ZJER

ZIMBABWE JOURNAL OF EDUCATIONAL RESEARCH

Volume 13 Number 3 November 2001

ISSN 11013 - 3445

CONTENTS

Theory-Based School and Community-Based HIV Prevention in Zimbabwe: A Prospective Study

Sonja Feist Price, Elias Mpofu, Rick Zimmerman and Pamela Cupp

A Survey of Bindura University of Science Education Student Teachers' Perceptions of the Mentoring Model of Teaching Practice

Lovemore Nyaumwe

Situational Analysis on Primary Teacher Preparation for Environmental Science Education in Zimbabwe

Overson Shumba

Factors Affecting Condom Use Among Nigerian University Students

Karl Petzer, Yetunde Oladimeji and Olufemi Morakinyo

The Views of Blind Students Towards Inclusive Education

T. D. Mushoriwa

Situational Analysis on Primary Teacher Preparation for Environmental Science Education in Zimbabwe

Overson Shumba

Department of Teacher Education

Abstract

Knowledge of the existing situation and of current practices is fundamental to human resources development and training programmes. This article reports on a situation analysis to explore the structural problems, teaching reality, and support needs of college science departments in ten primary teachers colleges in Zimbabwe. It was established that students and lecturers would like the main subject course in science to develop teachers to serve as resource persons for other teachers in their schools. For science departments, the main subject they would want to offer is Environmental Science developed around topics in the primary school syllabus. The situation analysis established the need for support in order to change the orientation of the college science curriculum and teaching to become more responsive to the demands of primary school Environmental Science teaching.

Introduction

Traditionally, the quality of teacher training and education has been inferred from assessments of the effectiveness of practising teachers. Lewin and Bajah (1991) who evaluated the effectiveness of implementation of Environmental and

Agricultural Science (EAS) the predecessor of Environmental Science (ES), the current subject in primary schools, noted the poor teacher- dominated teaching strategies teachers employed. The teaching observed was reportedly "discrete, with links to material in previous lessons infrequent and an emphasis on content and definitions rather than process skills or inquiry" (Lewin & Bajah, 1991:5). The teaching observed in a recent survey of Environmental Science teaching and learning in primary schools in Zimbabwe showed that where teachers have not benefitted from in-service training and staff development, their interpretation of the syllabus and their teaching methodologies deviated substantially from that recommended by the syllabus developers (Shumba, Voss & Zilg, 1997). In primary science teacher education, concerns with the quality of teacher education has been raised with respect to the level of articulation and congruence between the college curriculum and the school curriculum (Shumba, 1995). Articulation between college and school curricula affects the extent to which college prepared teachers to function competently and effectively in implementing the school curriculum. Specifically with reference to environmental science education, Shumba (1995) noted that "the current discrepancy and lack of integration of college curricula with school offerings will continue to plague the education system for years to come" (p. 91).

Reform should seek to deal with this discrepancy; unfortunately, two problems appear to haunt science education reform. First, there is the problem of systemic change and the basis on which it should be initiated and dealt with. For example, of science curriculum reform, Barrow and Tobin (1993) observe that "reform is a process that requires systemic change to be initiated and sustained throughout a culture. Too, often, however, reform tends to be something done to someone else, and too often perpetrators of reform have not undertaken thorough analyses of what is happening and the reasons for what is happening" (p. 115). Second is the problem of lack of support strategies and resources for implementation of new curricula and innovations. Hall (1992) states something that appears stakely relevant to the present circumstances of reform in primary school environmental science education. Hall states, "grudgingly, policy makers provide occasional support for development, but little for dissemination, and nearly none to support implementation in individual schools and classrooms" and yet as he notes, "implementation *costs* as much (if not more) than development" (p. 879). Further, he notes that the "implementation phase can be assessed, planned for, and facilitated."

Objectives

These problems in so far as Environmental Science is concerned are beginning to be dealt with. For example, the Better Environmental Science Teaching Project (BEST) in the Curriculum Development Unit (CDU) of the Ministry of Education, Sport and Culture (MoESC) facilitates the implementation of the revised Environmental Science syllabus in primary schools. Overall, the BEST project seeks to improve the learning and teaching of Environmental Science in Zimbabwe's primary schools through wide-scale training and support targeted at primary school teachers, heads, supervisors, and science lecturers in primary teacher training colleges. In order for relevant and effective training and support to be realised, there is need for "thorough analyses of what is happening and the reasons for what is happening" (Barrow & Tobin, 1993:115). This article reports on the findings of a situation analysis to find out the status of Environmental Science teaching and learning in Zimbabwe's primary colleges of education. This is particularly useful to gain insight into the existing capacity and training needs as well as to propose support strategies for science lecturers with a view to promoting active teaching and learning methodologies in preparing student teachers. The specific objectives of the situation analysis were therefore:

1 to assess the existing situation pertaining to teaching and learning of Science and Environmental Science in primary colleges of education.

2 To provide a critical appraisal of the changes required to the college science curriculum for it to effectively prepare teachers for teaching Environmental Science in primary schools.

3 To identify specific needs and areas of support for the further professional development of science lecturers.

4 To recommend strategies by which systemic change and improvement of the college science curriculum and the teaching and learning of ES might be accomplished.

Methodology

The methodology of the situation analysis was premised on the need to identify training and related support needs of primary college science lecturers. Overall, the design of the situation analysis was qualitative, whereby in-loco observation, documentary analysis and review, structured interviews, and seminar techniques and dissemination strategies were triangulated. All the ten primary teachers colleges were visited. At each college, observations of the teaching and learning environment including laboratories, libraries, and the materials they carried were observed and assessed with respect to their suitability and adequacy for preparing teachers able to effectively implement the primary school ES syllabus. A review of documents including Science main subject syllabuses, science applied education syllabuses, Professional Studies syllabus A, and Theory of Education syllabuses paying particular attention to their relationship to ES teaching and learning in particular and to primary school teaching and learning in general. In order to ascertain and validate observations concerning the syllabuses, meetings were held with staff in the Theory of Education, Professional Studies, and Science departments. All of the members of the science department were interviewed in focus group format. In addition, a focus group interview of third year student teachers was arranged; a focus group consisted of between 10-12 students. In some cases, the science department lecturer-in-charge was able to arrange for the team to observe a science or applied science education lecture in session.

At the end of each visit to a college, discussion meetings with all the science lecturers were held. These meetings served as feedback sessions which provided a forum for initial validation of the findings. When all the colleges had been visited, a seminar to which all the science lecturers were participants was organised. This seminar gave lecturers an opportunity to comment on the results, to complete them, and to participate in the identification of training and related support needs. This seminar was attended by 36 out of the 46 science lecturers in the 10 colleges. Lecturers agreed to the description of the situation as discovered by the research team and together, the researchers and the college science lecturers drew conclusions on problems and suggested solutions and training needs. This participatory approach to situation and needs analyses for initiating change and reform is supported in the literature (Barrow and Tobin, 1983; Hall, 1992).

Results

In this section, a description and interpretation of the findings of the situation analysis are given. All the findings must be are interpreted with respect and concern for the quality of teaching and learning of Environmental Science in primary schools.

Analysis of the Primary College Science Curriculum

The analysis of the college science syllabuses was conducted in relation to the Teacher Education Review Committee (TERC) (1986) guidelines; purpose, structure and content of main subject and applied science education; time allotment relative to the rest of the college curriculum; emphasis on scientific skills acquisition and development; and to interpretation and relationship to the primary school Environmental Science curriculum. For this purpose the syllabus documents were analysed and interview-discussions were conducted with the staff in the science department to verify perceptions and interpretations.

Relation to TERC Guidelines

The science main subject syllabuses deviated substantially from TERC guidelines and showed little connection to the primary school ES syllabus. Proposed topics in Section 3.5 of the guidelines (pp. 74-75) are water, soil, plants, crops and animals, pastures and forestry; conservation, health and disease, population, pollution, fuel and energy, weather; land-forms and minerals, machines and materials. The primary college syllabuses were based on sections that are directly meant for secondary colleges covering biology, chemistry, and physics content topics

(Section 3.2 to 3.4 of TERC, 1986:75). The college syllabuses were designed closely around the structure of the disciplines. As a result there was in many cases content overload and little reference to the development of skills. The nine topics of the primary school ES syllabus were not covered in the main subject.

Purpose, Structure and Content of Science Main Subject

The traditional rationale for offering student teachers a main subject is to prepare students for personal development and for further studies. This view was changing among science lecturers in favour of a view that the main subject should help to prepare teachers who having pursued deeper study of a science subject will serve as resource persons for other teachers in primary schools. There was increased desire to change college science syllabuses so that they are better aligned with the primary school syllabus for ES. However, conceptualisation and interpretation of 'ES' content and emphases varied by college. At least one college had a pure science syllabus which they re-titled 'ES' without changing the substance and content from the science discipline structure. In other colleges, ES was simply a mix of topics from the natural sciences and agriculture. Three quarters (75%) of the lecturers needed assistance in the form of workshops, seminars or courses to better conceptualise what ES is.

All colleges provide content upgrading on topics found in the primary school ES syllabus in applied education (AE) which 60% of the colleges have revised to reflect the topics and demands of the primary ES syllabus. Four of the colleges still used the EAS-based applied education syllabus. Two factors seem to influence the pace of change. First, changes to the primary school syllabus were not communicated to some colleges at the time syllabuses were distributed to schools and at least two colleges had not yet received copies from the MoESC. Second, there was no orientation to the demands of the revised primary school syllabus. This made the interpretation of the syllabus difficult as admitted by two thirds of the science lecturers.

Focus on Developing Scientific Skills

In analysing the college syllabuses for both main subject and applied education two more observations were made across all colleges. First, the syllabuses clearly identified the content to be covered but rarely identified specific scientific skills to be developed. Lecturers did admit that in teaching, more time was used to teach content than skills. In one college, it was estimated that 90 % of the time in main subject is used to deal with content and 10 % is used to deal with scientific skills. The assessment scheme for both syllabuses in main subject and in applied education gave only the relative percentage weighting and contribution to final assessment of course-work and examinations without identifying specific skills to be assessed as stipulated by TERC guideline 6.1. The scheme of assessment in teachers colleges is not as explicit as in the primary school ES syllabus where the skills demanded for the examination are defined and weighted, i.e., factual recall (40%), comprehension (30%), application (20%), and deductive reasoning (10%).

Time Allotment

The weekly time distribution for college based courses is approximately (but varies slightly according to colleges) 4-5 hours for Main Subject and Theory of Education, 2-3 hours for Professional Studies (syllabus A), 1 1/2-2 hours for Applied Education (syllabus B), and 2 hours for Curriculum Depth Study (syllabus C) in some colleges. Virtually all, lecturers in science departments expressed concern, first, with the time available for applied education, second, the congestion of the college time table, and, third, the nature of the courses offered in the colleges. Although not unique only to applied science education, lecturers held the perception that there was too little time allotted for applied education, i.e., of between 1.5 and 2 hours a week. A lot of the time for specific subject methodology was spent in upgrading content in ES leaving relatively little time for methodology. Lecturers lacked confidence in their students' ability to acquire content enrichment on the topics carried in the primary college syllabus through self-study assignments.

The concern expressed with the nature of the college curriculum were multi-fold. There was a concern raised that TOE, Professional Studies, and Main Subject courses are too theoretical, academic, and overloaded. Presently the courses were perceived to be divorced from professional practice in primary schools. The links and co-ordination among the three major areas of teacher preparation were not well formalised to the extent that there was some avoidable duplication in the content offered in the three areas. There was reported little exchange of syllabuses and more importantly schemes of work across the sections. There was no systematic plan for co-ordination of planning between and across departments. Lecturers were not happy with the fragmented approach and the poor linkages and exchanges among departments which were largely at the informal level.

Some 60% of the interviewees were concerned also about internal staff transfers from one section to another which left a section under-staffed or made the lecturer transferred relatively inexperienced in the new department. In two colleges, experienced members of the science department who participated in the development and revision of the primary school Environmental Science syllabus had transferred to either TOE or Professional Studies leaving staff who had relatively little experience with the environmental science curriculum. Individual sections or individual lecturers may share or exchange schemes of work and adjust theirs accordingly, but by and large, the self-reports in the colleges revealed that this was not frequently practised.

Interpretation and Relationship to Primary Environmental Science

Appreciation of the primary ES syllabus among lecturers has improved but, admittedly, lecturers had not been able, in their teaching, to implement methodologies in the primary ES syllabus. With only a few copies (± 4 sets) of the ES syllabus, colleges were finding it difficult to teach syllabus interpretation. In almost all colleges there was a movement from content orientation to skills orientation even if this movement is not reflected in the ES college syllabuses and assessment schemes, or any other documents accessed. There was an evident mismatch in what colleges and what schools were assessing as outcomes of instruction in ES or science. In most colleges lower level skills were given more attention in Applied ES than higher mental skills. The higher mental skills are known and sometimes included, but not in a systematic and deliberate manner. Greater than 60% of science lecturers expressed difficulties in incorporating higher mental skills in their teaching and in integrating science with other subjects. They lacked confidence to teach "integration" to their student teachers yet ES which they will eventually teach is an integrated subject. In primary schools ES is expected to be taught in ways that demonstrate for pupils its connectedness to the rest of the school subjects.

Analysis of Teaching and Learning Environment

The analysis of the college teaching and learning environment was done in relation to availability and suitability of science infrastructure; the experience of staff in science departments; participation in staff development activities; the nature of students in science courses; and the methodologies in use and information resources.

Availability and Suitability of Science Infrastructure

All colleges have laboratories which vary in size and resource availability. However, the laboratories are oriented more towards "classical science teaching" and generally are "over-equipped" relative to primary school ES teaching. The laboratories are not well adapted for ES teaching and it is not clear how they will be in the future. Up to 60% of the science lecturers prefer to have a workshop for ES material production and/or modification of the existing laboratory to make it suitable for supporting ES teaching.

All colleges except one have an environment that is suitable to support the teaching of topics in the primary school ES syllabus; a variety of vegetation, insects, land forms, gardens, and other features in the college campuses or around campuses was observed. While some colleges have started efforts to teach with and in this local environment, this was not done sufficiently due to two constraining factors. First, main subject syllabuses followed were not yet adapted for ES teaching and, second, many lecturers had relatively little experience in teaching using the environment as a laboratory. Teaching with the environment as a laboratory is very important because upon graduation, the students will be posted to schools where a science laboratory is non-existent. Further, the primary ES syllabus demands the use of the environment as a laboratory for pupils to acquire scientific knowledge and to develop various scientific skills through practical experience.

Experience of Staff in Science Departments

There was a desire among 80% of the colleges to revise their science curriculum so that it becomes better aligned to the primary school ES syllabus. Greater than 50% of the lecturers claimed to have the potential to teach the nine topics in the ES syllabus for primary schools. Colleges already had lecturers who could teach the grouped topics in ES syllabus. For example, in the primary school syllabus topics one to four (Water; Soil, Grass and Grazing; Trees and Forestry; and Crop Plants and Animals) are 'agriculture' based. An agricultural specialist would be able to handle them. Topics five to eight (Health and Pollution; Energy and Fuels; Weather; and Materials and Technology) are 'science' based and science lecturers would be able to handle them. Topic nine (Land forms and Maps) could be handled by a geographer. Presently, lecturers in science departments do not have formal qualifications in environmental science but it is not entirely necessary to wait to adapt their curriculum until formal qualifications are obtained. In the past, ES was not offered at the local university (now an Institute of Environmental Studies has been established) and therefore most lecturers' education was in discipline science. The consensus was that, with more seminars such as those organised and offered by BEST, the lecturers would adapt readily to the demands of ES teaching and teacher preparation.

Less than 25% of the science lecturers have previously taught in primary schools (those who did have relatively short experience of a few months to a year or two);

more than half have experience in teaching at the secondary level, having gone through a secondary teachers' college or through the Grad.CE programme. Lack of primary school teaching experience led to the perceived gap between what happens in primary school and what happens in college. The lack of knowledge of primary school pupils is one of the reasons why they cannot give realistic demonstrations to student teachers. At the same time there was a greater bias towards content mastery than towards skills development.

Adaptation to college teaching was reported to be a problem by approximately 40% of lecturers, especially those recruited from secondary schools or colleges. No structured induction into primary college teaching of new lecturers was done, i.e., induction to college teaching was not formalised. First, in college they had to deal with adult students, second, they had very large classes, and third, they simply did not know whether or not the methodology they used with younger students would be applicable or adaptable. Virtually all lecturers suggested the need for closer interaction with primary school teachers. First, to make colleges more responsive to real needs of primary school teachers, second, to gain insights into the reality and practical problems of primary school teaching, and third, to enable colleges to adapt their curricula and teaching in meaningful ways.

Participation In Staff Development Activities

Opportunities for college based internal staff development activities were reported to be very few. There were also relatively few lecturer exchange programmes with other colleges. The main mode of exchange with lecturers from other colleges was when the lecturers were appointed external assessors by the Department of Teacher Education, University of Zimbabwe. While they find this experience to serve as external assessors in another college or the opportunity for interaction with members from another college 'beneficial', the primary college lecturers were concerned that some of the external assessors appointed to their colleges were from secondary teachers' colleges. These assessors were able to review and appraise work and content in the main subject but little insight concerning methodological issues in applied education and curriculum depth study. Another recent and important means to exchange with lecturers from other colleges was through participation in the BEST seminars and workshops. Before BEST seminars, lecturers asserted that they "did not know each other." In addition to the opportunity for professional interaction and exchange, some lecturers felt that BEST seminars should also assist with overcoming the methodological difficulties they have with specific topics in the primary school syllabus, e.g., health and pollution, maps and land forms, materials and technology, and weather.

Nature of Students in Science Courses

The number of students in ES main subject is ranges from 21 to 50 and these figures are comparable to those of other main subjects. Students who study science main subject passed (Grade C or better) at 'O' level. In applied education approximately 1 to 2% may not have a science background. In a few colleges, a noted problem is that although students may have passed science at 'O' level, they do not volunteer to study it in college as a main subject. Those who did were reported to perform relatively well in science. For example, in the majority of colleges, performance is said to be average but when science is combined with agriculture they performed above average. The change to ES main subject was expected to appeal to more students.

Student performance was reportedly affected by the predominant use of lecture-discussion methods in dealing with large groups of students (there are 3-6 lectures in science departments depending on college size). At least 50% of the lecturers admitted that they lacked practical training in large group organisation, dynamics and management and in team teaching. This created obstacles when teaching applied education where combined groups can be as large as 80 to 130. Problems with the language of science and with written language in general also hampered student performance. Some failed to present arguments logically, had negative attitudes, and others lacked both mathematical and scientific skills. Lecturers commented that their students perceived learning science as memorising facts and could not design experiments. All student focus group interviews established a perception that they did not to appreciate and value problem solving approaches and/or the development of scientific skills. This problem was connected to both their school and college experiences which under-stressed problem solving, self study and over-emphasised mastery of factual content.

Methodologies in Use and Information Resources

Lecturers are now adopting at different rates, active learning techniques suggested in the ES primary syllabus. They however reported that active learning methods were not popular with students. Students had perceived difficulties in dealing with application, analysis, or synthesis tasks, and problem solving preferring "to reproduce from books." Failure by students to engage in high mental skills was reported to be caused by inability to use exact language, to follow an argument logically, and/or inability to apply mathematical and scientific logic. Lecturers did not seem to find a solution to this problem which they viewed system wide. On the other hand, students disagreed with this view blaming instead the over-reliance on the lecture method, lack of focus on developing scientific skills, and overemphasis on memorisation of factual content in college science teaching. The overall situation was that, final year students were not yet confident with the interpretation and implementation of methodologies proposed in the primary ES syllabus.

Three factors were thought to contribute to rate of change in teaching and in confidence among student teachers. First, changes to the primary science curriculum were communicated to all colleges in the first half of 1996, two years after the ES syllabus was published. The communication of the changes was not directly from the CDU. Further, by the end of May 1996, sets of syllabuses supplied to the colleges averaged about four sets. This number was too few for easy access and reference within a college. There was no accompanying information on proper interpretation and use of the syllabus.

Second, an assessment of library stock showed that less than 40% of the colleges had too few primary science teaching textbooks and nearly all colleges did not have books directly relevant to the teaching of ES. Most books in libraries were useful in supporting teaching of discipline Science. Numerous science books, however, carried content information on some ES topics. Lecturers and students did not seem to use these books to extract content relevant to their syllabuses or to the ES primary syllabus. The titles and headings of chapters are different from the chronology of the ES-topics in the syllabus. Both lecturers and students required the development of a specific book giving topic by topic information on ES.

Third, for various logistical problems cited, e.g., unavailability of reliable transport, field-based support and supervision of classroom based Curriculum Depth Study and teaching practice was difficult. Students were rarely observed teaching ES.

First, there was no college policy on subject specific supervision and therefore subjects like Mathematics and Languages which were scheduled early in the school day were supervised more frequently. Second, the supervision of students teachers was not based on subject specific criteria to reflect the varied methodological demands of particular subjects. Third, students' confidence affected supervision of ES. /Some preferred not to teach ES for supervision purposes. Finally, effective supervision of ES depended on the knowledge and confidence of both lecturers and teachers serving as mentors in the school. At the time of analysis, this confidence was low.

Discussion

The analysis established that there are both structural and practical problems in the everyday teaching process in the colleges. The structural problems could be solved within colleges and also by good co-ordination between the Ministries of Education and Higher Education. What happens in primary schools should be the basis of what happens in colleges. Colleges prepare teachers for primary schools and yet when looking at the syllabuses there was a certain disconnection. When colleges design their 'own' syllabuses, they take more or less the structure of the discipline as the structure of their syllabus. This approach is not the most appropriate way for the primary school level which is the final system of application. Co-ordination, of course, becomes very difficult when concepts are derived from the structure of the discipline and not from the application situation in primary schools. In most cases, the college syllabuses are heavily overloaded, highly theoretical, and not very well adapted to primary school learning.

These structural problems have a direct influence on the everyday teaching practice and the practical preparation of students. The Science main subject is taught in an overloaded, theoretical, and content oriented way which is sometimes totally disconnected from the topics of the primary school ES syllabus. But also in applied education the content taught was very often not in line with the primary school syllabus. Both courses are more content than skill oriented. Lecturers argue that the quality of secondary school science teaching influences the teaching reality in applied courses. Since everything was taught in a theoretical manner in secondary schools, they had to spend much time on refreshing students' knowledge on science content instead of just exercising the teaching of science.

Lecturing was still the main method in use during college main subject and applied education courses. If any skills are taught, then the focus is put on scientific skills like observing, measuring, calculating and so forth. Skills like judging, interpreting, predicting, and concluding are given less attention in ES-teaching. During discussions with lecturers the terms 'low level skills' and 'high level skills' were used in order to describe the difference. Low level skills are those reproducing or translating knowledge presented into another 'language' whereas high level skills lead into 'the unknown'. High level skills demand different mental activities than the low level ones, e.g., for predicting one needs to combine known facts in a way which allows to guess or forecast what will happen in an unknown situation (similarly judging and interpreting requires thinking operations where known facts lead to yet unknown concepts or findings). These skills are the basic skills allowing problem solving and applications; that is, take fact A and fact B, look at situation C and see what one can do with A and B when wishing to change situation C bringing it to a desired situation D.

During the discussions, it became clear in several situations that science lecturers were also not very clear about the differences among skills. For example, they knew that they were expected to teach 'problem solving' and 'application' without knowing how to 'operationalise' these composite and complex 'skills'. They did not know how to translate them into practical teaching. The dilemma is that the lecturers are the product of an educational system which hardly emphasised higher level skills but which concentrated on reproducing content. Exam standards reflect this orientation. Being a product of this educational system, they have difficulties to reorient their teaching even though theoretically they 'know' that teaching can be different.

ES is a subject which more than others can address high level skills. It has a much bigger potential of making pupils/students think. Besides teaching 'reading', writing' and 'calculating' which are the three basic 'cultural techniques' in a modern society, primary schools have the task of developing children's capacity to think. If this is neglected or not done because teachers are lacking in the knowledge and the skills of 'making pupils think' then schools (and at a later stage also universities) produce adults who just know many facts but do not know anything to do with them. Youth and adults coming out of such a system even have difficulties to find new, unknown information in various sources (books, videos, seminars, etc.). They have difficulties in realising the relevance of given information to their everyday application situation. They are neither efficiently prepared for further studies nor for self studies. They will always ask for books written exactly for their situation or will ask for 'recipes' during seminars. Higher level skills thus are an essential part of education, even at primary level where they could be included in a child adapted way (e.g., instead of 'hypothesising' one uses 'intelligent guessing', i.e., "what do you think will happen, if ...?"). These skills are very often 'key qualifications' for further studies and also the ones for functioning effectively in daily life.

To a certain degree, the ES primary school syllabus reflects these considerations. It emphasises more on skills and less on content. The assessment scheme refers to skills (application, deductive reasoning) as well as to content (factual recall). The problem is that when it comes to the formulation of objectives and of examples on assessment exercises for the different topics throughout the seven years of schooling, nearly always, lower level reproductive skills like describing are proposed. There are hardly any higher level skills even though the final assessment is said to include 'application', 'deduction,' and 'problem solving' with its constitutive skills like 'design', 'hypothesise', or 'justify', for example. Regardless of some of these deficiencies and sometimes some confusion about skills, the primary ES syllabus leads in the right direction which is worth supporting.

The teaching and learning reality in primary schools described in Shumba, et al. (1997) illustrates the focus on the lower level reproductive skills. When teachers taught ES, they brought items from the surrounding environment into the classroom or left the classroom with the intention of observing some objects. Teachers gave some initial information (facts) on the objects to observe before looking at them. After the observation questions about the objects were asked. The formulations of the answers were exactly those used during the introductory presentation of the objects by the teacher. Pupils did not to answer according to their own observations or findings. They were repeating what the teacher said in the beginning of the lesson. Even though making pupils see the objects they are talking about is progressive, teaching is still oriented towards content by using methods addressing low level skills. In many cases an observation is not really exploited making it a real source of learning. Few teachers were observed asking 'what do you think will happen if ...', (which would be 'hypothesising' or 'predicting' or 'intelligent guessing'), 'what do you think is the reason for ...?', or 'what do you think? where can we find the answer?' or ''what do you think? how can we find out what we want to know about object X?' (which would be 'design a research concept'), or 'what do you think we can do with this observation /information?', and so on. The teaching observed was largely tell, look and repeat.

At the college level, lecturers also admitted that their teaching methods rarely addressed, high level skills. They were not reflecting with students about methods on how to address high level skills at primary school level, to make prospective students aware of these methods and to make them use these methods. In fact, ES-related teaching methods which should be in the centre in the applied education courses are very often taught theoretically, with few demonstrations.

Conclusions

Lecturers' answers or visions indicate a strong desire to improve ES in colleges and schools. There seems to be need for a national forum on ES teaching which brings together policy makers, decision makers, and practitioners to address issues such as revision of TERC guidelines for Main and Applied syllabuses, better linkage of college syllabuses with primary school syllabuses, the value of high level skills for the development of personalities and the country, the revision of assessment schemes including ES in Grade 7 examinations, and to discuss the perspectives of ES and science education at secondary and tertiary level. Decisions on improvements in these areas would create a climate of security for lecturers when working on new syllabuses and reorienting of preparation the students for teaching in primary schools.

During the situation analysis seminar this idea was developed and it was proposed to start as soon as possible with a series of meetings facilitated by the BEST project. Such a seminar should not only reflect on how to construct a "Main Environmental Science" syllabus but also to include ES-Applied in the discussions. It is true that the situation in Applied Education is already more advanced than in Main Subject, but this does not mean that it is perfect. On the other hand, a well adapted course design for applied education could be considered a basis and a reference point for the development of a good Main subject syllabus. For example, topics taught in ES-Applied could also be treated in Main Subject during the same week. This creates the possibility of giving topic-related enrichments to main ES students in order to better prepare them to become ES resource teachers for primary schools.

Figure I shows a structure of ES-applied which seems to have the potential to improve many aspects of ES teacher preparation. The nine primary ES-topics can be covered during a year when concentrating on three topics per term. Each term consisting of approximately three months gives the opportunity to sacrifice a month to each topic.

Figure 1: Scheme for ES Teaching During the First Year of Primary Teacher Training

Term 1			Term 2			Term 3		
1st month	2nd month	3rd month	1st month	2nd month	3rd month	1st month	2nd month	3rd month
Water 1	Soil 1	Trees 1	Crops 1	Health 1	Energy 1	Weather 1	Mat.1	Landforms 1
Water 2	Soil 2	Trees 2	Crops 2	Health 2	Energy 2	Weather 2	Mat.2	Landforms 2
Water 3	Soil 3	Trees 3	Crops 3.	Health 3	Energy 3	Weather 3	Mat.3	Landforms 3

Key: Mat. = Materials

Each term has about 11 to 12 weeks which means that 2 to 3 sessions per term could be used for general introductions and other general aspects of ES-teaching.

Teaching in such a well organised ES applied education course should concentrate on the aspect of supplying skills for teaching ES in primary schools and not on content. If students suffer from problems of understanding the concept of a topic then they should be initiated to self studies in the library or in tutorial groups. ES-time should not be mainly used for content revision or enrichment. Ideally, students should have studied the content of a topic before attending the applied lesson in the classroom so that lecturers can concentrate on teaching methods and teaching practically 'how to address high level skills,' 'how to use the environmen,t' 'how to tap local resource persons,' 'how to integrate with other subjects' and so on.

When students return from teaching practice during the second year, selected aspects of practical teaching could be deepened on the basis of their experience. General aspects like 'addressing high level skills', 'use of the environment', 'local resource persons', 'subject integration' could now be at the centre of learning and should determine the planning of lessons instead of following the topic-list of the ES-syllabus. Students would now be able to contribute their own observations and difficulties during teaching practice, they could propose solutions, simulate them, and so on. In the third year they will understand much better what everybody is talking about when these abstract terms are used. During the first year, they experiment with the teaching of those topics but without treating them theoretically, and now, during the third year, they can go deeper into the concepts of teaching ES.

These proposals may be considered as guiding principles for reformulating college science syllabuses and teaching. The most important aspects are a better linkage between primary school ES teaching and teacher preparation in colleges and the concentration on teaching methods in ES Applied courses. In order for this to happen, as established in interviews and during the workshop, three major areas of training needs for lecturers have been identified and must be dealt with, namely, how to teach high level skills, how to make better use of resource materials and persons, how to create and manage ES workshops, skills for the production of didactical materials, and use of varied methodologies in primary school and college teaching.

These findings point to the need for systematic and systemic support for pre-service teacher training which should lead to improvement of the quality of pre-service teacher preparation. The findings are certainly informative to those who may be considering interventions in pre-service primary teacher preparation. A more detailed account of the findings is in the report prepared by Bucholz, Mukwirimba, and Shumba (1997).

References

Barrow, D. & Tobin, K. (1993). Reflections on the role of teacher education in science curriculum reform. In Peter A. Rubba, Lois M. Campbell, & Thomas M. Dana, (Eds.). *Excellence in Educating Teachers of Science.* Auburn: Association for the Education of Teachers in Science.

Bucholz, J., Mukwirimba, A., & Shumba, O. (1997). Situation analysis on primary teacher preparation for Environmental Science education in Zimbabwe and Proposals for a support programme for primary teacher training colleges. Harare and Frankfurt: Curriculum Development Unit and Technical Co-operation of Germany.

Hall, G. E. (1992). The local Education Change Process and Policy Implementation. *Journal of Research in Science Teaching,* 29, 8, pp. 877-904.

Lewin, K. & Bajah, S.T. (1991). *Teaching and Learning in Environmental and Agricultural Science.* Bonn: German Foundation for International Development.

Ministry of Education. (1994). *Primary School Environmental Science Syllabus.* Harare: Curriculum Development Unit.

Shumba, O. (1995). Environmental and Agricultural Science: Are the Primary Colleges Meeting the Primary Level Demands? *The Zimbabwe Bulletin of Teacher Education*, 4; 2, pp. 84-94.

Shumba, O., Voss, I., & Zilg, A. (1997). *Baseline Survey of the Better Environmental Science Teaching Programme (BEST) in Primary Schools and Teacher Training Colleges in Zimbabwe*. Harare: Curriculum Development Unit and Technical Co-operation of Germany.

TERC. (1986). Report of the Teacher Education Review Committee. Harare: Author.