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Exploring the Gap between College Cluster Natural Science and 1st Cycle Primary School Environmental Science Curriculum

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Abstract

The purpose of this study was to explore the gap between college cluster Natural Science and School Environmental Science Curriculum. It was conducted realizing the fact that primary level science education is a corner stone to lay a foundation to get young citizens who are interested and attracted towards natural science and other technology fields as these fields determine greatly the advancement of a nation. The study analyzed different documents like college cluster natural science curriculum guide and school environmental science curriculum guide, environmental science textbooks, environmental science MLC document, and primary school science kit manual. In addition, the study included 14 Debre Markos & 7 Injibara Teacher Education Colleges' natural science instructors and 28 school environmental science teachers working in and around Debre Markos Town as human participants of the study. Objectives, contents, teaching learning methods, assessment techniques, and learning experiences were investigated in the documents mentioned earlier. Sample units were selected using availability sampling technique. Data relevant to the study were collected using open ended & closed ended questionnaires from college and school science teachers, document analysis, and discussions with college and school science teachers. Quantitative and qualitative data analyses techniques were employed. Data collected from closed ended questionnaires and some part of the document analysis were analyzed quantitatively whereas data collected from open ended questionnaires, some part of document analysis, and discussions were analyzed qualitatively. Based on the analyses of the data from the multilevel sources, conclusions were drawn and recommendations were forwarded to concerned authorities.

Key words: Primary School Science Education, College Cluster Natural Science Curriculum, School Environmental Science Curriculum,

Introduction

Science is a discipline that builds and organizes knowledge systematically using scientific methods to try to explain the events and phenomena of nature in a reproducible way. Science is thought to have two dimensions: the body of knowledge that has been accumulated by scientists and the process by which knowledge is acquired (Kaushik, and Sharma, 2002; Nanda, 2002). It is essentially a practical subject where a systematic approach to studying phenomena, including careful observation, accurate measurement and careful experimentation and collection of data is used. Realizing that science and technology are the bases for development in today's modern world, the Ethiopian Federal Democratic Republic Ministry of Education prepared strategies for improving science and mathematics education in Ethiopia (Eshetu, et al., 2009; MoE, 2009). In this strategy, the Ministry of Education underlined that sustainable and all-round development of a country depends on availability and mobilization of scientifically and technologically literate work force.

Several criticisms were made on Ethiopian science education since the beginning of the first modern school in Ethiopia in 1908 (Temechegn, 2001). Some science educators argue that science education in Ethiopia like other subjects was not for improving the life of people in science and technology. In a national conference held in Addis Ababa from 31 January to 3 February 2011 concerning the familiarization of strategies for improving science and mathematics education, it was pointed out that science education at the start was for administrative purpose (MoE, 2009). On the other hand, during the reign of Emperor Haile Sellasie I, for example, there were no official curricula as well as textbooks from Ethiopia; Students were expected to reflect; Teachers were neither fully qualified nor appropriately trained; These teachers mostly came from India and Peace Corps

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Programme and were not trained to meet with the specific needs and problems of the Ethiopian society (Messay, 2006). In view of that, science education in our country until recently was discarding of reflecting the realities, interests and needs of the Ethiopian societies.

In general, low educational quality, irrelevance, inefficiency and low access to education were the features of Ethiopian education service before 1991 (TGE, 1994). To alleviate these shortcomings, the New Education and Training (ETP) policy of Ethiopia was launched in 1994. Following this new policy, the national curriculum prioritized science and mathematics subjects at all grade levels in curriculum development and implementation programs. As a result the new curriculum framework indicated that it is the learner centered approaches and the constructivist epistemology that the teaching learning process should follow in order to be efficient and effective.

The objectives for teaching science in schools are found embedded in the Ethiopian science curriculum. These include science for meeting personal needs, for resolving current societal issues and problems, for developing student abilities to deal with the world around them, for assisting with career choices and for further study (MoE, 2009). Based on the above objectives, students are expected to develop critical thinking & creativity skills, making informed decisions on local and national societal and political issues, and for their further study. When we talk about the objectives of science education and the approach to science teaching, we should again ask ourselves the way student science teachers are trained. Since children are curious and eager to explore the world around them, science teachers must be competent enough for developing students' interest in science. Moreover, teachers must be skilled enough to provide a greater variety of activities because students learn about science in a number of ways.

Following the launching of the new education and training policy, new science curricula and textbooks were developed for the two cycles (1st cycle and 2nd cycle) of primary school. These levels of schooling is very important to establish a foundation to get children who are interested to study engineering and other fields of natural science in their later age. To successfully achieve the 5 years growth and transformation plan of the country, the Ethiopian government has recently designed a strategy through which 70% of the students that join higher education are expected to study natural science and engineering (Eshetu et al, 2009). Consequently, measures should be taken to make students more motivated towards science. According to MoE (2009), there are many simple, interesting and non-hazardous experiments that can be used to make students attracted towards science in primary schools with equipments made from simple and locally available resources like plastic bottles, string, and meter rules.

Environmental science is one of the subjects offered to primary level 1st cycle schooling. This subject is the integration of social science, natural science, agriculture, hand-craft, environmental and health education, home economics, and art (ICDR, 2004). The general objective of 1st cycle environmental science education is to help children grasp basic education which is relevant to the age, physical and mental level so that it prepares them for the next grade level. Moreover, environmental science education acquaints children with their community production activities and services, help them to be problem solvers, and train them to work with farmers and crafts- men based on their interest and abilities (Ibid).

A child gains knowledge and experience in different aspects and it seeks to understand his /her environment using the experiences. Children understand their environment in integrated way. Therefore, it is necessary to help them relate the knowledge and experience they get in school to the knowledge and experience they get outside the school (ICDR, 2004). Consequently, school environmental science teachers must be competent to help children meet the baseline standards set for each grade level by using suitable teaching learning methods and approaching science as a process, evaluating students achievement and progress continuously, using the science kit manual and additional teaching aids from locally available materials, and recognizing that primary level science is based on materials available from the environment and can easily be prepared by teachers and the environment itself is a good source of teaching aid for this level (ICDR, 2004; ICDR, 2003; MoE,2008). Consequently, teachers of science must be fully trained in all aspects mainly with subject matter knowledge & skills and pedagogical skills and teacher training institutions have to ensure that all science teacher trainees meet the expected criteria. The strategy document for improving science and mathematics education in Ethiopia emphasized the link between the school curriculum and the teacher training curriculum (MoE, 2009) and other sources promoted the symbiotic relationship between school education and teacher training institutions (NCTE, 2009). It was with this understanding that the present study was conducted. Thus, this study was designed to explore the perceived mismatch between college cluster natural science curriculum and school environmental science curriculum in Amhara Region.

Statement of the Problem

Even if the government of Ethiopia gives due emphasis for quality of education, many studies on the country's education publicize that quality education in Ethiopia is an issue not yet addressed (USAID, 2008; Derebssa, n.d). The national learning assessments conducted in the years 2000, 2004 and 2008 for grades 4 and 8 students show that the average score for mathematics was less than 40% while it was less than 50% for science subjects (NOE, 2008). Environmental science is one of the key academic subject areas selected for testing pupils' in the National Learning Assessment to determine the various levels of pupils' performances after completing grade four. The findings of the National Learning Assessments conducted in the years 2000, 2004 and 2008 for grades 4 and 8 students show that the average score for mathematics was less than 40% while it was less than 50% for science subjects. In addition, decline in achievement level was observed from findings of the third National Learning Assessment when compared with the first and second National Learning Assessments (NOE, 2008).

Low performance in science subjects is very aggravating as the country is striving to promote science education. Different problems can be mentioned for the low achievement of science subjects as there are different stakeholders and variables that contribute for quality science education. Thus, an intervention must be made by identifying problems that exist related to science education.

Discussion with in-service science teacher trainers and pre-service trainee science teachers who are working their practicum, independent teaching, mentioned that there is a mismatch between school natural science curriculum and college cluster natural science curriculum. These mismatches between school science and college cluster natural science curriculum are related to content, skills in handling hands-on and minds-on activities, the use of a wide range of teaching and learning strategies, the use of methods for continuous assessment and methods of meeting the needs of students with special educational needs. Especially, school environmental science teachers failed to do daily life science practical activities which promote indigenous or local knowledge. It is believed that students of science should know the practical applications of the science contents, the methods of science, and the resulting social implication and applications of science (Temechegn, 2001; Venkataiah, 2002).

Moreover, eye-boring examinations of contents and practical activities in 1st cycle primary school environmental science textbooks, cluster natural science curriculum guide, , environmental science curriculum guide and minimum learning competency document for grade one to four revealed that there are mismatches between the two curricula. On the other hand, from literature some science education researchers suggest that one of the main causes of crisis in science education is the failure of colleges and universities to do an adequate job of preparing future science teachers (Mc Dermott, 1990). In our context, colleges of teacher educations should assure that their training curriculum be in harmony with school curriculum. In addition, the MoE (2009) and Eshetu, et al. (2009) pointed out that one of the goals to avert the situation is to work to suit the existing teacher education curriculum with the changes made in the school curriculum. Thus, the researcher planned to explore the inconsistency between college cluster natural science curriculum and school environmental science curriculum to contribute his part in the campaign of taking interventions to keep quality of science education in primary level schooling.

Consequently, this study has been organized to answer the following four main questions:

- To what extent the objectives of college cluster natural science curriculum targeted to meet the objectives of school environmental science curriculum?
- Are the contents of the school science curriculum for each of the natural sciences (Physics, chemistry and biology) specified in detail in the college cluster science curriculum?
- Do cluster natural science student teachers get appropriate skills in making hands-on activities and teaching aids from locally available resources?
- Are student teachers of science trained in the use of a wide range of teaching and learning strategies?

Purpose of the Study

The general objective of this descriptive research was aimed at exploring the mismatch between school environmental science curriculum and college cluster natural science curriculum of the Amhara region. More specifically, the study has attempted to:

- determine the extent to which the objectives of college cluster natural science curriculum is in harmony with 1st cycle primary school environmental science curriculum.

- assess the extent to which the contents of the school science curriculum for each of the natural sciences (Physics, chemistry and biology) specified in detail in the college cluster natural science curriculum.
- investigate whether or not cluster natural science trainees get appropriate skills in making hands-on activities and teaching aids from locally available resources.
- assess the extent to which the would be science teachers are trained in the use of a wide range of teaching and learning strategies.
- suggest possible solutions to improve the link between school environmental science curriculum and college cluster natural science curriculum.

Significance of the Study

Primary school science education in our country is promoted this time than any time before. This is because primary level schooling is a level where foundation is laid for scientific inquiry. Upgrading of school science teachers to diploma (10+3) level is among the many activities undertaking to promote quality science education. Thus, this descriptive research is concerned with exploring the mismatch between college cluster natural science and school environmental science curriculum. The findings of this research are expected to benefit various individuals, groups, and institutions.

- It will enable college natural science teacher educators of the Amhara Regional State in acquainting them with mismatches between the two curriculums. For example, college natural science instructors will use the findings of this research to fill the gaps that exist between college cluster natural science curriculum and school environmental science curriculum during pre-service and in-service program of school science teachers training. More specifically, it will help college natural science instructors concentrate on practical activities which can be performed with simple and locally available materials.
- It presents valuable comments and recommendations for science curriculum experts, for teacher education colleges, and the Amhara Regional State Education Bureau to bring immediate solutions and for further update.
- Since science education has become a national as well as global issue, this research will be used as a starting point for other interested researchers who will conduct similar researches in the area to improve quality science education in primary schools.
- Governmental and non -governmental organizations working to promote quality science education in primary schools can use the findings of this research to fill the gaps identified.

Delimitation of the Study

Even if the research participants of this study were 14 Debre Markos and 7 Injibara colleges of Teacher Education Natural Science instructors and 28 primary school 1st cycle environmental science teachers in and around Debre Markos town, it can be said that the research is delimited geographically to Amhara Region. This is because the 10 teacher education colleges of the region are using the same curriculum and the schools too are implementing the same curriculum. It will be more useful, had it include the opinion of college natural science from other colleges of the region and school environmental science teachers working in other parts of the region. On the other hand the study is delimited conceptually to explore the gaps between teacher education cluster natural science curriculum and school environmental science curriculum in the specified cycle. It did not consider the relevance of the school environmental science curriculum. The study explored what is omitted in the college cluster natural science curriculum taking the school curriculum as a standard because one of the missions of teacher education colleges is to train competent teachers who will satisfy the demands of primary schools. However, since the main source of data for the study was document analysis it is believed that the samples taken might give reliable data to draw reasonable conclusions from findings of the research.

Limitation of the Study

Only limited human participants were taken as sample units of the study. Regular duties of the college along with financial and resource constraints were serious challenges confronted the researcher to complete the study. As a result it was difficult to undertake focused group discussions and interview with science curriculum experts. Nevertheless, since the main data sources were documents, the researcher set forth maximum effort to use the limited resources available effectively and collected relevant data using the sample units available to

complete the study on time. On the other hand, the findings of this study would have been more comprehensive and trustworthy could these limitations have been tackled.

Conceptual Framework

Primary School Science Curriculum

Science encompasses knowledge and understanding of the biological and physical aspects of the world and the processes through which such knowledge and understanding are developed (NCCA, 1999). It is a way of exploring our environment in particular and the world at large using careful observation, accurate measurement, careful experimentation, and collection of data (MoE, 2009). On the other hand, effective science education results in citizens who are scientifically literate and better able to make informed decisions about issues involving science and technology that affect their present lives, the lives of future generations, and develop the problem solving capacity of citizens (ESTA, 2006; MoE, 2009; Thornton, 1999).

Primary school science curriculum involves helping children develop basic scientific ideas and understanding, which will enable them to explore and investigate their world. It helps to understand the key concepts and principles of science and be able to use this knowledge and ways of thinking in everyday life (Kober, 1993). The focus of science education in primary school will be on helping children to modify their ideas or alternative conceptions and develop more scientific understanding. To achieve this objective, science curriculum should be related to everyday life and teachers of science should receive proper training to make use of simple resources and science kit to do science (MoE, 1999).

The new curriculum framework of our country indicated that it is the learner centered approaches and the constructivist epistemology that the teaching learning process should follow in order to be efficient and effective in implementing the science education at all levels of schooling (MoE, 2009). Yager as cited in Temechegn (2001) defined constructivism as a model of how learning takes place, rather than a theory of how rationality develops. Thornton (1999) pointed out that listening to someone's talk about scientific facts and results is not an effective means of developing concepts. Students of all ages learn science better by actively participating in the investigation and the interpretation of physical phenomena. This implies that student science teachers must be educated in a way to apply active teaching learning methods.

Teacher education researches indicated that teachers teach in a manner consistent with their own way of learning (Chatterje, 2008). This implies that teacher education institutions play pivotal role to effective science education in the primary schools as this level is important to lay a foundation for further study. The natural curiosity of children, eager to understand their surroundings, is often diminished by instruction that discourages inquiry and discovery. In many countries science education in the lower grades has lacked a clear focus and has been provided by teachers ill- prepared to deal with science content (NCREL, 1995).

Teacher Training Curriculum

National Council for Teacher Education (NCTE) of India justified that teacher education and school education have a symbiotic relationship (NCTE, 2009). It further explained that developments in teacher education and school education mutually reinforce the concerns necessary for the qualitative improvement of the entire spectrum of education. The school curriculum is reformed to include priority areas and sectors of the country to satisfy community needs so that teacher education colleges should in turn satisfy the changing demand of schools. Thus, science teachers must be trained in the way to satisfy the demands of schools and the needs of the community at large. The strategy document for improving science and mathematics education in Ethiopia suggested different methodologies for orienting student science teachers on how to teach science. One of its approaches is that initial teacher training should be strengthening to ensure that student teachers are confident in their scientific subject knowledge and also a wide range of active teaching and learning strategies, including high quality practical work which promotes thinking skills (MoE, 2009). The document further explained that at present teachers lack confidence in subject knowledge, practical work and active teaching and learning so that student teachers need guidance and training in these aspects.

The link between Teacher Training Curriculum and School Curriculum

As the vision of teacher education colleges is to prepare human power that fulfils the demand of schools, the two curriculums must be in harmony. The National Council for Teacher Education (NCTE) argued this point as follows:

A teacher functions within the broader framework of the school education system-its goals, curricula, materials, methods and expectations from the teacher. A teacher education curriculum framework needs to be in consonance with the curriculum framework for school education, and a teacher needs to be prepared in relation to the needs and demands arising in the school context. As such, it needs to engage with the question of the learner, the learning process and the content and pedagogy of educating teachers. The expectations of the school system from a teacher change from time to time, responding to the broader social, economic and political changes taking place in the society. The issue of teacher education accordingly has to be discussed in the much wider and changing context and demands of school education (2009:5).

From the above quotation it can be implied that the teacher training curriculum needs to be in congruence with the school curriculum. Teachers' education take an analytical and open-minded approach to their work, that they draw conclusions based on their observations, and experiences and that they develop their teaching and learning environments in a systematic way (Niemi and Jakku-Sihvonen, 2009). As professionals, teachers need a lot of practical skills that will enable them to mediate something to individual or groups and to construct knowledge jointly. The academic contents and practical skills must not be seen as separate or exclusively; they are always complementary in the teaching profession.

The strategies document prepared by the Ethiopian Federal democratic republic of Ethiopia to improve science and mathematics education in the country emphasized that it would be the responsibility of the teacher training institutions to insure that all trainee science students met the necessary content knowledge, understanding and skills (MoE, 2009). When science education is considered, the content of the school curriculum for each of the science subjects should be specified in detail in the teacher training curriculum for student science teachers. This does not mean that the courses that student science teachers take are only bounded to the contents of primary school science textbooks. There is a common consensus that primary school science teachers lack the necessary knowledge, skill, and understanding of the science concepts. Thus, an intervention must be made to fill these mismatches so that particularly difficult areas of subject knowledge could be taught in the Teacher Training Colleges, but students would be expected to master other areas through self-study (Ibid). Student science teachers must also become confident in their skills in carrying out, and managing, good quality practical work, including safety related aspects. They need training and guidance in making equipment and teaching aids from everyday resources and using these.

In addition, teachers of science must be fully trained in the use of a wide range of teaching and learning strategies. These active learning methods should be specified in the teacher training curriculum. There should be checks to ensure that teacher trainers use a wide range of methods with their students. Student teachers should be trained in the features of good teaching, including effective methods for continuous assessment, and in meeting the needs of students with special educational needs. There needs to be clear guidance on planning effective lessons and also in behavior management when classes are involved in active learning (ibid).

In general, teacher education colleges should design/revise their curriculum in line with primary school curriculum. This is because; the ultimate goal of teacher education colleges is to train competent manpower that will satisfy the demands of primary schools. The Ministry of Education in the strategies for improving science and mathematics education in Ethiopia (2009) and Eshetu, et al. (2009) explained that teacher education curriculum should be in harmony with school curriculum.

Research Methodology and Design

Research Design

The present study has attempted to explore the mismatch between college cluster natural science curriculum and school environmental science curriculum of the Amhara Region. To attain this objective, descriptive research design was used to investigate whether the two curricula are in consistence or not. The approach or methodology followed in this study was both qualitative and quantitative. The study proposed research

questions and data were collected using closed-ended and open-ended questionnaires and different documents to answer the research questions.

Population and Data Sources

Sources of data for this study were 1st cycle primary school environmental science teachers, college natural science instructors, and the different documents shown in Table 1 below.

Table 1. Summary of Analyzed Documents

	Components Observed	Practical Activities	Contents	Objectives
Type of Document	School Environmental Science Curriculum Guide	-	✓	✓
	Teacher Training Curriculum Guide	-	✓	✓
	Grades 1 to 4 Environmental Science Textbooks	✓	✓	-
	MLC Document	-	-	✓
	Grades 1 to 4 Science Kit Manual	-	✓	-

As it can be seen in table 1 above, contents in school curriculum guide, grades one to four environmental science textbooks, and cluster natural science teacher training curriculum guide were categorized into units, subunits, and sections to see if there were missed contents in the college cluster natural science curriculum. Learning objectives in MLC document, school environmental science curriculum guide, and college cluster natural science curriculum guide (Course Outline) were assessed whether the objectives in these documents were in harmony or not. Moreover, practical activities in 1st cycle environmental science textbooks and grades 1 to 4 science kit manual were listed and counted whether or not these activities were included and covered in college cluster natural science curriculum.

The components in the documents (contents, practical activities, and objectives) were explored without taking samples. However, sampling techniques were employed to select the two groups of human participants of the study. Availability sampling technique was employed to take samples of school environmental science teachers who were working in and around Debre Markos town in 2011/2012. A total of 28 environmental science teachers were included in the study out of which 16 of them were graduates of diploma in natural sciences and 12 of them completed their 3rd year study in cluster natural science program. The researcher thought that the same curriculum was implemented in all of the 10 colleges of the Amhara Regional State in the cluster natural science (Amharic) modality.

In addition, Debre Markos College of Teacher Education and Injibara College of Teacher Education were selected purposely to get samples of natural science instructors. The former is selected since the researcher was working in this college whereas the latter was selected because of additional trainings in local language and its proximity. There were 22 and 8 natural science teachers working at Debre Markos and Injibara College of Teachers Education, respectively, out of which 6 of them were participated in the pilot study and 21 of them in the main study as it is shown in Table 2 below.

Table 2. Summary of Participants

School Environmental Science Teachers by Department		College of Instructors by Department			
Sex	Natural Science	Sex	Physics	Chemistry	Biology
Male	10	Male	6	0	7
Female	18	Female	0	0	2
Total	28	Total	6	6	9
		Total	21		

Two instructors from DMCTE were not participated since they joined the college in this academic year and as a result the researcher believed that they were novice in investigating gaps between the two curricula. From the 8

natural science teachers teaching at ICTE, 7 of them completed the questionnaires successfully and were participants of this study.

Data Collection Tools

Data relevant to this study were collected using both qualitative and quantitative data gathering tools. To collect quantitative data, questionnaires for both school environmental science teachers and college natural science instructors were used. In addition, science practical activities were counted from environmental science textbooks and science kit manual; contents and objectives were categorized from MLC document, grades 1 to 4 environmental science textbooks, and college cluster natural science curriculum guide. The qualitative data were collected using open-ended questionnaires and informal discussions prepared for teachers and instructors. Contents in environmental science textbooks were organized in grade level, unit, subsection, and section to investigate whether or not these contents are clearly specified in the college cluster natural science curriculum. Science practical activities were identified, counted, and categorized as physics, chemistry, and biology. Objectives in the college cluster natural science curriculum guide and school environmental science curriculum guide were categorized as cognitive, psychomotor, and affective.

Likert type closed ended questionnaires (ranging from 1 to 5 where the median was 3) were distributed for school environmental science teachers and college natural science instructors to explore whether or not college cluster natural science curriculum was in harmony with school environmental science curriculum. The number of items in the school teachers' and college instructors' questionnaires were 10. These items were prepared based on components of a curriculum. i.e. the questionnaire items contain questions related to objectives, contents, teaching learning methodologies and strategies, assessment techniques, instructional materials and resources. The open ended questionnaire items were presented to triangulate the data found from the closed ended items and to gather the opinion of school environmental science teachers and college natural science instructors.

Data collection Procedures

The first procedure in collection of data relevant for this study was to develop closed and open ended questionnaires based on components of curriculum. The questionnaire items and titles of practical activities were prepared in Amharic language for both the college instructors and school environmental science teachers in order to minimize language barriers. The questionnaires were given to colleagues for their scholarly comments and it is believed that this assures content validity. In addition, to assure the validation of the inferences made, some educational researchers like Erlandson, Harris, Skipper, and Allen cited in Stemler (2001) suggest that triangulation assures credibility to the findings.

After including the comments given by colleagues, the open ended and closed ended questionnaires were administered for pilot study. Cronbach alpha coefficient was calculated to check the reliability of the questionnaire quantitatively. The reliability of school environmental science teachers' and college natural science instructors' questionnaires were found to be 0.74 and 0.87, respectively. Reliability coefficient values up to 0.65 are accepted for researches conducted to investigate attitude, opinion, interest, etc towards an issue (Yalew, 2006). Thus, the calculated values of the questionnaires items indicate that the tools were consistent. On the basis of the results found from the pilot study, the tools were refined further.

In addition, science practical activities were counted and categorized as physics, chemistry, and biology focus from science kit manual and environmental science textbooks. Accordingly, the numbers of science practical activities at the start were 52, 28, and 18 for physics chemistry, and biology, respectively. In the main study, after comments from colleagues, the number of practical activities was reduced to 46, 26, and 17 for physics, chemistry, and biology, respectively since there were repetitions. In addition, some modifications of titles of practical activities were made. Finally, by incorporating the comments from colleagues and feedback from the pilot testing, instructors were asked to identify the school science practical activities which were included and covered in the college cluster natural science courses.

Methods of Data Analysis

The open-ended and closed-ended questionnaires were initially administered for 21 college natural science teachers and 33 school environmental science teachers. All the 21 questionnaires from the college natural

science participants were filled completely and appropriately, however; only 28 questionnaires were completely filled by school environmental science teachers. Data collected from open-ended questionnaires, unstructured interview with school environmental science teachers and college natural science instructors, and some part of the data from documents were analyzed qualitatively.

The quantitative data collected through the above data collection tools were coded into Microsoft Excel 2007. As a result percentages were used to compare to what extent objectives in MLC guide and college cluster natural science curriculum guide were in harmony. In addition, percentages and frequency counts were used to determine how many of the practical activities found in environmental science textbooks covered in the college curriculum. Descriptive statistics such as mean scores and standard deviations were again computed to explore the opinion of environmental science teachers and college instructors regarding mismatch between college cluster natural science and school environmental science curriculums. In addition, science practical activities which are physics focus, chemistry focus, and biology focus were counted and compared in percentages. Data obtained through open ended questionnaires and unstructured interview were organized into themes like opinions related to contents, objectives, science practical activities, teaching learning processes, assessment techniques, instructional materials and resources, special needs education, and science process skills.

Results

Based on the analyses made from collected data, the following results were obtained:

When the MLC guide and college cluster natural science curriculum guide were investigated, the objectives stated in the college cluster natural science curriculum gave much emphasis (94.3%) for scientific facts, principles, and theories (knowledge) but only 3.4% for skill related activities. On the other hand, the objectives stated in the 1st cycle primary school environmental science MLC document provided relatively fair emphasis to knowledge (42.1%), psychomotor (31.6%), and affective (26.3%) domains.

The mean linkage score between objectives of college natural science and school environmental science by college instructors and school teachers was found to be 2.1 and 2.6, respectively. This result indicates that objectives of the two curricula were found tenuous. According to NCTE (2009), a teacher needs to be trained to meet the demands of the school context and in turn teacher education curriculum needs to be in harmony with the curriculum for school education. Thus, the teacher training curriculum emphasizes the learning of scientific facts, principles, and theories. This approach does not promote school science teachers to help children learn and do science (MoE, 2009; Thornton, 1999; Kober, 1993)

From analysis of contents by grade level, unit, and section from environmental science textbooks, the contents in the first cycle primary school environmental science textbooks were clearly specified in the college natural science courses except simple machines & their types and preparing inks from flowers and leaves. On the other hand, school environmental science teachers were asked to write environmental science contents which were not covered in the college cluster natural science courses and find difficult for them. Most of them responded that there are no difficult contents in the textbooks whereas some listed the topics which were already identified by the researcher as not specified in the college curriculum.

The mean score of the link between contents of college cluster natural science and school environmental science curriculum by college natural science instructors and school environmental science teachers was found to be 1.95 and 1.68, respectively. The results indicate that the contents found in environmental science textbooks were not covered in the college cluster natural science courses. The rating scores were found to be inconsistent with content agreement analysis of the researcher and responses of open ended questions. This might be because of the two groups of respondents belief that the contents covered in the college were by far difficult than the contents in environmental science textbooks. It is believed that the content of the school science curriculum for each of the science subjects should be specified in detail in the teacher training curriculum for student science teachers (MoE, 2009). That is, difficult areas of contents in the school curriculum must be covered in college courses where as student science teachers are expected to cover others through self study. Based on the above findings it can be concluded that the contents in environmental science textbooks were clearly specified in the college courses and there were no difficult contents which were not covered in the college courses except those mentioned above.

Environmental science textbooks were thoroughly investigated to list science practical activities which were related to physics, chemistry, and biology. Accordingly, in the cycle's environmental science curriculum more

than 51.7% physics related, 29.2% chemistry related and 19.1% biology related practical activities were observed. Similar practical activities were observed in grade levels so that an attempt was made to summarize and present the activities. Based on the data collected, only 47.5% of the activities related to physics, 46.8% of the activities related to chemistry, and 40.5% of the activities related to biology were indicated and covered in the college natural science courses. To say it in other words, more than half of the science practical activities found in environmental science textbooks were found to be not indicated or covered in the college natural science courses. From this, it can be concluded that science teacher trainees do not get appropriate skills to teach children basic science process skills. Thus teacher training institutions failed to ensure that science teacher trainees met the necessary skills (MoE, 2009).

College natural science instructors thought that the courses offered in the college satisfactorily (mean score=2.62) help student science teachers to gain and develop different learning experiences whereas they were not satisfied (mean score=1.38) with the facilitation and guidance given at the college to help trainees prepare practical activities and hands-on activities from locally available materials. On the other hand, school environmental science teachers feel happy (mean score=3) about the cluster natural science courses offered in the college since the courses help them to gain and develop different learning experiences whereas the facilitation and guidance given by natural science instructors was found to be below average (mean score =2.04). Besides, school environmental science teachers reported that the laboratory courses offered in the college did not help them to do the activities indicated in environmental science textbooks. The college cluster natural science curriculum did not invite them to be acquainted with science kits and to practice other hands-on, minds-on activities, and to prepare & work real life practical activities by using locally available materials. It is concentrated on rote memorization of facts, principles, laws, and theories.

Some of the teaching learning methods and assessment techniques which were commonly used in the college were missed from the cluster natural science curriculum guide. In addition, even if there is no one effective method of teaching for every subject and topics, it is believed that some methods are more convenient than others depending on availability of resources, facilities, students' interest, etc. For example, even if laboratory method, lecture method, and assignment methods are out of the most commonly methods in physics and chemistry classes, they were not mentioned in physics and chemistry courses. The result indicates that the teaching learning methods and the assessment techniques indicated in the college cluster natural science curriculum guide were found to be written arbitrarily. Besides, the teaching learning methods and the assessment techniques were found to be a "paste" and "copy" in every course of a discipline. That is, discussion, survey, problem solving, peer teaching, individualized instruction, inquiry, and discovery methods were found to be repeatedly mentioned in each of the physics and chemistry courses. Even though there are problems in the type of active learning methods mentioned in the curriculum guide, data collected from closed ended questionnaires and reports of evaluative training of the college held in the college in 2011 revealed that there were gaps in applying active learning methods in teaching learning process. On the other hand, school environmental science teachers reported that they were not taught in the way they are expected to teach environmental science in primary schools.

No circumstance was observed either in main courses, lab courses, or method of teaching science course which gives some insights how student science teachers help children with special needs education. Both college and school science teachers thought that the science courses training in college did not help them to meet the needs of students with special educational needs.

College natural science teachers and school science teachers believed that the cluster natural science training given at the college did not help the student science teachers to identify the two approaches of science: Science as a product and science as a process. Investigation of college natural science curriculum guide showed that approaches to science teaching and science process skills were indicated in none of the natural science courses including methods of teaching natural science. Many evidences show that science process skills form the foundations for doing science; they remain for a relatively longer period, the child can use them repeatedly in life, help the child to be actively engaged in constructing her/his own understanding of science, technology, and the world which they live (Kaushik & Sharma, 2004; MoE, 2009; NCREL, 1995).

From open-ended questionnaires, college natural science instructors reported that college natural science curriculum and practical lab activities were not prepared in line with school environmental science textbooks and MLC document. In addition, college natural science instructors reported that the natural science curriculum was a direct copy of the linear one so that it had limitations in contributing to teach children science in an integrated and practical approach. The contents in the cluster natural science courses were found to be by far difficult than school environmental science contents so that it induced psychological problems and academic

knowledge gaps upon student science teachers. Some of the opinions of college natural science instructors were found to be shared by school environmental science teachers. School environmental science teachers reported that contents were too difficult and not related, science kit training was not given in college, science courses were not supported by practical activities, and the lab experiments did not help to do practical activities in environmental science textbooks.

Conclusions and Recommendations

Conclusions

The purpose of this study was to explore the mismatches that exist between college cluster natural science and school environmental science curriculum in reference to colleges and first cycle primary schools of the Amhara region. Accordingly; based on the findings summarized above the following conclusions were made:-

The objectives in the college cluster natural science curriculum were not in harmony with the school environmental science curriculum. School environmental science teachers should be trained to help children learn and do science. However, the objectives indicated in the college cluster natural science curriculum guide were not designed in the way to promote environmental science teaching and learning skills. In other words, the objectives stated in the college cluster natural science curriculum did not promote student science teachers to use simple resources to do science as it demands.

The environmental science contents were found to be clearly specified in the college cluster natural science courses. This conclusion was drawn based on investigation of environmental science textbooks and contents in the college cluster natural science courses. Moreover, the opinion of school environmental science teachers have shown that there were no as such difficult contents in the textbooks except simple machines and their types, preparation of dyes from leaves and flowers. However, respondents' opinions revealed that the contents in the college cluster natural science courses were found to be by far difficult compared to the contents of school environmental science textbooks. These prominent gaps create psychological and academic knowledge problems upon student science teachers. Consequently, interventions must be made in alleviating such gaps especially in the first year courses.

Investigation of environmental science textbooks and science practical manual revealed that more than half of the activities were found to be not indicated and covered in college science courses. On the other hand, the lab courses in the college dealt with contents which have no immediate usage in teaching environmental science for children. Of course these higher level courses help student science teachers to broaden their knowledge, understanding and skills. However, since the cluster natural science program was designed to take intervention on the gaps that existed, priority must be given for practical activities which are indicated in the textbooks and science practical manual. It can be concluded that more sophisticated materials were used in the college. This emphasizes that there is a need of helping and guiding student science teachers in preparing locally available materials to meet the need of elementary schools.

Even if different active learning methods and assessment techniques were indicated in the college's cluster natural science curriculum guide, different problems were revealed in applying these active learning methods and assessment techniques in a way that school science teachers used to teach environmental science. In addition, it has been mentioned by school teachers that due emphasis was not given in preparing and using teaching aids along with the science courses in a way to encourage school science teachers. There was no well-organized school pedagogical resource center that helps school science teachers to teach environmental science. The science courses were not supported by learning experiences from grades 1 through 4.

The different cluster natural science courses and the training given in college help student science teachers to increase their academic knowledge; however, student science teachers thought that the cluster natural science curriculum was limited to help teach environmental science for children in an integrated way by using practical and hands-on activities.

Recommendations

In line with the results of investigation using data from human participants & various documents and the conclusions drawn, the following recommendations are forwarded so as to improve quality science education in primary schools.

The objectives of the college cluster natural science courses should be revisited to meet the demands of primary schools. Emphasis should be given to train student science teachers in a way to help children learn and do science, and to raise their curiosity.

The contents of environmental science textbooks are clearly specified in the college cluster natural science courses except contents related to simple machines & their types and preparing inks from leaves and flowers. These contents should be covered in the college training. Besides, there must be an intensive induction and orientation for novice student science teachers about the science courses they take in college. Since the contents of the courses they learn in college are by far difficult than the contents of environmental science textbooks, they may feel inconvenient and lose interest towards the science courses. On the other hand, some rearrangements should be made to bring into discussion about primary level contents and how they teach children using locally available resources. Since the cluster program is designed to take interventions for the existing gaps in academic knowledge and skills, the college courses should be revised to alleviate the trainees' psychological and academic readiness. The cluster natural science curriculum should not be a direct translation of the linear natural science curriculum.

College natural science teachers should look for practical activities in environmental science textbooks and inculcate them in the course as an immediate solution to practical inadequacy of school environmental science teachers. However, the Colleges and the Bureau should create conducive conditions to select and organize practical activities indicated in the textbooks and in the science kit manual so that they should be offered either with the courses or methods of teaching science course. Laboratory courses and activities should primarily focus on practical activities found in environmental science textbooks and science kit manual.

College natural science teachers should use a wide range of teaching learning methods, assessment techniques, techniques of helping and guiding students with special needs education when they teach science courses. The college and the bureau should arrange suitable conditions and organize science seminars which help to indicate and select appropriate teaching methods, assessment techniques, and learning experiences for teaching a certain course and topic.

There are new approaches to science teaching like constructivist approach. Consequently, science workshops and seminars should be organized in the college level and a debate should be held on different aspects to bring quality science education in primary schools as far as science is among the prioritized subject to bring sustainable development of this country.

Ultimately, the researcher would like to recommend all interested teachers to conduct a research which investigates problems and gaps in primary education and brings immediate remedial solutions either individually or with departmental collaboration.

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