DonnishJournals

Donnish Journal of Educational Research and Reviews
Vol 4(1) pp. 001-007 July, 2017.
http://www.donnishjournals.org/djerr
ISSN: 2984-8849

Original Research Article

Influence of Teacher's Knowledge of Content on Effective use of Inquiry-Based Approach in Teaching Preschool Science in Migori County, Kenya

Ganira Khavugwi Lilian and Odundo Paul Amolloh*

Department of Educational Communication and Technology, University of Nairobi, Kenya.

Accepted 21st March, 2017.

Teachers' background knowledge in science, professional development in teaching methods, and effective use of instructional resources are indispensable components for effective use of inquiry-based instruction in pre- school. Successful use of inquiry-based approach provides pre-school children opportunities for improving abilities in reasoning and experiences in enhancing early stage of cognitive development and understanding of science concepts. Since preschool is where children receive initial formal training in science, teachers require extensive exposure to scientific contents and methods critical for achieving problem-solving techniques. However, teacher education programmes regularly overlook content as an integral part of teaching. As a result, many studies have focused on aspects of teaching, but more often limited attention is given on understanding of content. Hence the study examined the influence of teacher's knowledge of content on effective use of inquiry-based approach in teaching preschool science. The study applied descriptive survey method to source for information. Primary data was sourced from preschool teachers both from the public and private sector in Migori County through questionnaires, and an observation schedule. Data collected was recorded, analyzed, interpreted and presented in tables using frequencies and percentages. A mixture of probability and non-probability sampling procedures were used to select 63 preschool teachers for inclusion in this study. Findings illustrated that teachers with background knowledge in Science successfully employed inquiry-based instruction. Even though this approach is good, professional development does not influence inquiry-based method but knowledge of science content does. The study recommends teacher training institutions to incorporate pedagogical practices coherent with hands-on experiences in preparation programmes for preschool science. Kenya Institute of Curriculum Development should design appropriate pre-school curriculum for teaching and learning science as well as create awareness on the importance of inquiry-based instructional method.

Keywords: Content knowledge, Inquiry-based approach, Pre-school science, Teacher knowledge, Professional development.

INTRODUCTION

Understanding content knowledge is essential for determining teachers' success in the effective use of inquiry- based approach necessary for authentic scientific experiences for pre-school children. Teachers with deeper content knowledge are more likely than those with weaker knowledge in engaging learners in investigating nature of science as well as processing skills of prediction, inferring, hypothesizing, experimenting, identifying and controlling, Cuevas *et al*., (2005). In addition, Odundo & Gunga, (2013) emphasized that while appropriate teaching methods improve learner achievement, inappropriate approaches limit knowledge retention, application and achievement of learning objectives. Besides learner centred methods are known for critical thinking, innovation and knowledge retention. Conversely, Njagi, (2016) illustrated that inadequate teacher background in science, coupled with insufficient facilities and teaching resources, negative teacher attitudes about science, as well as ineffective teacher training in science methods are impediments to effective use of inquiry-based technique in teaching. Similarly, Erbas, & Yenmez, (2011), observed that content of what is being taught seem to be ignored as though it were irrelevant. He further noted that science teachers know the importance of inquiry approach, but many are deficient in practical framework.

**Corresponding Author: Odundo Paul Amolloh. Department of Educational Communication and Technology, University of Nairobi, Kenya. Email: odundopaul@yahoo.com*

As a consequence inquiry-based approach remains rare in many science classes. To overcome these challenges, professional development should permit teachers in exploring science content deeply with a desire of equipping learners with appropriate knowledge, reasoning and problems – solving skills required in modern changing and technology based world.

According Duschl, & Grandy, (2008) philosophical understanding of science principles comes with inquiry – oriented instruction for engaging children in investigating nature of science, In this regard, appropriate adoption of inquiry-based approach increases creativity, better attitudes towards science, improved logic development, as well as communication and reading readiness skills vital for knowledge retention. In addition, development skills such as recording data, communicating and reassuring are often seen in textbook–based programs, but higher level process skills of prediction inferring, hypothesizing experimenting and identifying and controlling variables can only arise through activity-based experiences, Capps & Crawford, (2012).

Naturally, inquiry-based teaching engages learners in investigating scientific questions. For instance questions are correctly answered when children have constructed mental frameworks that adequately explain hands-on experiences. Since hands-on Science is intrinsically interesting for children, content knowledge is crucial for improving teaching and learning only if teachers can acquire appropriate structure of knowledge, theories, principles and scientific concepts.

Analysis by Phelps *et al*., (2010), showed that pre-school instruction is not producing the kind of science literacy desired in relation to world's future scientific needs. To address this concern, teachers require content knowledge with special reference to science principles, and strategies of effctive class management that goes beyond subject matter. This implies that professional knowledge, educational aims, purposes and values should be grounded in philosophy and historical arguments that supports inquiry-based approach.

Therefore, when teachers begin to grasp science content adequately, learners' outcome changes for better. For example, Kangori, (2014), found out that learners exposed to an inquiry-based approach to science express more positive attitudes to learning in all disciplines, show increased enjoyment of school, and have increased skill proficiency in including independent thinking abilities than those taught the traditional way. In response to this, teachers' professional education should address aspects of content, curriculum knowledge, grasp of program materials and planning for effective use of inquiry-based instruction.

Hence Kennedy, (2013), put forward that giving children direct content with scientific investigation helps in preparing for life in an increasing complex scientific and technological world. In turn , children are able are to understand the natural world when direct with natural phenomena, and constructing knowledge as opposed to experiencing learning through print materials.

In the view of Barron & Darling (2008), inquiry-based programs are dynamic, depicting science as ongoing process of exploration and discovery rather that a content domain to be memorized. For this reason inquiry instruction if adequately adopted, allows learners opportunities for drawing connections between academic content and own life. Furthermore, when teachers are confident in employing inquiry-based teaching they demonstrate greater sustained commitment to aiding children's development of critical thinking skills. Thus studies conducted by Friesen, & Lock, (2010), concluded that learners participating in an inquiry-based learning have high inclinations to given tasks of knowledge learning and retention. As a result learners are able to pose questions, as well as foster skills in acquiring knowledge about the word. In this regard, teachers should identify and remedy misconception, manage operation of learning and exploration in class as well as proficiently guide follow up discussions to children's discovery. However, despite benefits of inquiry-based approach Kurmar & Vigil, (2011) found out that pre-school teachers still use textbook-based content acquisition approach to science education.

In such circumstances learners are denied opportunities for exploration, describing, comparing and investigation that are acquired through inquiry- based approaches. Kangori, (2014), also found out that teachers possess generally low level of conceptual and factual science knowledge as well as content area of science. Therefore, inadequate background in science knowledge significantly contributes to uncertainty in teaching the subject and possibly incapability in delivering inquiry-based instruction effectively. It is based on this background that the study assessed influence of teachers' knowledge of content on effective use of inquiry-based method in teaching pre-school science.

Teachers' background knowledge in science and effective use of inquiry-based approach

Background knowledge in science enables teachers in generating appropriate examples rendering the subject comprehensible to children. In this regard, Heal *et al.,* (2009), emphasized that teachers with extensive background knowledge of scientific principles influence learners' interests in and retention of the subject. In this context, knowledge in science should be developed during discipline coursework in college as well as in early childhood years. Conversely, Hammond, & Bransford, (2005), found out that content knowledge is frequently taken for granted in teacher education courses in assumption that students already know the subject.

To this end teachers need analytical background knowledge in order to make decisions on what to teach, what sequence to teach, and how to devote to the subject in terms of organization of content and methods of inquiry within science. More still, Jussim, & Harber, (2005), argued that background knowledge facilitates teaching about a subjects' cultural, social, and pragmatic relationship in lives. Implying that knowledge ought to differ in its character rather than its content, also in terms of meaning, information should be explicit in order to facilitate inquiry method effectively.

Though teachers may have background knowledge in Science, Bok, (2006), opined that through methods of instructions, teachers take learner's knowledge of the subject matter for granted and spend time providing specific topics, rather than helping understand how children learn content, as well as what is conceptually important. In order to assure satisfaction in understanding content, policy makers should merge subject matter and pedagogy as one entity in order for learners to benefit from inquiry instruction. Moreover, teachers' background knowledge should aid in developing and corroborating habits of mind in characterizing a long-life learner as well as giving opportunities for learners to take ownership in learning.

Teachers' professional development in science methods and effective use of* inquiry-based *instruction

Teachers who understand multiple representation of scientific content are likely to engage learners in hands-on Science experiences, Douglas, (2006). Likewise, discomfort with

Science content can lead to distress in inquiry-teaching. In this respect, for children to benefit from Science, professional development methods should be consistent with problem-solving techniques. Analysis by Goe, (2007), found a positive relationship between higher levels of subject matter, knowledge and willingness in teaching science as well as relationship between lower levels of science subject matter, knowledge and decreased confidence in science.

By implication, inadequate professional development in science reduces capacity for effectively exercising judgment in handling unexpected behaviour of children when using hands-on materials. Therefore, effective use of inquiry method requires a thorough knowledge of the subject, good mastery of content and as well as teachers' self-efficacy. Studies by Bitengo, (2005), on preschool teacher's attitude towards the teaching of mathematics in Kasarani division in Nairobi, found a significant relationship between teacher's characteristics, content, instructional resources, learning activities, individual differences among children and objectives to be achieved at the end of the learning process.

Further studies by Gichure, (2010), on the relationship between teacher's characteristics and effectiveness of project method in preschools in kikuyu district found out that teachers are controlling, restricting and limiting children in constructing knowledge through project method. In order to facilitate change, teachers need pedagogical practices, programmes and effective policies for implementing inquiry –based approach in teaching pre-school Science.

Teachers' instructional resources for effective use of inquiry-based program

Effective use of instructional resources in hands-on activities provides children with opportunities for direct interaction with realities, independence, as well as individualised learning. While modern technology has made available a lot of learning materials, the questions remains how well do preschool teachers creatively select and adopt these resources to suit hands-on activities inquiry-based technique, Milimu et al,.(2016). This could be attributed to significant lapses in use of instructional materials in science classrooms.

Among surveyed classrooms, the only available materials for instructions were textbooks and chalkboard. This is an indication that the problem in use of appropriate materials in facilitating inquiry-based methods is due to reluctance of teachers in improvising materials, coupled with insufficient science skills. On the other hand, Morgan, *et al,.* (2016), affirmed that effective use of instructional resources promotes greater acquisition and longer retention of factual knowledge in science. Thus there is need for teachers to identify coherent science instructional resources as well as ways of processing concepts in a logical way in order to facilitate inquiry-based instructions.

STATEMENT OF THE PROBLEM

A lot of concern has been expressed by parents and educators on poor performance in science observed in Kenya Certificate of Primary Education, (KCPE) analysis (2011-2006) from Examination Department Office in Migori County. Studies have been conducted on performance of learners at primary level, contextual and teacher factors affecting implementation of science in primary schools but little have been done in relation to approaches of teaching science in pre-schools. Besides, Kilgallon & Maloney, (2008) explained that; inadequate teacher background in science, coupled with insufficient facilities and teaching resources, negative teacher attitudes about science, as well as ineffective teacher training in science methods are impediments to effective use of inquiry-based technique in teaching. Even though Science teachers know the importance of inquiry-based approach, they remain deficient in practical framework for teaching science as inquiry in guiding instruction. As a consequence, pre-school instruction is not producing the kind of science literacy desired in relation to world's future scientific needs. To this effect, the study examined teacher's knowledge of content in the effective use of inquiry- based approach in teaching science in pre-school.

PURPOSE AND OBJECTIVE

The purpose of this study is to find out influence of teacher's content knowledge on effective use of inquiry-based approach in teaching science in preschools. Findings of this study will enable Kenya Institute of Curriculum Development (KICD) in designing appropriate pre-school curriculum for teaching and learning science as well as creating awareness on importance of inquiry-based instructional method. Teacher Training Programs will benefit by reflecting on pedagogical practices coherent with hands–on experiences. The objective of this study is to examine whether teacher's knowledge of content influences inquiry–based instruction in pre-school science.

THEORETICAL CONTEXT

The study adopted Constructivist theory by Dewey, (1966); and Brunner, (1966). Constructivists assert that individuals actively construct knowledge and understanding from immediate environment through social interaction with the environment. This implies that for learning to take place, learners should be actively engaged in meaningful and relevant activities. By implication, Dewey's philosophy is ideal in inquiry-based instructional method of teaching and learning since learners are given opportunities to come up with own problems for investigation with an aim of getting solutions.

For effective inquiry to take place, Brook and Brook, (2001) stipulated that teachers should not only transfer information but also encourage children in exploring the immediate world, discovering knowledge, conducting experiments, reflecting, thinking critically and reporting results. In this regard, inquiry instruction occurs when teachers are responsible for knowledge of learners and of subject matter for enabling learning activities to be selected in a manner in which learners are active participants. With respect to this, teacher's background knowledge in science, professional development in teaching methods and instructional resources are essential for active learning to take place.

CONCEPTUAL FRAMEWORK

The conceptual framework describes the relationship between inputs, process and output in inquiry-based instructional approach in preschool Science. To achieve success in inquiry-based approach, input process consisted of; teacher's background knowledge in Science, professional development in teaching methods as well as instructional resources for inquiry-based technique. The process was influenced by intervening variables including teachers' activities in facilitating scaffolding in learner's activities, such as formulating hypothesis, predicting, inferring, experimenting, identifying and controlling.

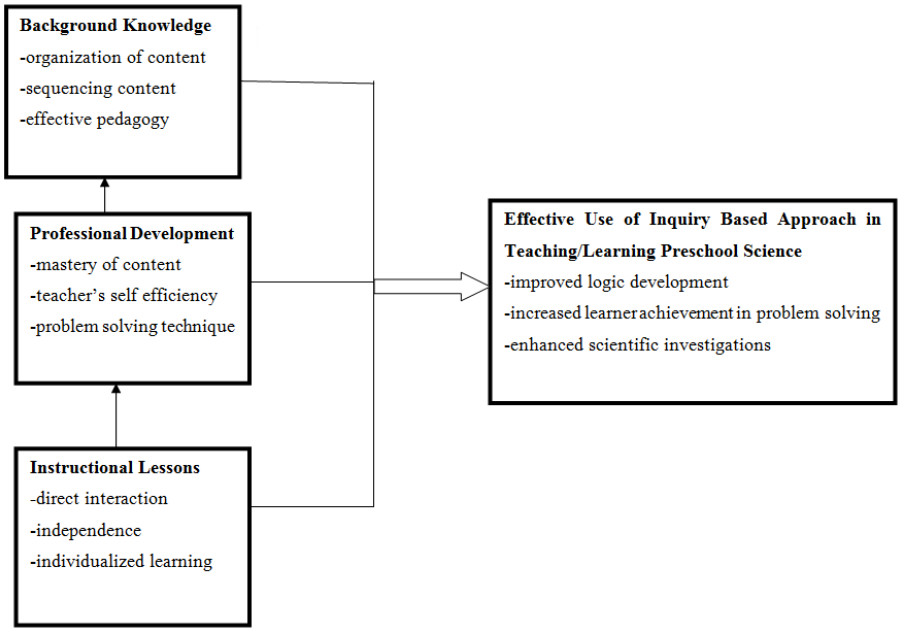

Figure1: Conceptual Framework

Table 1: Years of service and academic qualifications of the teachers

No of years of service	Frequency	%	Academic qualification of teachers	Frequency	%
<1 year	0	0	Certificate	44	69.84
1-3 years	12	19.05	Diploma	19	30.16
3-5 years	11	17.46	Bachelors	-	
5-7 years	18	28.57			
7-9 years	9	14.29			
>10 years	13	20.63			
Total	63	100		63	100

Table 2: Teacher's background knowledge in science

ITEM	Yes Frequency	%	No. Frequency	%
Background knowledge assisted in organisation of inquiry-based approach.	38	60.32	25	39.68
Background knowledge influenced learner's interest in Science.	15	23.80	48	76.19
Background knowledge increased interest in inquiry method	42	66.67	21	33.33
Background knowledge in Science Strengthened inquiry teaching.	29	46.03	34	53.97
Background knowledge encouraged coherence into teaching	26	41.27	37	58.73
Background knowledge rendered Science understandable	53	84.13	10	1.59

Table 3: Teachers' professional development in Science and effective use inquiry-based method.

Responses	Yes Frequency	%	No. Frequency	%
Professional development in Science methods assisted in engaging learners in problem-solving techniques.	42	66.67	21	33.33
Professional development in Science methods facilitated inquiry –based teaching.	29	46.03	34	53.97
Professional development in Science methods encouraged willingness in employing inquiry method.	33	52.38	30	47.62
Professional development in Science methods increased capacity in exercising inquiry instruction.	21	33.33	42	66.67
Professional development in Science methods enhanced mastery of content for inquiry –based approach.	19	30.16	44	69.84

Table 4: instructional resources the pre-school teacher's displayed in the classroom

Type of Instructional Resources	Number of Pre-Schools Public (13) Private (7)	Frequency 20	Percentage 59%
Free choice corner	√ √		
Charts	√ √		
Science corner	√ √		
Shop corner	√ √		
Market corner	√ √		
Social Studies corner	√ √		
Language corner	√ √		

Given possible repercussion of teachers' knowledge of content together with effective use of inquiry instruction in pre-school Science, learners are likely to experience improved logic development, increased problem-solving techniques, enhanced scientific investigations and positive attitudes towards learning.

DATA AND METHODOLOGY

The study applied descriptive survey to source for essential information. Descriptive studies collect information by interviewing or administering questionnaire to a sample of respondents Orodho (2004). It also includes collecting information about people's attitudes and opinions on education or social issues. For purposes of data collection, process and analysis the study used quantitative and qualitative approaches. Quantitative approach produced quantifiable and numerical data, useful in generating descriptive statistics, frequency tables and statistical inferences. Qualitative approach captured in-depth information arising from experiences and opinions of preschool Science teachers through interviews, and questionnaires respectively.

A combination of probability and non-probability sampling procedures were used to select 63 preschool teachers for inclusion in the study. The preschool teachers were purposively and randomly selected from public and private preschools. The study used 21 preschools. There were 14 public schools with a total number of 42 teachers and 7 private schools having a total of 21 teachers. The percentage used was more than 30% as recommended by Mugenda and Mugenda, (1999).

Instruments for data collection were questionnaire and observation schedule. Questionnaire were administered to respondents and collected by the researcher after two weeks for data analysis and presentation. An observation schedule was used to pre-code questions for producing quantitative data. This instrument was used to determine teachers' and children's behaviour during teaching and learning process. Kothari, (2004) stipulated that observation is an effective method of data collection because information gathered is relevant to current occurrences and respondents too feel relaxed for less demands.

STUDY FINDINGS

The study examined the influence of teachers' background knowledge in Science on effective use of inquiry-based instruction. The study sought to find out years of service and educational qualification of the respondents. Academic qualifications and professional orientations are vital indicators of one's potential towards problem-solving techniques. From table 1. For work experience, out of 63 teachers, 12 (19.05%) had 1-3 years, 11(17.46%) had 3-5 years, majority of teachers18 (28.57%) had an experience of 5-7 years. Only 9(14.29%) had 7-9 years while 13 (20.63%) had worked for over ten years.

During class observation, the study revealed that teachers with planning experience depicted the quality of being more enthusiastic than their colleagues with low teaching experience. This was observed in the way the younger teachers in the profession actively involved the use of inquiry-based approach in class. It was therefore concluded that inquiry method can only be effective when teachers have adequate background knowledge of the subject. Concerning academic qualification, the study found out that 44(69.84%) of the teachers were Certificate holders while 19(30.16%) were Diploma holders. The study revealed that teachers with diploma successfully employed inquiry method better than those with certificates. Learners taught by teachers with adequate knowledge of the subject and inquiry-based method were able to do the practical activities. As a result, attention was captured throughout the lesson as the teachers demonstrated confidence in giving instructions.

Table 2 shows how teacher's background knowledge in science influenced ability in effective use of inquiry-based method. Findings revealed that, out of 63 respondents, 38 (60.32%), indicated that, background knowledge aided in organisation of inquiry-based approach while 25(39.68%), did not. Similarly, Taylor, & Kowalski, (2004), emphasized that teachers with extensive background knowledge of scientific principles influence learners' interests in and retention of the subject.

In this context, knowledge in science should be developed during discipline coursework in college as well as in early childhood years. When asked whether background knowledge influenced learner's interest in Science, 15(23.8%) responded in the affirmative, while 48(76.19%) said no. In this regard, Hammond, & Bransford, (2005), observed that content knowledge is frequently taken for granted in teacher education courses in assumption that students already know the subject. To this end, teachers need analytical background knowledge in order to make decisions on what to teach, what sequence to teach, and how to devote to the subject in terms of organization of content and methods of inquiry within science.

For 42(66.67%) respondents, background knowledge increased interest in inquiry method while 21(33.33%) it did not. This was closely followed by 29(40.03%) respondents who reported that background knowledge in Science Strengthened inquiry teaching while for 34(53.97%) it did not. Further still 26(41.27%) acknowledged that background knowledge encouraged coherence into teaching, but for 37(58.73%), it did not. On whether background knowledge rendered Science understandable 53(84.13%) said yes while for 10 (1.59%) said no.

These findings imply that background knowledge in science content is significant to effective use of inquiry-based approach. The study sought to find out how teachers' professional development in Science methods influenced inquiry –based approach. Respondents were asked whether professional development in Science influenced use of inquiry-based method as shown in Table 3. Out of 63 respondents, 42(66.67%), agreed that, professional development in Science methods assisted in engaging learners in problem-solving techniques while 21(33.33%) responded in the negative. For 29(4.03%), professional development in Science methods facilitated inquiry–based teaching while for 34(53.67%) it did not.

More still, 33(52.38%) confirmed that professional development in science methods encouraged willingness in employing inquiry method while for 30(47.62%) it did not. Similarly, Goe, (2007), found a positive relationship between higher levels of subject matter, knowledge and willingness in teaching science as well as the relationship between the lower level of science subject matter, knowledge and decreased confidence in science. Besides, 21(33.33%), indicated that professional development in Science methods increased capacity in exercising inquiry instruction while for majority 42(66.67%) it did not.

Finally, 19(30.16%) acknowledged that professional development in Science methods enhanced mastery of content for inquiry-based approach. Even though this approach is good, a higher number 44(69.84%) disputed. These shows that professional development does not influence use of inquiry approach. These results agree with Plourde, (2002), who revealed that inadequate professional development in science often reduces capacity for effectively exercising judgment in handling unexpected behaviour of children when using hands-on materials. The study then examined nature of teachers' instructional resources for inquiry-based approach. Table 4 shows instructional resources that preschool teachers displayed in 20 out of 34 preschools that were visited. Out of 20 preschools, (13 public and 7 private schools), 65 % (n=13) of public schools and 35% (n=7) of private schools had well displayed instructional resources.

Use of adequate instructional resources and practice aid in internalization of information in detail. It also aids in self-discovery learning. The implication is that children in the observed preschools may have missed out on early stimulation. It was also found out instructional resources that were not displayed at the children's reach, did not help them in manipulative skills. This indicates that, effective use of materials did not take place. This was mostly observed in public preschools.

All the teachers interviewed 100% (n= 45) were in agreement with the fact that instructional resources aid learner's learning in terms of concentration, attention, skill acquisition and reinforcement of concept learned. These findings corroborate with Ainsworth, & Burcham, (2007), who noted that effective use of instructional resources promotes greater acquisition and longer retention of factual knowledge. Similarly, instructional resources help in making learning more realistic and arouse curiosity, interest and practical ability of learners, constructing their own knowledge hence self-actualization.

CONCLUSIONS

The study explored whether teachers' content knowledge has influence on effective use of inquiry-based method in teaching science in pre-schools. The study found out that teachers with a diploma in Early Childhood Education successfully employed inquiry method better than those with certificates. During class observation, it was revealed that teachers with planning experience depicted quality more enthusiastic than their colleagues with low teaching experience.

This was observed in the way the younger teachers in the profession actively involved the use of inquiry-based. It was therefore concluded that inquiry method can only be effective when teachers have adequate background knowledge of the subject. Learners taught by teachers with adequate knowledge of the subject and inquiry-based method were able to do the practical activities. As a result, attention was captured throughout the lesson as teachers felt more confident while giving instructions.

The focus of science education has been on hands-on methods for some time, but the process of change is slow. Contrary to earlier research findings, this research showed that science is an interesting and well-liked subject. Most teachers feel that they are competent and have good content knowledge, yet they do not necessarily feel that they are effective "science teachers". Making science teachers effective needs to be a priority.

Successful science teachers have children who respond well to science instruction, enjoy science as a subject and have the ability to retain what they have learnt. If teachers feel that they can effectively teach science then they need skills to successfully monitor experiments. It appears that effective science instruction will be simply a matter of giving teachers ideas and strategies that they can use to teach science using the inquiry process. As much as teachers are trained at different levels, teacher training programs need to reflect more of what the teachers will need in the classroom after professional training.

RECOMMENDATIONS

Teacher training programmes need to make pedagogical changes to the curriculum to reflect science course requirements that give pre-service teachers background and concept development appropriate to preferred teaching levels and more modelling of hands-on methods and strategies that can be used in class. What is needed is restructuring of the traditional "science methods class" with most teacher training programs to include more semesters of science methods classes, perhaps at least one semester for each of the major scientific areas of study.

Teacher training Colleges need to prepare the pre-service teachers for teaching pre-school level science. College level astronomy courses won't teach a fledgling instructor how to explain to their young judges about the vastness of space. The governments through the Ministry of education should employ preschool teachers with the best practice and well equipped with the knowledge of the subject that can to enable preschool children construct own knowledge.

REFERENCES

Barron, B., & Darling-Hammond, L. (2008).Teaching for meaningful learning: A review of research on inquiry-based and cooperative learning. Powerful Learning: What We Know About Teaching for Understanding (pp. 11-70). San Francisco, CA: Jossey-Bass

Bitengo, A. (2005). Factors that influence preschool Teacher's Attitude towards teaching of mathematics in Kasarani Division, Nairobi. Unpublished Masters Thesis.

Bok, D, (2006). Our Underachieving Colleges A Candid Look at How Much Students Learn and Why They Should be Learning More: Princeton University Press, Princeton, NJ413p.

Brooks, J.G & Brooks, MG. (2001).In search of understanding: the case for constructivist classroom upper sandle river
Bruner, J. (1966).Toward a theory of instruction. Cambridge, MA: HarvardUniversity Press.
Capps, D.K. & Crawford, B.A.(2012). Inquiry- Based Instruction and Teaching about Nature of Science; Are they happening? Journal of Science Teacher Education,1-30.
Cuevas, P., Lee, O., Hart, J., & Deaktor,R. (2005). Improving science inquiry with elementary students of diverse backrounds. Journal of Research in Science Teaching, 42(3), 337-357
Dewey, John. (1966). Democracy and Education. New York: Free Press.
Douglas, R., Klentschy, M. P., Worth, K., & Binder, W. (Eds.). (2006). Linking science and literacy in the K-8 classroom. Arlington VA: National Science Teachers Association.
Duschl, R., & Grandy, R. (Eds.). (2008).Teaching scientific inquiry: Recommendations for research and implementation. Rotterdam: Sense Publisher
Erbas, A & Yenmez, A. (2011). The effect of inquiry-based explorations in a dynamic geometry
environment on sixth grade students' achievements in polygons Computers & Education, 24622475.
doi: 10.1016/j.compedu.2011.07.002.
Friesen, S. & Lock, J. (2010). High performing districts in the application of 21St century learning technologies: Review of the research. Edmonton, AB: College of Alberta School Superintendents.
Gichure, C. (2010). Relationship between teacher characteristics and effectiveness of project method in primary schools in Kikuyu District, Kenya. Unpublished Masters of Education Thesis University of Nairobi.
Goe, L. (2007). The link between teacher quality and student outcomes: A research synthesis. Washington, DC: National Comprehensive Centre for Teacher Quality. Retrieved February 27, 2008, from;
http://www.ncctq.org/publications/LinkBetweenTQandStudentOutcomes.pdf
Hammond, L. & Bransford, J. (Eds). (2005). Preparing teachers for a changing world: What teachers should learn and be able to do (pp. 1-39). San Francisco: Jossey-Bass.
Heal, N. A., Hanley, G. P., & Layer, S. A. (2009). An evaluation of the relative efficacy of and
children's preferences for teaching strategies that differ in amount of teacher directedness.
Journal of Applied Behavior Analysis, 42,123-143.
Jussim, L., & Harber, K. D. (2005). Teacher expectations and self-fulfilling proph-ecies: Knowns and unknowns, resolved and unresolved controversies. Personality and Social Psychology, 9 (2), 131–155.
KCPE analysis in Science (2006-2011), Exam Department Office, Rongo District.
Kilgallon P. and Maloney C. (2008). EarlyChildhood Teachers Coping With Educational Change. Australian Journal of Early Childhood (33)1.
Kennedy, D. (2013). The Role of Investigation in Prompting Inquiry-Based Science Education in Ireland. Science Education International, 2(4), 282-303.
Kothari, C. R. (2004). Research methodology. Methods and techniques (2nd revised Ed).New delhi. New angel international publishers
Kangori, B. N. (2014). Teacher related factors in the Implementation of Science Activities in Preschools in Nairobi County. Unpublished Master's Thesis, University of Nairobi, Kenya.
Marx, Ronald W., Phyllis C. Blumenfeld, Joseph S. Krajcik, Barry Fishman, Elliot Soloway, Robert Geier, and Revital Tali Tal. (2004). Inquiry-Based Science in the Middle Grades: Assessment of Learning in Urban Systemic Reform. Journal of Research in Science Teaching41 (10):1063-1080.
Milimu G. S., Odundo P. A., Ganira K. L., & Mwanda S. (2016). Selection of Developmentally Appropriate Technology in Early Childhood Education Environments, Serving Ages 4-6 in Nairobi County Kenya. Donnish Journals of Educational Research and Reviews Vol 3(1)pp. 001-008 April, 2016.
Morgan,P.L., Farkas, G., Hillemeier, M.M,. & Maczugu, S. (1016). Science achievement gaps begin very early, persist, and are largely explained by modifiable factors, Educational Researcher, 45(1), 18-35.
Mugenda and Mugenda (1999), research methods: qualitative and quantitave approaches. Nairobi.
Njagi. J. (2016). Determinants of use of inquiry-based Instruction by Early Chidhood Teacher in Teaching Science in Meru South Sun County, Kenya. Un published Thesis, Kenyattta University, Kenya.
Odundo, P. A, & Gunga, S. O., (2013). Impact of instructional methods on learner's achievement in Business studies in Kenya's Secondary schools. International Journal of Education and Research Vol No. 5 May 2013.
Oganwu, P. (2004). The effectiveness of guided discussion, problem solving, inquiry and expository lecturer strategies on social concept attainment. Unpublished PhD thesis Delta State University (DELSU) Abraka.
Orodho, A.J. (2004). Essentials of education and social research methods. Nairobi. Majola publishers.
Phelps, G., Bell, C., Croft, A., Leusner, D. & Qi, Y. (2010). Content knowledge for teaching in history and physical science. Princeton, NJ: ETS. Draft Monograph.
Tarik Tosun (2000). The beliefs of preservice elementary teachers toward science and science teaching. School Science & Mathematics, 100: 376-381.
Taylor, A. K. & Kowalski, P. (2004), Na ï ve psychological science: The prevalence, strength, and sources of misconceptions. The Psychological Record, 54.