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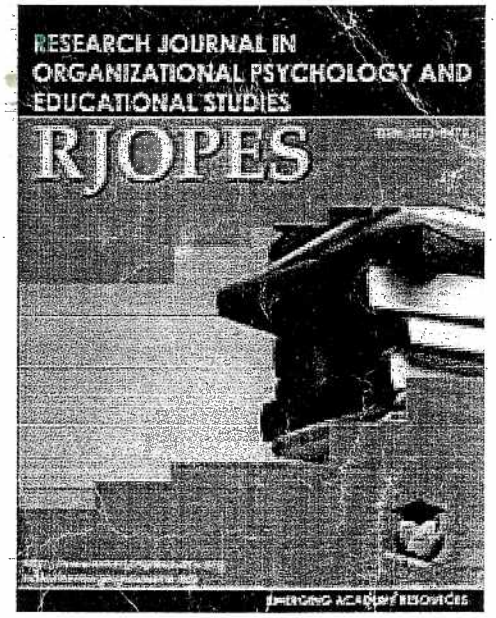

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NO EASY ROAD: INNOVATIVE PROFESSIONAL DEVELOPMENT OF SCIENCE TEACHERS IN MALAWI

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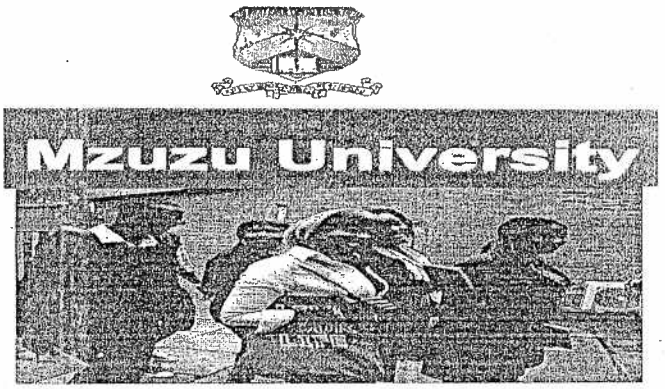
ABSTRACT

This paper focuses on some challenges of the democratization of the education process in Malawi following the advent of the Multi-Party Democracy in 1994. The paper analyzes issues of quality, relevance and equity that have punctuated reforms over the past two decades with particular reference to the Professional Development of Science Teachers in Community Day Secondary Schools (CDSSs). The first part offers a brief historical overview of the effects of the rapid expansion of the Secondary School Education Sector in Malawi since the late 90s. The second part discusses how Mzuzu University and the Ministry of Education, Science and Technology (MoEST) have together provided Teacher Professional Development. The third part presents a summary of the outcomes and/or lessons learnt from the Secondary School Teacher Improvement Project (SSTIP). It finally concludes by highlighting the Malawian experience that given the right support, both financially and materially, and coupled with a strong political will, the SSTIP Programme can potentially re-train under-qualified Science Teachers in pedagogical skills and subject matter to a level where they can cope with curricular changes, and update their skills in subject matter and more importantly, improve on their use of educational materials in the Secondary Schools.

KEYWORDS: MoEST, Mzuni, SSTIP, IN-SET, talular, democratization, equity

INTRODUCTION

Following the second Presidential Democratic Elections in 1999, the Malawi Government established about 240 Community Day Secondary Schools (CDSSs) by transforming what used to be Distance Education Centres (DECs) and also constructed 31 additional new Secondary Schools as had earlier promised the electorate in their Election Manifesto. As a result, the Secondary School student population rose to about 65,000 in Conventional and Private Secondary Schools, while more than 100,000 students registered in CDSSs (MoEST PIF Preliminary Report, 2000). This dramatic increase in student population eventually influenced a big teacher shortfall in Secondary Schools which was at that time estimated to be at about 12,000. The expansion of Secondary Education also piled pressure on Tertiary Education as the then only university- the University of Malawi (Unima) could not manage to absorb all the school leavers that qualified for University Education. At that time, only 0.03% could be admitted to this University as (Chibambo, 2014) observes. Because of the pressures to broaden and increase access to tertiary Education, the Government established a second national university- Mzuzu University (Mzuni) which is located in the Northern Region of Malawi. Mzuni's establishment followed an Act of Parliament of 1997. Initially, Mzuni was established to train teachers for Secondary Schools to supplement the University of Malawi which had been, among other programmes, training Secondary School teachers since 1965. In the meantime, Mzuni's total student enrolment has risen about six-fold from 550 in 2003 to about 3,500 in 2015. Mzuni started enrolling students in 1999 under the Faculty of Education only. As its mission, Mzuni is committed to provide high quality Education, Training, Research, and other complementary services to meet the technological, social and economic needs of individuals and communities in Malawi.



***EDUCATION:** is fundamental to economic and social development*

Up until very recently, the majority of the teachers in CDSSs were under qualified. Most of them had either a Malawi School Certificate of Education (MSCE) or an O-Levels and a Primary Teaching Certificate. Initially, they went into Distance Education Centres to supervise the students, nevertheless, most of them ended up teaching in the CDSSs following an acute shortage of qualified Secondary School teachers. These teachers were mostly able to teach Junior Certificate of Education (JCE) subjects at Forms 1 and 2, respectively. However, they got cognitive challenges when it came to teaching Senior Secondary School classes (MSCE).

Realizing the need to improve the quality of education in CDSSs, the Malawi Government with the financial support from the African Development Bank (AfDB), initiated the Secondary School Teacher Improvement Programme (SSTIP) to help improve the teaching of Mathematics and Sciences in Secondary Schools by strengthening teachers' abilities so that they could apply the new *knowledge* and *skills* in their teaching. Borich (1988) has listed some key behaviours that contribute to effective teaching and such behaviours include clarity, variety, task orientation, engagement in the learning process and moderate to-high success rate. He contends that it is safe to say that without knowledge and skills to present lessons that are task-oriented, and that actually engage students in the learning process at moderate to-high rates of success, no teacher can be truly effective in producing desirable patterns of student achievements and attitudes. High quality education is, therefore, directly related to excellent teaching and successful learning. In addition to these factors, school resources such as textbooks also do influence student achievement as (Heyneman, et.al., 1981) suggests. Moreover, Bloom's (1979) Model of School Learning, defines achievement as a linear function of three things, related as follows:

$Y = F(X_1, X_2, X_3)$

Where Y = achievement as measured by criterion-referenced tests

X_1 = a set of cognitive entry characteristics

X_2 = a set of affective entry characteristics such a attitude and

personality, and

X_3 = the quality of instruction.

Bloom (1979) further argues that, of the three constructs, namely cognitive, affective characteristics, and quality of instruction, which are casually related to learning, do account for all the variations in academic achievements and/or quality of education. One can therefore understand that where the quality of instruction in schools is not as expected, even if the students are bright and motivated, they will be unable to achieve the anticipated academic results. Since the most critical challenge faced in the Secondary Sub-sector in Malawi is lack of adequate qualified teachers, Mzuzu University, a Secondary School Teacher Training Institution, is playing a major role in training well qualified teachers who are critical and nerve center in the provision of quality education in the country. Indeed, the professional development of both new and old teachers is key to improving instructional quality as J.W. Hanson cited in Ikejiani, O (ed.) (1964) asserted,

> *"An important sign of the long-range health of a nation is the spirit and quality of its teachers. There is no substitute for teachers who are dedicated to their nation and to their learners. It is for this reason that African Nations are correct in emphasizing the importance of getting the very best people possible into teaching and making every effort to keep them there. The future of the nation rests in the hands of the teachers, for the qualities they possess today will inevitably be reflected in the citizens of tomorrow."*

Therefore, in considering raising the quality of teaching and quality of education alike, one must begin at the teacher development level. Teacher development must be seen as a continuum of learning, with teachers located at various places along the continuum. The stage of a country's development will also affect the range of learning experiences on this continuum. Teaching experience is gained over time. Long-term goals for excellence in teaching should be ambitious, but short and mid-term goals must reflect the reality of the everyday working situation for teachers (Craig, et al., (1998).

CONTEXT OF THE PROBLEM

Because of persistent low pass rate at the MSCE level, MoEST through the Department of Teacher Education and Development (DTED) initiated the SSTIP Programme to help improve the teaching of Mathematics and Sciences in CDSSs. Mzuzu University was contracted to run a 5-year Innovative Teacher Professional Development Model. The three-month SSTIP Training Programme started with an initial intake of 204 CDSS teachers in January, 2004. The trainees were those teachers who were already teaching in CDSSs but did not possess a diploma or a first degree. Prior to the commencement of SSTIP, the staff in the Faculty of Education conducted a Needs Assessment where gaps in the teachers' subject knowledge and teaching skills were identified and documented. The SSTIP programme, therefore, was guided by the assumption that better educated teachers can make informed choices and decisions about the curriculum,

and will have a larger body of knowledge to draw upon when teaching students. In addition to knowledge of subject matter, the programme was also concerned with pedagogy; assuming that teachers need to know not only what to teach but also how to teach it.

METHODOLOGY AND IMPLEMENTATION OF THE SSTIP PROGRAMME

The implementation of the programme is described and analysed with respect to the Innovative Curriculum of the programme and the mode of training. This paper, therefore, gives an analysis of the inputs, processes, and outputs of the SSTIP residential training for cohorts **1** to **5** of Mathematics and Science teachers (N=1122) drawn from all the Six Educational Divisions of Malawi. Selection was based on the criteria that the participants were those teachers who had taught natural Sciences and/or Mathematics in CDSSs for at least two years, and had good credit passes in the relevant Science subjects at MSCE level.

THE OBJECTIVE OF THE SSTIP PROGRAMME

The objective of the SSTIP Programme was two-fold:

- To improve the academic competencies of Mathematics and Science teachers in CDSSs in Malawi and thereby strengthening their ability to apply knowledge and skills in teaching; and
- To enable those who would do well in this twelve-week residential In-service Education Training (IN-SET) to be eligible for entry into a Diploma Programme either at Domasi College of Education or in any State Universities. In other words, these were the type of teachers that needed a bridging course before qualifying for entry into the said Diploma and or Degree Programme.

THE CURRICULUM FOR THE SSTIP PROGRAMME

The curriculum comprised of the following subjects: Communication for Academic Purposes, Education, Mathematics, Biology, Physics and Chemistry. Communication for Academic Purposes and Education Foundations were service subjects, while the others were subject content as per Mid- Term Evaluation of SSTIP Cohort 1 Report (Chimwenje, et al., 2004). These combinations took into consideration the subjects that the trainees were teaching in their respective schools. Science and Technology, as a subject was taken care of by combining Biology, Physics and Chemistry. This was so since the curriculum designers had been informed that Chemistry and Physical Sciences would soon be re-introduced in Secondary Schools as core courses instead of Science and Technology.

Department of Languages and Literature

The course in Communication was designed with the background that CDSS teachers require strengthening of their spoken and written language skills and also require additional communication skills to help them function more effectively as managers. Literature, structures and statements that provoke critical thinking were also used for discussions. For example, "The eyes of a frog cannot prevent a cow from drinking water." Discuss. That is, "Where there is a will, there is away." Moreover, the communication course was compulsory.

Department of Education and Teaching Studies

The Department of Education and Teaching Studies offered an education course entitled Integrated Foundations of Education and Pedagogical Issues. The Department believed that teachers are key to the quality of education in Malawi and that they wanted to help them realize that they teach learners not subjects, and that their prime responsibility was to help individuals realize their full potential in life. The course offered combined Pedagogical and Foundations of Education issues. The four components of the course included The Art and Science of Teaching, Educational Media and Technology, Testing, Measurement and Evaluation, and Teaching Practicum Aspects.

BASIC SCIENCES

There were four Basic Science courses. These courses were offered by the Departments of Biology, Chemistry, Mathematics and Physics.

The Biology Department

The Biology Department offered intermediate Biology content its Methodology. The Needs Assessment conducted by the Faculty of Education at the initial stage of the Programme revealed that such topics were necessary for this group of students. The Needs Assessment also indicated that some topics in the new MSCE syllabus were considered to be more difficult by teachers than others. The difficult topics were the ones that were included in the Biology syllabus. For example, Genetics was considered one of the most difficult topics. Efforts were also made to provide relevant background knowledge, and to link the topics properly. A methodology component was incorporated in the usual content course. This meant that after teaching each topic, issues related to how it can be taught were also discussed immediately. The Department handled the course content by taking into consideration the Biology syllabus at MSCE and beyond. Practical lessons were planned in such a way that emphasis was placed on using materials that might be available in CDSSs.

Physics and Chemistry Departments

The Physics and Chemistry Departments offered intermediate Physics content and its Methodology, Chemistry content and its Methodology respectively. The aims and objectives of the course outlines were in line with those of the SSTIP. The selected course topics aimed at providing a deep understanding for them to teach effectively in their schools. They also aimed at introducing them to Physics and Chemistry at an Advanced level since they were only teaching Science and Technology then. The practical sessions for the Methodology courses were also conducted using the readily available resources, an approach commonly known as ***Talular.*** This was done in order to provide them with skills to make their own materials and also encourage them to be innovative. At this level, the most difficult modules were Moles and Molarities in Chemistry; and Electricity and Magnetism in Physics.

Department of Mathematics

The Department of Mathematics offered Mathematics I, Mathematics II, and Mathematics Methodology. Mathematics I covered pure Mathematics topics, while Mathematics II covered Applied Mathematics. The facilitators made deliberate efforts to make sure that the learners acquired the practical working knowledge of Mathematics. The learners acquired the Mathematical skills required to solve problems arising in Mathematics as a subject as well as other science subjects. The way this subject was handled was dictated by the requirements of the MSCE syllabus. Advanced topics suited for A-Levels were also presented. Here, emphasis shifted from an algorithmic approach to a more rigorous and abstract approach. Reasonable efforts were also made to include a good number of examples and exercises for the learners practice. Just like in Physics and Biology, methodology and content courses were simultaneously taught in this subject. This means that after teaching each content, issues regarding how best it can be taught were discussed immediately. In Mathematics, there were also topics that were considered more difficulty by the learners, such as Number Bases, Probability, and Linear Programming, among others.

RESULTS AND DISCUSSION

Based on the results of the overall performance of the SSTIP (see Figures 1 and 2 below), it can be concluded that the Teacher Professional Development Programme was a success. The In-service Education Training (IN-SET) had demonstrated that it was possible to upgrade teachers in mathematics and scientific concepts by designing a curriculum that suits their needs and abilities. The general performance of most of the participants, both male and female, was good and very encouraging. Out of 1122 participants, 700 successfully completed the programme, representing 63%. But the performance for Cohort 2 was even much better as 154 out of 200 passed, representing 77%. This was a very remarkable achievement. Nevertheless, the performance of Cohort 3 was not as good as expected since only 56% (N=168) passed out of 300. A review of the challenges of Cohort 3 showed that the selection process was less rigorous and problematic.

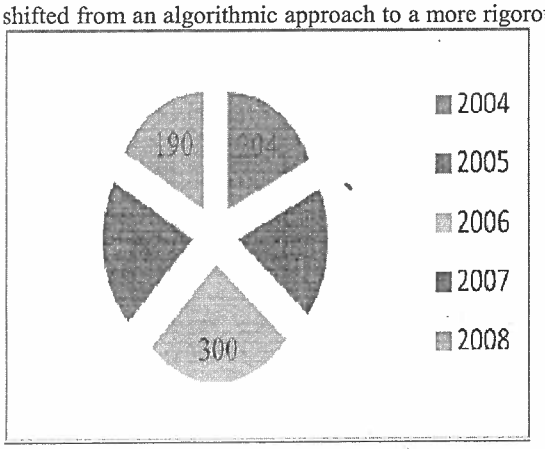


Figure 1: Summary of SSTIP Enrolment from 2004 – 2008 (clockwise).

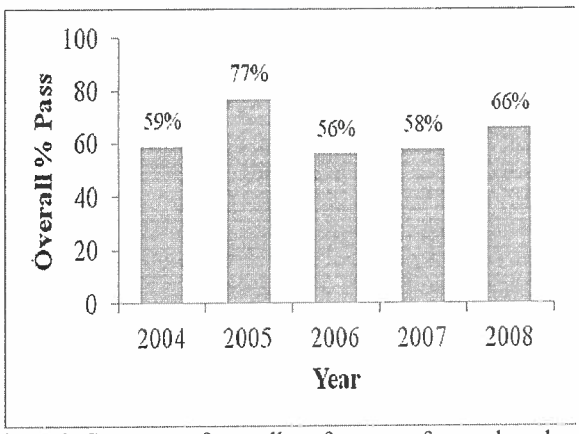


Figure 2: Summary of overall performance for each cohort from 2004 – 2008.

However, during Cohort **5,** 125 students passed out of 190 in all the subjects in their end of Programme Examinations, representing 66%. In recognition for their hard-work, all successful candidates (N=700) were issued with *Certificates of Achievement.*

IN-SET of Science and Mathematics Teachers in Malawi is extremely important because of the periodic

reviews usually done, every 5 years, on the Malawi School Curriculum. Science and Mathematics teachers, therefore, urgently need practical guidance to cope with the anticipated changes. Consequently, efforts were made in the SSTIP to enable ill-equipped schools to adopt activity-based teaching. Teaching using locally available resources (Talular) was also emphasized. In addition, a variety of Concept-based Experiments (CEs) were designed for the Science courses, to enable them link content learnt to actual observations. This perfectly agrees with Craig, et.al. (1998) who observed that even when small changes with teachers and their learning environments are made, for instance, changes of the right type, they can make a difference to children's learning and retention in the educational system. Hence, helping teachers to be knowledgeable and responsible enough to make needed adjustments to the learning environment is one of such right changes. Likewise, since the Content and Methodology courses were combined, and that recent modifications in the Sciences and Mathematics School Curricular were well anticipated, it enabled the learners to directly reflect on what they were teaching in their schools.

Findings from several Case-studies have shown that the academic and professional training of teachers has a direct and positive bearing on the quality of their performance and consequently on the achievement of students as (Avalos and Haddad,1981; Schiefelbein and Simmons, 1981) cited in Lockheed and Verspoor (1991) observed. In particular, specific factors such as the years of teacher training, the teacher's verbal fluency, subject matter knowledge, adequate books and materials and knowing how to use them, teacher expectations of pupil performance, time spent on classroom preparation, and frequent monitoring of student progress are known to affect student achievement (Farrell and Oliveira, 1993; Fuller and Clarke, 1994; Ginsburg & Schubert, 2001).

At the end of each IN-SET programme, it was pleasing to note that participants were more enlightened on how to teach most of the difficulty topics in the MSCE Science syllabi, e.g., in

i) ***Biology:*** Genetics, Photosynthesis, and Respiration.

ii) ***Chemistry:*** Moles and Molarity (preparation of solutions – chemical reagent).

iii) ***Physics:*** Nuclear physics, Electricity, and Magnetism.

iv) ***Mathematics:*** Number bases, Probability, Functions, and Linear programming.

In addition, participants were committed to learning, and had an immediate opportunity to gain feedback on their studies from facilitators and their peers. Similarly, they shared experiences and knowledge through Participatory Approaches which ultimately benefitted their respective schools.

CONCLUSION AND RECOMMENDATIONS

The following factors were the major strengths that greatly contributed to the success of the programme:-

i) Content and methodology courses were combined, recent modifications in the Science and Mathematics School Curriculum were included in the courses to enable the learners have a direct reflection of what they were teaching in schools.

ii) Funding by ***AfDB*** for each Cohort was timely and adequate that influenced the availability of instructional resources.

iii) Prompt timing in procurement of teaching and learning resources enabled the students to have enough practical skills in the laboratories, for example, hands-on approach to learning.

iv) Course Facilitators, Management, and Support Staff were very committed to the SSTIP and this too contributed to its success.

v) Assurance of being recognized by an award and the possibility to pursue a Diploma /Degree Programme motivated the trainees.

vi) The Programme brought awareness to the public in Malawi that there was great need to help teachers in CDDSs upgrade themselves.

Challenges of the SSTIP

- Gender imbalances among the students as there were fewer female teachers (about 16%) who participated in the Programme. MoEST should monitor gender equity within the Secondary Education Sector.
- MoEST in partnership with Mzuni should design specific bridging programmes in natural sciences targetting potential female teachers in order to increase equity and access.
- In view of the challenges faced during the selection process of Cohort 3 students,

all stakeholders should ensure that the selection process is rigorous and balanced.

CONCLUDING REMARKS

Although the quality of instruction and attainment results at MSCE were not as good as those from the Conventional Government Secondary Schools, particularly in Science subjects, CDSSs have provided more opportunities and broadened access to education by democratizing the education process in Malawi. Hence, the need for Malawi to provide more rigorous IN-SET Programmes for Science teachers cannot be over-emphasized. As alluded above, even small changes with teachers and their learning environments and coupled with the right *political will,* can make a difference to students' learning and retention in the educational system.

RELEVANCE OF THIS PAPER TO THE THEME OF THE CONFERENCE

From these findings, it can be safely concluded that this paper is ***tying*** well with the theme of this conference: The SSTIP Programme has been presented as one of the beacons to national capacity building strategies for sustainable development and poverty alleviation. Well trained teachers are key to national development, poverty alleviation and empowerment of individuals including the vulnerable groups such as women and physically challenged individuals. Educated individuals are likely to create an educated nation and propel national development. Moreover, the approach adopted by SSTIP is highly sustainable as it emphasized on use of affordable and locally available resources (Talular). More importantly, upon upgrading of these teachers, their contribution was recognized by MoEST and it accordingly elevated their status through promotion, which in turn, improved their social and economic welfare. In addition, some of them got admitted into various institutions of higher learning to pursue diploma/degree programmes.

AREAS FOR FURTHER RESEARCH

There is need for further research on the impact of the SSTIP graduates particularly on their post-performance in the CDSSs. Also, studies are necessary to find out how many of these graduates (N=700) managed to progress to Diploma/Degree Programmes using this award, and how they performed in the new Programmes against those who did not attend the SSTIP.

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