Training of Science Teachers for Early Childhood and Primary Grades in Kenya

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ABSTRACT

This paper analyses teacher training in science education in early childhood development and primary grades in Kenya. The paper argues that even though the Kenya Government emphasises science as a subject critical for technological advancement and for achieving Vision 2030, the training of science teachers in early childhood and primary colleges nationally triggers a lot of quality questions. The author visited primary teacher training colleges and early childhood development training institutions in Nairobi, Kiambu and Thika Counties and observed the training activities and resources for science education. The article questions science teachers' adaptability in ensuring science instruction captures the diverse cultures of Kenya in science classrooms. The author raises methodological questions in science instruction as it appears that the tutors training teachers at the colleges did not directly undergo training at the universities in Kenya that prepare them to train primary level teachers.

INTRODUCTION

This paper examines the challenges of teacher training in early childhood and primary levels in science education. The article provides a critical analysis of the quality of science skills of the graduates from the training colleges who in turn are recruited to elementary schools in Kenya to teach science and other subjects of the curriculum. The author questions the degree to which the training offered to science teachers meets the instructional demands of science understanding as knowledge and as a way of thinking. To gather materials for this paper I used phenomenological inquiry borrowing also from ethnographic study methodologies used in my dissertation (Ng'asike, 2010). I visited primary teacher training colleges (PTTC) in Nairobi and Thika and early childhood residential training for early childhood development (ECD) teachers. I interviewed science tutors in PTTC including deans of curriculum and coordinators of ECD training. I visited classrooms and observed teaching procedures in science instruction. This paper is the narratives of my interviews and observations of science instruction. The article has borrowed from my observations of science instruction in elementary and early childhood classrooms in Turkana. I used this data from my dissertation to demonstrate the weakness of teacher training in Kenya in embracing the diversity of the Kenyan cultures in science education.

SCIENCE EDUCATION IN KENYA

The Kenya Government through the Ministry of Education (MoE) has elevated the status of science subjects in education curricula. Science is a key subject that children study at all institutions of learning from early childhood to university. Science subjects are argued by officials of the Ministry of Education Science and Technology (MoES&T) to be critical in providing students essential skills needed for accelerating economic growth through industrialisation and advancement in technology (MoES&T, 2005). In addition, science is considered critical in the attainment of Vision 2030, which outlines Kenya's development road map and what economists envisage the country would become economically and technologically.

The emphasis on science subjects in education in Kenya was triggered by the curriculum of the colonial education system which appeared to discriminate against African children in science subjects. For instance, before Kenya attained her independence in 1963, the Colonial Government had three sets of schools operating separately for Europeans, Asians and Africans. African schools were to train skilled labourers with technical and clerical skills to work for colonial administration and in addition prepared Africans to participate in religious activities run by the missionaries. This colonial education arrangement ensured that science subjects were a preserve of children of the European settlers, Asians and children of a few African elites.

To ensure, therefore, that African children catch up in science education, an emphasis on science became a priority in education curriculum and teacher training in modern Kenya. Teacher training institutions for early childhood and primary levels in Kenya comprise District Centres for Early Childhood Education (DICECE) which train certificate and diploma teachers in early childhood and PTTC which train certificate or primary one (PI) teachers. Kenyatta University and other public and private universities also train early childhood teachers. Training programmes specifically tailored for primary training for science teachers are yet to take effect in Kenyan universities. The early childhood department at Kenyatta University teaches science content and method courses, although the Teachers Service Commission (TSC), which is the employer of Kenya teachers, has yet to recognise ECD graduates for employment, especially at the degree level. There are public and private universities in Kenya which offer programmes that combine primary teachers' education with early childhood.

However, the training of teachers at elementary and early childhood levels continues to face challenges. In Kenya, the training of teachers at the primary level is well established. But many of the graduates are not hired to teach as a result of structural adjustment policies imposed on education by the World Bank. In early childhood, teacher training is gaining momentum. Currently, over 56 percent of ECD teachers are trained in Kenya (MoES&T, 2005). However, early childhood faces the problem of attrition as over 40 percent of ECD teachers move out to seek employment in other sectors of the public and private service. ECD teachers depend on the community for employment which is unattainable as the majority of people in rural communities in Kenya live on less than a dollar a day.

In PTTC, a trainee is required to train in all the seven subjects covered in the primary school curriculum. However, education policy acknowledges that

teaching all areas of the curriculum by an individual teacher can be subject to poor content coverage. The challenge is how the trainees can cover a wide content of the curriculum in addition to acquiring the pedagogical skills required for quality instruction.

In early childhood the assumption is that preschool teachers do not require rigor in science training as the learning in ECD is perceived to be holistic and less academic. Education policy describes the curriculum of ECD as anchored in experimental learning methods. However, the policy also acknowledges that there is pressure in ECD for teachers to ensure preschool children are provided an academic head start in preparation for primary school entry. As a result, primary school teachers subject preschool children joining first grade classes to interviews. The consequence is that although ECD training encourages hands on learning through playful exploration of concrete objects, the pressure on children to pass interviews to join primary classes contributes to rote memorisation of content mastery in early childhood learning environments.

Although the challenges facing science teachers in early childhood and primary levels of education in Kenya continue to be part of the education system, the MoE continues to address curriculum instructional issues from time to time. Currently, MoE is exploring strategies that make science accessible to all learners through instructional approaches that emphasise everyday life experiences of the students in science instruction. These instructional approaches are intended to demystify science subjects as an elitist subject and instead become a subject that is accessible and affordable to every child in the society. As a strategy for Vision 2030, the Government of Kenya plans to achieve industrialisation by 2020. In order to achieve this goal, the MoE has been mandated to carry out an in-service programme for teachers in primary schools that will focus on improving the skills of students in mathematics and science.

To carry out this goal, the Ministry of Education is initiating a training programme with the assistance of Japan that trains primary teachers in new approaches to teaching science referred to as Strengthening Mathematics and Science Education (SMASE) for science teachers. This new approach is geared towards making the teaching and learning of science student-centered. The approach involves hands-on teaching strategies that use locally available materials from the children's environment in science instruction. This hands-on instructional strategy is referred to as Activity Student Experiment Improvisation (ASEI). Other strategies encourage science teachers to use reflective approaches of teaching that monitor and assess students' learning, referred to as Plan Do See and Improve (PDSI). When teachers use PDSI, they are required to constantly improve their lessons according to students' learning achievements and educational needs.

The irony is that new approaches in science instruction initiated by MoE do not target early childhood directly, although there exists a science curriculum at this level, which covers the ages 3–5 years (MoE, 2004). However, to ensure there is quality in science instruction in early childhood, a national policy framework and early childhood service standard guidelines have been developed to promote a safe environment for learning science and other areas of the ECD curriculum.

Of major concern is the fact that reforms in science education do not necessarily cover the needs of children across all socioeconomic groups in Kenya including indigenous communities such as the nomadic and other disadvantaged areas. Teachers in Kenya are trained in colleges established during the colonial era referred to as national institutions. These institutions are not in the proximity of most rural communities and yet teachers from these communities have to train in these colleges in the belief that they are acquiring universal education. The problem is that this universal education trains teachers away from their own culture and yet these teachers will return to teach children who are learning in schools operating in the cultures of their communities.

SCIENCE CURRICULUM REVIEW AND PRIMARY TEACHER TRAINING IN KENYA

While compiling this paper, I had a chance to visit a few primary teacher training colleges and a number of District Centres for Early Childhood Education (DICECE) operating within Nairobi, Kiambu and Thika Counties. I interviewed lecturers and observed science laboratories in teacher training colleges. I also carried out interviews with the lecturers and programme officers in DICECEs and observed their training sessions. In these training institutions, I came face to face with training realities in Kenya colleges. The most overwhelming challenge in training, especially at the primary teacher colleges, was related to the skills of science tutors teaching at the training colleges. Tutors teaching at the primary colleges are graduates from public universities who trained as secondary school science teachers. A majority of these tutors get promoted to teach at the colleges after several years of teaching in secondary schools, even though fresh graduates without teaching experience can also be posted to teacher training colleges directly from the universities after graduation. Students taking their training at the universities are also posted to these colleges to carry out their teaching practice. My interviews with the tutors, especially those in charge of science departments, revealed that these tutors lacked skills that are appropriate for science instruction for primary students as their training initially was intended for secondary school students and not for training teachers at college level who will in turn teach in the primary sector. The tutors acknowledged this anomaly and argued that they needed further training in science methodology that is focused on primary school teaching. They argued that the focus of training in primary is to prepare teachers who will teach science to young children and not secondary students.

Further, the tutors faced additional challenges when adjustments in the curriculum are initiated at the Ministry of Education level to address emerging societal needs. A change in curriculum, for example, will require that tutors of colleges get additional skills to cope with emerging teaching approaches related to curriculum adjustments. However, the reality on the ground is that tutors rarely get induction training when a new curriculum is launched by the MoE. For example, a recent curriculum review by the Ministry of Education recommended that subjects taught in primary school be reduced from eight to five. One way of achieving a reduced subject curriculum is to merge subjects that are related – for example, science oriented ones like home science, agriculture and natural sciences are merged into one subject area referred to as integrated science curriculum. To achieve integration, some topics in the three areas have been

eliminated and others merged, so that the content of the integrated science area is reasonable in coverage and content quality. The reduction of science subjects into an integrated subject in primary will equally be matched with a change in the curriculum of science in the primary teacher training colleges. This means that the colleges will have to incorporate the integrated science curriculum in their training package.

To implement the new curriculum change, a tutor explained to me that in the science curriculum the trainees in the first year of primary teacher training in Kenya will cover an integrated science course. At the end of the first year of training the trainees sit a national examination prepared by the training colleges to determine the students who will take science as a separate content area during the second year of training. The average of math and science scores is used to determine the students who will proceed to do science as a separate content area and the students who score below the average continue with the arts-oriented subjects. Even though trainees in their second year of training do science as a separate content area, science continues to be taught as an integrated content area in elementary schools in Kenya. In addition, teachers who qualify to teach at primary level are not necessarily competent in science instruction as some might have taken arts subjects during their second year of training. However, even those who feel competent to teach science find themselves teaching the integrated curriculum. Teaching the integrated curriculum means that the teacher in some understaffed elementary schools will teach science content knowledge that he/she has not studied. For instance, teachers who learned home science will be required to teach biological or physical sciences in the integrated science curriculum. This is also the challenge the tutors face when teaching the integrated curriculum during the first year of the training in the colleges. Most of them find themselves teaching science areas they have never studied, including courses like agriculture and home science.

There is a need to prepare the tutors for these new subject areas including at least the methodology for handling the integrated curriculum. MoE overlooked this challenge either due to lack of resources or simply due to the pressure to implement the new curriculum. One tutor confessed to me that he had to teach the areas of science he was familiar with and let the students teach themselves the areas that were beyond his level of mastery. The MoE (MoES&T, 2005) has acknowledged the lack of induction of tutors in teacher training colleges as among the challenges in teacher training.

In addition, the practice in teacher training is that qualified teachers are posted to different parts of the country to teach any of the subject areas of the curriculum taught in primary schools. In this arrangement even teachers who may not have done science as a separate content area in college in their second year find themselves teaching science once they are posted to schools. The assumption is that once trainees have done the integrated science curriculum, they would be able to teach science in any primary school in Kenya.

An important observation is that those students who qualify to take science and mathematics as separate content subjects in the second year in college are most likely to be interested and motivated to teach science. It appears, therefore, that in elementary schools in Kenya there are two categories of teachers; one group that is interested in science and the other group of teachers who are arts-oriented and lack an interest in science. Despite

the differences in the skills of qualified elementary teachers, the irony is that at the primary school level both categories of teachers teach science depending on the staffing situation in the schools. The question then arises regarding the skills of science of the students, especially in relation to those students who are taught science by teachers that lacked adequate science content knowledge and interest in science. How would teachers without interest or training in science be expected to prepare learners to become future scientists who will inspire the technological advancement critical for creating a robust 'Kenyan Technology' as alluded to in official Kenyan education policy? If teachers in primary schools can teach all subject areas in the integrated curriculum, why then not train them to cover all these subjects in the two years of their training? Alternatively, it would make sense if only teachers with adequate science content knowledge and interest were to be assigned to teach science in elementary schools to ensure all students received adequate skills of science.

Another development in training is that the introduction of the integrated science curriculum in PTTC adds new challenges in science education and training in Kenya. For instance, the tutors at PTTC have not yet been able to come to terms with the rationale for introducing the curriculum even though they are the ones implementing it in the colleges. There is disquiet among the tutors as most of those interviewed felt that they were 'ambushed' by the MoE when this curriculum was introduced in PTTC as there was no attempt to carry out adequate needs assessment involving wide consultations of all stake holders, especially related to the training of both the tutors and the PTTC trainees. For instance, one important criticism of the integrated curriculum voiced by the tutors was the concern that the integrated curriculum dilutes the content and skills of science. The tutors believed that if science is learned as an integrated subject, it is likely not to inspire creativity in science in primary school students. In addition, the skills of science learned in the integrated curriculum may be inadequate for creating the scientific attitude in students that is essential for the attainment of a scientific community in Kenya.

In addition to the inadequacy of content knowledge and skills of science necessary for the integrated science curriculum, there were also concerns related to the manner of implementation of the integrated science curriculum in colleges. The tutors at the PTTC felt unprepared to teach trainees this new curriculum approach as there was no induction or in-service programme to update the trainer's skills at the college to prepare them to teach the new integrated approach in science instruction. The interpretation of the new approach of science curriculum was left in the hands of the tutors to figure out for themselves.

The tutors also pointed out that being graduates of science from public universities did not necessarily mean they subscribed to the same instructional philosophy of science. The tutors argued that some higher institutions offer general courses in science, others focus more on science education while others tend to place emphasis in teaching science content. There is, therefore, the need to harmonise the skills of tutors when they are selected to teach in PTTC. The induction would need to focus on developing a common instructional approach for science education teacher training so that the impact of training nationally is reflective of the quality of science instruction in schools.

Another training challenge in PTTC emerges as a result of the emphasis of the Government training policy that PTTC should be national institutions. This

means that students joining PTTC do not necessarily train in their local home environment. This policy encourages teachers to experience a national culture by training away from their own cultural environments. The results are that trained teachers are products of national culture which is the culture of the middle class elites of Kenya. The danger is that these teachers will become strangers to their own cultures and the skills of science will not be easily adapted to the cultural environment of the children unless the schools are operating in an urban environment where the elites of Kenya are live.

Ironically when these teachers finish training, they find themselves teaching in their own home districts. Consequently, teachers teach children of their own ethnic backgrounds using experiences the policy of education in Kenya perceives as 'national'. This means that teachers of science are more likely not to apply the local knowledge and cultural experiences of children in science instruction. The consequence of training nationally is to socialise teachers with experiences that are likely to alienate them from their own communities. Yet, if these teachers were familiar to their own culture it would be easier for them to apply their science knowledge to local solutions in addition to being culturally sensitive.

SCIENCE INSTRUCTIONAL MATERIALS IN TEACHER TRAINING COLLEGES

To assess the science instructional materials in both primary teacher training colleges (PTTC) and early childhood development (ECD**)** colleges, I observed classrooms, resource centres and laboratories in these institutions. In one of the primary colleges, for example, the science tutor, who was also the head of science, described the only science laboratory in the college as a 'science room or a resource room' and not a traditional laboratory. According to the tutor, the college laboratory is no longer performing the function of a laboratory that students can use to carry out science experiments as it is underequipped and poorly maintained. It would be appropriate to call it a resource room for demonstration purposes as it is no longer in use for practical experiments. This resource room is the only one in the college and has very little to show in the form of science equipment. The few materials and equipment available are not maintained and are not regularly used. In addition, there are no indications of replacement of used equipment and chemicals. In practice it is hard to believe that over one thousand students in the college use this science room for science instruction. The science tutor agreed that the laboratory is not extensively used for science experiments as it lacked equipment and other science materials. However, he argued that the gap caused by lack of materials is bridged by the fact that science instruction emphasises improvisation and the use of local materials. However, my findings during my visit to the schools indicated that teachers' instructional practices did not reflect the views of tutors and curriculum experts at the Kenya Institute of Education (KIE) regarding the use of local resources in science learning. Rather, science instruction in the schools is dictated by the textbooks and is based on decontextualised rote memorisation of scientific facts and concepts.

At the ECD training colleges, the situation of science equipment is much worse than at the primary colleges. At least one can find ill-equipped laboratory in primary colleges which is unheard of in ECD colleges. ECD training

institutions are most likely to have resource rooms which may contain prepared materials developed at the training institution. These materials are not necessarily scientific. They are described as learning materials developed by teachers for general instructional purposes. In ECD diploma training, it appears that a hands-on approach to science instruction is a luxury that is considered unnecessary. Tutors prefer whole class discussions or lecture methods to pass on science information. According to the tutor I interviewed, hands-on learning at the ECD colleges is inhibited by the heavily content-loaded science curriculum. In addition to the heavily loaded curriculum, congestion in the classrooms makes the learning in ECD training challenging to carry out practical experiences when teaching science. Trainees sit in desks arranged in rows and columns which hinders group sharing or learning science by experiments. In general, it is problematic to argue that the training at both ECD and primary encourages hands-on learning using locally improvised equipment. With laboratories which can only function as resource rooms and a lack of science equipment in ECD training colleges, it is hard to believe how teachers can be trained to teach science effectively given that teachers require a lot of guidance to teach science from a practical approach that embraces children's cultures and experiences of their everyday life.

Further the ECD diploma training needs to be reviewed to examine its effectiveness in preparing skilled trained science teachers. An interview with the tutors at the training institution revealed that the diploma syllabus is highly theoretical and examination focused. Consequently, the tutors in the ECD training are preparing teachers for examination and not necessarily for skills appropriate for science instruction in preschool classrooms. Further, diploma colleges operate in secondary schools which are an unfamiliar environment inappropriate for training early childhood teachers. This unfamiliar environment limits exploitation of local resources that involve hands-on teaching. Besides, resource rooms for science teaching cannot be initiated in institutions that only serve as temporary training facilities to be used during the time the training is in session.

The training difficulty is further compounded by the challenge of having to train primary teachers alongside ECD teachers. The two groups of teachers do not share the same aspirations and teaching philosophy. Whereas ECD students are joining the training as first timers, or after taking their certificate training, the primary teachers join the training to get a higher certificate that will enable them earn a promotion to qualify for better remuneration. In addition, primary teachers feel superior to ECD teachers as they are earning regular salaries with permanent terms of employment. This superiority promotes the tendency of primary teachers to look down on ECD teachers and this in turn affects active participation of early childhood teachers in their training. Training two groups of teachers together with different motivations and especially when the primary teachers feel they have already been trained in science can be problematic. The tutors in the ECD diploma programme acknowledged that the training is driven by primary school teachers whose attitude is examination driven. The ECD teachers who wish to improve their teaching skills to focus on early childhood children do not necessarily benefit from this training as the attitude of the primary teachers discourages hands-on approaches. The primary school teachers who think they have been trained in science methods during their certificate (Primary One, P1) training at the primary teacher colleges feel it

is a waste of time to learn the methods of science instruction used in ECD diploma training. These teachers therefore drive the tutors in ECD diploma training to teach theory at the expense of hands-on learning of science. An emphasis on theoretical training arrangements at the ECD and primary teacher colleges is compounded by a heavily content-loaded curriculum at all levels of education in Kenya and contributes to over-reliance on textbooks and a lack of creativity in science instruction in both early childhood and primary classes.

SCIENCE CURRICULUM AND INSTRUCTION IN RURAL EARLY CHILDHOOD CENTRES AND PRIMARY SCHOOLS

An observation I carried out in science classrooms in Turkana (pastoralist area) as a follow up to my interviews at PTTC confirmed that trained teachers of science teaching in primary schools do not necessarily honour and use local cultural knowledge in science classrooms in early childhood and lower primary classes. Students find it hard to relate science skills to their local cultural experiences as teachers mainly used rote presentation of facts directly delivered from the textbooks. Textbooks represent the views of popular Western culture and consequently they do not present science based on perspectives of the local context of the learners. Training policy may contribute to the lack of use of cultural knowledge in science instruction particularly in indigenous cultural traditional communities of the nomadic pastoralists. This contradicts the instructional strategies of science advocated by SMASE (the Ministry of Education initiated programme that trains primary teachers in new approaches to teaching science, termed Strengthening Mathematics and Science Education) that calls for the use of everyday life experiences. National training denies indigenous children access to science learning using their indigenous knowledge and cultural materials that are accessible, affordable and sustainable. Indigenous children are also denied opportunities to interact with their teachers in the most natural and culturally relevant ways in the classroom.

Educationally, training teachers locally in their home environment would enhance the cultural relevance of the curriculum and the learning of science. In contrast, training teachers to pursue a national policy may be argued to be a system of promoting inequalities in education. Kaomea (2003), an indigenous educator in the United States, proposed the theory of defamiliarising the familiar to unearth the hidden oppressive aspects of postcolonial education policies. Analysing the Kenyan teacher training policy, one may see the disadvantages it poses to the marginalised rural and pastoralist communities whose students are always the ones travelling from far away to train in these national colleges. These training institutions are not usually available in marginalised districts, thus inviting one to speculate that the concept of national training is an act of the perpetuation of education inequalities that are oppressive. Training in another district or in one corner of Kenya does not necessarily make one think and act nationally. Culturally, education represents the culture of the well-endowed cultures of Kenya, including aspects of the Western culture, which are economically and socially represented in the school science curriculum. Students from well economically endowed communities of Kenya do not necessarily see themselves as being national since the national institutions are part of their culture. On the contrary, students from indigenous communities of Kenya who live in arid and semi-arid (ASAL) areas of Kenya find themselves

experiencing challenges of having to adapt to this new culture each time they travel to train outside their community environment. In this way, familiar policies can be challenged or defamiliarised to expose their injustices in instructional approaches in science education in Kenya.

Cultural relevance in the science curriculum in Kenya can be drawn from the findings of anthropologists studying the Turkana pastoralists and their sociocultural practices. Anthropologies have documented that Turkana children from birth are exposed to local knowledge of science related to health, animals, plants, soil, human body, energy etc. (Coughenour, 2004; McCabe, 2004). However, science instruction in schools in both early childhood and lower primary does not necessarily link the science concepts of the national curriculum with the local cultural knowledge (Ng'asike, 2010). For example, in the science curriculum observed in Kenyan pastoralist schools, concepts such as the human body are learned out of context as mere content based on naming the parts of the human body without making connections that relate the human body of a pastoralist person with the ability to withstand high temperatures as well as being able to survive with minimal energy intake to remain healthy for long periods without dependency on modern health medicine. Similarly, the study of animals in the science curriculum fails to link science instruction with the five species of livestock (cattle, sheep, goats, camels and donkeys) that form the herds of Turkana pastoralists. This failure in connecting science concepts from the textbooks to the local cultural context of the students is attributed to the socialisation that goes on in teacher training that portrays science as 'national'. Textbooks of science also present science from the perspectives of the national culture which narrowly gives the impression that Kenya is homogenous. Anderson-Levitt (2002) concurs with the nationalised training of teachers and argues that teachers' instructional strategies in the classroom are influenced by national and transnational cultures. Teachers tend to teach science based on the perspective of universal culture which is reflected in perceived notions of national culture or modern culture or transnational culture. For instance, a national curriculum is characterised as using a national textbook, applying state content standards, a perception that science is the search for truth, and pressure to prepare students to pass the national examinations etc. (Aikenhead, 2006).

In an earlier article (Ng'asike, 2011), I outlined a case where I faced cultural challenges from the students who pointed out, in a science lesson, that hooves of livestock represent different surface areas. During a physics lesson, the students argued that hooves of different species of livestock exert different amounts of pressure on a surface area. For example, camel hooves exerted less pressure on the ground while the hooves of goats and donkeys exerted more pressure on the ground due to their sharp surface areas. These experiences of students are not common in the national science content which constitutes the training of many Kenyan teachers in science education. Further, the national science curriculum, as observed in the science textbooks, attempts to marginalise the cultural knowledge of most Kenyan children, especially the cultural knowledge of pastoralist children. Cultural exclusivity is also evident in the training of teachers which prepares teachers with national orientations of science teaching that cannot be responsive to the relevant cultural knowledge students bring to science classrooms.

In a study by Aikenhead (2006) among the aborigines of Canada that explored the extent to which science teachers' classroom instruction connects science with children's everyday cultural life styles, the findings corroborated the influence of national culture in science instruction. Aikenhead established that teachers are not likely to adapt flexible instructional approaches when they believe that it is in conflict with the national curriculum. That study identified three ideological orientations of teachers' instructional beliefs, namely humanistic, pipeline and middle of the road teachers. Humanistic teachers are more likely to incorporate societal issues in science instruction. However, pipeline teachers adhere to beliefs of their professional training as commitment to an academic pursuit that requires them to prepare students to succeed in national examinations, while the middle of the road teachers are sympathetic to the cultural reality of learning experiences of students as well as remaining committed to national issues of science. Other studies of science teaching focusing on early childhood and lower primary levels in indigenous traditional communities in Canada cited risk factors in the delivery of science related to teachers' intrinsic factors, such as science teaching self-efficacy, professional science knowledge, science teaching interest and motivation. These studies also pointed out extrinsic or environmental factors such as time constraints, resource inadequacy, space, and facilities, poor administrative support and low priority placed on science curriculum over other subjects (Lewthwaite, McMillan, Renaud, Hainnu, & MacDonald, 2010). In Kenya, even though science is seen as critical in technological advancement, quality teacher training in science at lower cadres of education is still very elusive.

In an ethnographic study I carried out in Turkana pastoralist nomadic primary schools, I established that primary and early childhood teachers showed characteristics of the three ideologies identified by Aikenhead in his study of 2006. In the pastoralist schools I visited during my study, I observed that teachers who teach in upper primary, including the schools administrators (principals), tend to believe in a pipeline ideology. These teachers believed that education is universal and the language of instruction should be English (Ng'asike, 2010). The teachers in lower primary, where the majority of students speak less English, tend to show some empathy to the children's language challenges as well as their cultural beliefs and consequently they were most likely to take a middle of the road teaching ideology. However, a majority of preschool teachers tended to be humanistic as they were closer to the children and much of the teaching was culturally sensitive. During my field visit to the schools and training colleges, my observations showed that science instruction did not demonstrate the view that science teachers interpreted the syllabus to incorporate local resources.

In general, the Kenyan education system encourages rote and drill teaching in all its learning institutions. Whether one observes a training college or preschool learning environment, learning continues to be through direct teaching in all cadres of institutions. This theoretical mode of instruction is encouraged during training and mainstreamed in the schools. All Kenyan education institutions blame an overloaded curriculum. Just when Kenyan educators will be able to address the issue of this overloaded curriculum remains a knot for the policy decision makers to unravel. There is also a misplaced view that hands-on training is a priority in science training for lower cadres of teachers only, especially at the certificate level. At higher levels of

training from diploma to degree level, Kenyan teachers and educators think that the emphasis in training should be theoretical. This is a serious misconception.

CONCLUSION

This paper has set out the argument that the quality of training in Kenya of science teachers at the early childhood and primary level is problematic and raises more questions than answers. The paper presented analysis of the skills of trainers of primary teacher training colleges and demonstrated using the interview findings that these tutors are aware of their shortcoming as trainers of teachers who would teach young children in primary schools. This is a task they are not prepared to handle as they were trained as graduates of secondary school teaching. Lack of equipment and materials for training science teachers appears to be a chronic issue in both primary and ECD diploma training institutions. ECD diploma colleges do not own any training colleges and as such training in temporarily hired facilities complicates the development of resource centres for science training. The lack of a diploma credential in primary education has motivated primary teachers who are P1 trained to join ECD diploma colleges to get the higher certificate which will guarantee them promotion by and higher salaries. As such, primary teachers have used the ECD diploma as an avenue for promotion and not necessarily for training in better skills for the instruction of young children. Further, the emphasis on examinations by the Kenya National Examination Council (KNEC) has driven the training to be very theoretical as trainers focus on syllabus coverage at the expense of quality training of science teachers. The MoE's position lacks credibility when it asserts that science is critical for technological advancement and the attainment of industrialisation by 2020 through science education, as it appears to leave the training of science teachers to happen by trial and error. Investment in science education is critical in creating teachers who can inspire young people at all levels to develop the right attitudes and skills of science. This training in science does not need to be expensive if it emphasised culturally sensitive instructional approaches that focus on the use of local resources in science teaching.

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My research interests are in nomadic communities focusing on Indigenous epistemologies and exploring opportunities for integrating this knowledge into the national education curriculum of Kenya.

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