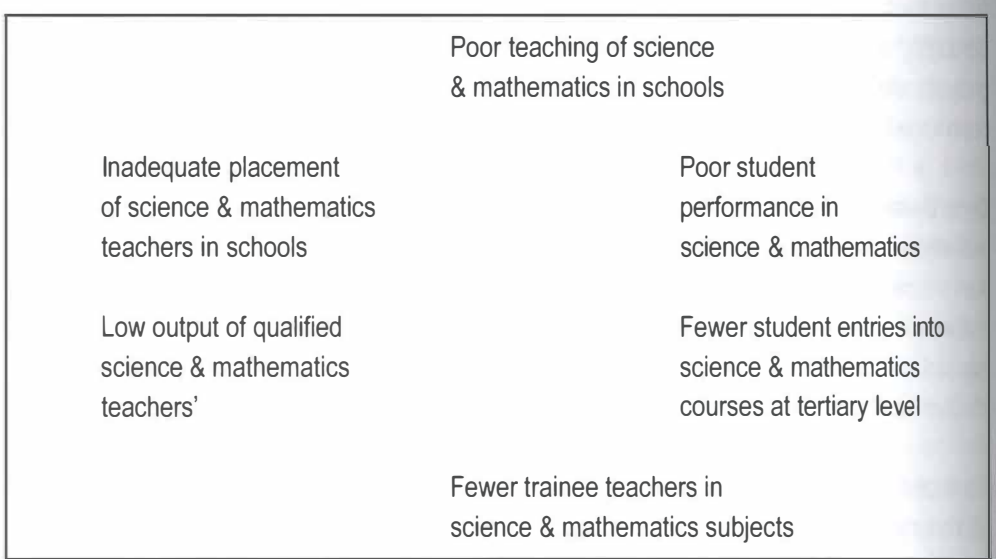

Figure 1: Effects of poor teaching of science and mathematics subjects at the secondary school level.

PROBLEMS HINDERING THE EFFECTIVE TEACHING OF MATHEMATICS AND SCIENCE SUBJECTS IN THE TWO COUNTRIES

The importance of science and mathematics education for the social and economic development of a given society cannot be over emphasized. Nonetheless, for both Zambia and Namibia a

number of problems appear to be hindering the effective teaching and learning of science and mathematics subjects. A few of these are addressed in this paper, and solutions are suggested later.

Inadequate numbers of qualified science and mathematics teachers

One of the major problems experienced in offering effective instruction to students in science and mathematics education is the lack of adequately qualified and professionally prepared teachers at secondary level. The World University Services (WUS, undated) and UNESCO/UNDP (1990) observed that 80% of the more than 12 000 schoolteachers in Namibia were untrained. Given such a large number of unqualified or ill equipped teachers in schools with the majority of the school population, one fails to see how effective instruction could be carried out (Clegg, 1989; Cunnington, 1989).

Even though a significant number of the few trained teachers are still in schools in Namibia, a number of the experienced ones have been leaving the profession for greener pastures in the private sector. Provision of a higher salary and related fringe benefits may forestall this exodus from the teaching profession before it becomes endemic and renders the gains achieved so far in providing qualified teachers for the schools insignificant.

Even though Zambia could be said to have trained a large number of science and mathematics teachers, the majority are no longer in the teaching profession. This is due to a variety of factors including, poor conditions of service, and low salaries. Indeed, the majority of these teachers have found employment in the private sector and outside the country (Kasanda, 1993; Kasanda and Nkosi, 1994).

Lack of laboratory space and laboratory equipment

In most schools especially in the rural areas, laboratories in the two countries lack even the most basic equipment for carrying out simple experiments (West, 1995; Mshigeni et al, 1993). Even though practical/experimental work in science does not necessarily ensure understanding or meaningful learning, lack of such equipment reduces the teaching and learning of science to an abstraction. The theoretical teaching of science and mathematics subjects pushes them beyond the students' realm of experience and understanding. They invariably perceive the subjects as being useful for passing the examination only, rather than as part and parcel of their daily

lives. Such a view of science and mathematics will only fuel the negative attitudes students hold towards the study of these subjects in our schools.

Lack of textbooks and other teaching and learning materials

The lack of suitable textbooks for the teaching of science and mathematics subjects has been recognised as contributing to the non-effective teaching of these subjects not only in the schools in the two countries, but in all SADC countries (Mshigeni et al, 1993).

The importance of the use and existence of appropriate science and mathematics textbooks in the SADC region has also been recognised. In the submitted country paper, Zambia suggested in 1992 the pooling of regional resources in the task of preparing common textbooks for schools in the SADC countries (Mshigeni et al., 1993; Wamulwange, 1993). The advantage of this suggestion, already a reality in the BOLESWA countries (Botswana, Lesotho and Swaziland) is that the abundant human and material resources in the region could be put to servicing the whole region rather than a particular country.

As a practical follow up to the region's expressed concern as far as lack of appropriate textbooks was concerned, a week long conference to map out ways and means of achieving textbooks sufficiency was held in Gaborone, Botswana in December 1993, under UNESCO'S sponsorship. Nonetheless, it seems the resolutions of this conference, which was a follow up to an earlier one in Arusha, Tanzania in 1989, are yet to bear fruit.

Teaching methods being utilised in the teaching of science and mathematics subjects in the two countries

Another factor affecting the teaching and learning of mathematics and science subjects is the use of teacher centred teaching methods. The lack of textbooks and other supplementary resources encourages the use of teacher centred methods, which often result in rote learning. Namibia has endorsed the learner-centred approach which places the child as the centre of all learning while the teacher plays the role of facilitator, learner and advisor (MEC, 1993; Branch 1995). Swarts (1995) notes that a number of teachers now appear to be comfortable with the learner-centred approach, although some of them had either passively or actively opposed its implementation. It is hoped that the learner-centred method will popularise these subjects and make students realize that science and mathematics are enjoyable and useful outside the classroom.

Zambia has not publicly endorsed the learner-centred approach as Namibia has done. Nonetheless the emphasis has also been on the use of methods that encourage a high level of learner participation in the learning process, with the teacher taking a less active role as the case is with teacher centred approaches. But as indicated earlier it is not easy for an overworked teacher to use learner-centred approaches and the majority end up using the chalk and talk method (Kasanda, 1981; 1993).

Inadequate funding for the purchase of educational requisites

Financing education is another factor that appears to affect the provision of better instruction in science and mathematics subjects. This is mainly due to the fact that these two subjects often require equipment and materials to enable hands on experience, in order for learning to be effective. Namibia spends approximately 20% of the national budget on education, while Zambia currently spends about 8% (1989 figure) due to the economic difficulties it has been experiencing (Mshigeni et al, 1993; Omari, 1991). The reduction of expenditure on education in Zambia and other countries reflects the fact that in times of economic crisis education is more likely to face the axe than other services. This is due to the fact that investment in education is long rather than short term (Omari, 1991). The effects of such cuts are not immediately obvious in the products of the education system. Nonetheless, cuts in education expenditure invariably result in impoverished teaching especially of the sciences, because chemicals, equipment and other needed resources will not be available in adequate quantities in the schools to cater for practical work to be held.

PRACTICAL APPROACHES TO IMPROVING THE TEACHING AND LEARNING OF SCIENCE AND MATHEMATICS SUBJECTS IN THE TWO COUNTRIES

The existence of the problems encountered in the teaching and learning of science and mathematics subjects has led to a variety of attempts to address them. Some of these attempts appear to have resulted in some limited success while others promise better success.

In-service programme provision

In-service provision for teachers is one such method, which has been used to address the problem of unqualified and or under-qualified science and mathematics teachers with varied success.

In Namibia there are two in-service providers at the secondary school for the training of science and mathematics teachers (MEC, 1991). The In-Service·Training Assistance to Namibian Teachers (INSTANT) project established with funding from the Economic Communities (EC) in 1991 and being executed by the Vriej Universitaite Amsterdam provides short in-service workshops for mathematics and science (Physical Science and Biology) teachers, and for resource teachers in the different parts of the country. The project has also provided science kits for use in schools.

Another area of its activities has been the sensitisation of science and mathematics teachers at the senior secondary level to the new school curriculum. The introduction of the Higher and International General Certificate of Secondary Education ((H)IGCSE) raised fears, doubts and questions in many of the teachers of how they would best provide effective instruction to their students. For many teachers the (H)IGCSE was not only unfamiliar to them, but, they also had limited or no easily available teaching and learning resources to enable them do a good job of preparing students for the final examinations.

The success of the INSTANT project in Namibia is exemplified by the achievement of most of its objectives and the, "... very strong support for and appreciation of the work of the INSTANT project ... and ... in forming a basis for important further work in mathematics and science at the secondary level" (MEC, 1995). Further, the INSTANT project's success could be measured in its success in introducing teachers to the idea of learner-centred approach. A concept that is not easy to put in practice in most schools in science given the lack of laboratory equipment and other facilities.

The INSTANT project has also played an important role in the preparation of teacher materials and guidelines. The MEC (1995) evaluation report regards this area as having been met with "particular success". The developmental research approach used in the preparation of these teacher materials is described in detail by Ottevanger, Benschop and van den Akker (1995), van den Akker, Ottevanger and Plomp (1994) and Ottevanger (1994). It involves the following steps: selection of a limited number of exemplary themes; standardization of the structure and design of the modules applying basic principles on materials and text design; provision of procedural specification for lesson planning and lesson execution to facilitate the implementation of curriculum innovations in the classroom; and a systematic and efficient formative evaluation of the modules. According to the authors the model involves a cyclic design and formative evaluation of prototype teacher guides, and views this as effective in introducing new teaching materials in the classroom. Since classroom teachers are partners in the writing process, they easily identify with the products. This results in their acceptance and use.

The Life Science Project (LSP) was established at about the same time as the INSTANT project in the country with funding from the Danish International Development Agency (DANIDA). It is being implemented by Ibis (World University Service, Denmark). Before independence, Ibis (WUS, Denmark) had been involved in piloting the Life Science subject at the SWAPO secondary school while in exile at Loudima, Congo. This cooperation continued after independence in the form of the LSP.

The LSP has been involved in several aspects of education directed at improving the teaching and learning of Life Science subjects at the junior secondary level. Life Science is a compulsory and multidisciplinary and application based natural science subject integrating Biology, Ecology, Agriculture and Health Education at grades 8 to 10 (MEC/Ibis, 1995).

Some of the Life Science Project's activities include; short term comprehensive in-service programmes for teachers; involvement in curriculum development and revision, preparation of teaching materials and teacher guides on how to plan, teach and conduct assessment in the Integrated Natural Science subject of the BETD, and the development of the Life Science textbooks incorporating a Namibian context for the schools in the country. Further, the project's involvement in the pre-service Basic Education Teacher Diploma courses has made it possible to contribute positively to the training of effective teachers for the teaching of these subjects. In an attempt to popularise the practical aspect of Life Science teaching, the project has supplied schools with kits of basic field and laboratory equipment and sets of basic garden tools to enable students learn Life Science both theoretically and practically (MEC, 1993; MEC/Ibis, 1995).

In Zambia the major efforts in addressing the problems described above have included the following: the establishment of the Zambia Advanced Mathematics and Science Teacher Education Project (ZAMSTEP) programme in the two Colleges starting in 1988; the running of the United Nations Development Programme (UNDP), a sponsored in-service programme at the University of Zambia for three years ending in 1985; the introduction and establishment of the Zambia Educational Materials Production Unit (ZEMPU); and the running of the UNESCO funded Science Teachers Resource Centre in Lusaka. These efforts are described next.

Earnest efforts in addressing the plight of science and mathematics education teachers in an in-service mode could be said to have started in the later part of 1983, when a UNDP sponsored science and mathematics in-service project was run by the Department of Education at the University of Zambia. The in-service programme was an intensive three-week programme for graduates of the Teachers Colleges. Both subject content and methodology components of

Physics, Chemistry, Biology and Mathematics were dealt with. Unfortunately, this programme could not be sustained after UNDP's sponsorship ended in 1985. But, its effectiveness in equipping teachers with the content and methodology for teaching senior secondary mathematics and science appear to have been achieved.

The second set of efforts came from the establishment of the ZAMSTEP project in the two Teachers Colleges. The ZAMSTEP project was a one-year advanced in-service programme for science and mathematics teachers who had graduated from the two teachers colleges and had been in the teaching service for about five or more years. The main aim of the ZAMSTEP programme was the strengthening of the academic and professional competence of the candidates so that they could function effectively in the senior secondary classes. The provision of further subject content in their areas of specialization helped address the shortage and lack of science and mathematics teachers for the senior secondary level. As indicated earlier, many University trained science and mathematics teachers never set foot in the classroom even though their studies had been financed by the government. Accordingly, the ZAMSTEP programme attempted to reduce the gap being created by University trained science and mathematics graduate teachers who were leaving the teaching profession for greener pastures in the private sector and outside the country.

The establishment later of the UNESCO Science Teachers Resource Centre in Lusaka was again an attempt to improve the teaching of science and mathematics subjects in the country. This Centre's task in ensuring effective science and mathematics teaching, involved the production of low cost materials for science and mathematics teaching. These included materials such as test tube stands, chalkboard rulers, set squares for both teachers and students and other essential basic equipment. It also provided teachers with methods of teaching these subjects, and resources which could be consulted by teachers in order to make their teaching effective.

The establishment of the Zambia Educational Materials Production Unit (ZEMPU) helped further in the production of teaching materials with a Zambian context. This project involved the identification of secondary school teachers with appropriate expertise in a particular subject at the secondary school level. As a team, they worked under the watchful eye of a subject specialist(s) of the Curriculum Development Centre to write textbooks for the secondary schools. Unfortunately, for many of these teachers, this exercise had little monetary rewards. They do not hold the copyrights to the works so produced.

The situation as far as textbook writing is concerned in Namibia has been different from that practised in Zambia. In Namibia, school textbooks have been and are being written by individuals.

These hold the copyrights to their publications and as such benefit financially from their labours. Accordingly, this serves as an incentive to write more textbooks. These new textbooks are mostly in the English language replacing those in use that were written in Afrikaans, since English is the official medium of instruction in schools in Namibia.

CONCLUSION

In conclusion, it should be emphasised that education in general and science and mathematics education in particular play an important role in raising the general living standards of the people. It is probably this realisation which has compelled nations the world over to spend more money in improving the quality of their education systems in general and mathematics and science education in particular, even though when faced with economic difficulties it is also the first to face the cuts. Mshigeni et al (1993) have noted that developed countries spend a large portion of their Gross Domestic Product (GDP) on science, technology and related subjects. This probably accounts for the observed higher advancements in science and technology in many spheres of life in these countries.

At the recent UNESCO Heads of African states meeting in Paris, the Heads were urged to do all they can to ensure that they spend about 5% of their GDP on developing human resources for effective teaching of science and related subjects (UNESCO, 1995). If this recommendation is adhered to at all costs, then science and mathematics education may make an impact on the quality of the lives of the peoples in both Zambia and Namibia.

It should be pointed out that the two countries are trying within their limited financial and human resources to provide an environment in the schools that is conducive to effective teaching and learning of science and mathematics subjects. But, more effort and material support is needed to achieve effective science and mathematics education in the schools. A firm foundation has been laid that needs to be sustained.

NOTES.

1. The author would like to thank Prof. Agnes N. Njabili for her useful comments and suggestions on the initial drafts of this paper. Nonetheless, the author assumes responsibility for the views expressed therein.

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