

TEACHERS' PERCEPTION TOWARDS INTEGRATION OF INDIGENOUS KNOWLEDGE IN TEACHING OF MATHEMATICAL CONCEPTS IN PRIMARY SCHOOLS IN KENYA.

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ABSTRACT

To address some of the knowledge deficiencies that are currently formulated from the western perspective, this study focused on teachers' perception towards integration of indigenous knowledge in teaching of mathematical concepts in primary schools in Vihiga County, Kenya. The study adopted Constructivism theory attributed to Piaget, Vygotsky's and Bruner. Cross-sectional design was used to collect the qualitative data using the questionnaires. The target population were class six math teachers, for the purpose of getting a representative sample, proportionate sampling was used to select 10% (40) of the schools in the county. The sample comprised all the class six math teachers in the selected schools. Descriptive statistics was used to analyse quantitative data while Pearson Product Moment Correlation was used to test the hypotheses. Findings revealed that, there is a low positive relationship between teacher's perception and the level of integrating indigenous knowledge in mathematics curriculum ($r = 0.182, p < 0.026$). Majority of the respondents 75%(30) indicated that IK is rarely incorporated in the classroom teaching. This was also evident because few 25%(10) teachers used Indigenous Knowledge/artifacts/tools while teaching mathematical concepts in the classroom. From the findings the researcher concludes that teachers' perception about the value and potential contribution of indigenous knowledge to sustainable development define how they integrate this form of knowledge into the formal school curriculum. Therefore, teachers and educators need to examine their practices and develop ways to authentically engage and legitimise indigenous knowledge forms into the formal education system. Further research should be done in order to find ways in which IK can blend with modern technology to solve current problems.

Key Words: *Perception, Integration, Indigenous Knowledge, Teachers.*

INTRODUCTION

As cultural mediators, teachers in the African context occupy an important but culturally ambiguous position. While their professional training commits them to the rationale and practices of a Western-derived school curriculum, their personal identities, together with those of their learners, are rooted in their own cultures and traditions. At school, teachers often de-emphasize the values of the students' home cultures, especially if they conflict with the values that the school is trying to promote (Thaman, 2009).

Unfortunately, most teachers (in most parts of the World) were never trained on how to teach culturally appropriate curricula. Hence, Herbert, (2006) statement that languages and teacher's pedagogical knowledge and theoretical frameworks are likely to pose challenges to those who are just joining the process of indigenizing their curriculums like Malawian primary Science teachers.

The consideration of cultural backgrounds of the learners in planning and teaching Science has informed much recent discussions in making teaching more learner-centered. In many countries today, formal education continues to be Euro-centric in outlook and academic in orientation, reflecting Western scientific cultures rather than the cultures of learners and the teachers (Abah, Mashebe, & Denuga, 2015). This phenomenon is a major concern in developing countries, where formal education does not put into consideration the way the majorities of learners communicate, think and learn. Learners' underachievement in school has been attributed to the 'cultural gaps' between the expectations of school curriculum and those of the environment in which the learners are socialized.

In Kenya, this gap also exists for majority of the teachers and thus, raises the question of whose and what knowledge is considered worthwhile? The current euphoria for market driven economies and education development make issues such as cross cultural transfer of knowledge, globalized curricula integration and appropriate teaching-learning strategies critically important for consideration. While commendable efforts are being made to better align educational curricula with indigenous realities, the interrelationship and balance between these two different ways of learning remain delicate (UNESCO, 2010). This research project will capitalize on the role that IK play in successful and meaningful learning of Mathematics in conventional and non-conventional contexts which cover contents and contexts that incorporate mathematical artifices.

Purpose of the Study

The purpose of this study was to establish teachers' perception towards integration of indigenous knowledge in teaching of mathematical concepts in primary schools in Vihiga County, Kenya.

Research Objective

This study sought to achieve the following objective;

- (i) To find out teachers' perception towards integration of indigenous knowledge in teaching of mathematical concepts.

Hypothesis

HO₁: There is no significant relationship between teacher's perception on indigenous knowledge and teaching of mathematical concepts.

Teachers' perceptions towards integration of IK in teaching

Teachers' attitudes toward and beliefs about the value and potential contribution of indigenous knowledge to sustainable development define how they integrate this form of knowledge into the formal school curriculum (Gachanga, 2007). Some of the challenges in the integration of indigenous knowledge in formal education arise from teachers' lack of faith that such a curriculum can actually contribute significantly in addressing the socio-economic needs of the country (Dei, 2002; Gachanga, 2007; Mwenda, 2003; Semali, 1999). Teachers' inability to integrate indigenous knowledge in their practice may also be resulting from limited knowledge on what aspects to integrate. Somjee (1996) noted that although teachers are entrusted with the responsibility of fostering indigenous knowledge in the learning institutions of Kenya, "there is no guidance on what aspects of culture are to be integrated into the curricula. The syllabus only tells teachers what they must do and should do, but not explain how to do it" (p.6), indicating the limitations that Kenyan teachers are bound to phase when implementing such a curriculum.

In teacher education this means preparing pre-service and in-service teachers to reflect on their own philosophies of education and ways in which these values support or inhibit their ability to integrate multiple ways of knowing and methodologies into their own classroom practices (Dei, 2002; Mwenda, 2003; Semali, 1999; UNESCO, 2006). The focus is for teachers and teacher educators to adopt practices that embrace both Western and indigenous knowledge in ways that defy dichotomous presentation, foster relevance, inculcate a sense of self-worth, and national pride among learners. As teachers and educators develop a more culturally inclusive curriculum practices, they must confront the emerging challenges from within themselves and the environment in which they are operating.

In order for educators and teachers to effectively integrate indigenous knowledge into curriculum content, there is a need to transform individuals' perceptions of what constitutes legitimate and valuable school knowledge, learning, and teaching. Teachers and educators need to examine their practices and develop ways to authentically engage and legitimise indigenous knowledge forms into the formal education system. As Mwenda (2003) asserts, "it is time that Kenyan educators come to the realization that Western diagnosis for development does not reflect Africa's realities". The purely Western models of education and economy are not capable of addressing the current socio-economic problems at the micro level, especially in the rural regions of Kenya. Hence, there is a need to revitalize the presence of ethnic indigenous ways of knowing, pedagogy and practices in the educational system if Kenyans are to redefine and re-shape their own socio-economic framework within their own terms of development at the micro level.

In problematizing what has been accepted in Kenya's schools as universal valid knowledge and standards for industrialization and economic development (Dei, 2002; UNESCO, 2006), the following questions would form aspects of a useful guide: What knowledge is of worth and in whose interest does the knowledge operate? How can indigenous knowledge and pedagogy be integrated in a reciprocatory way with Western knowledge in the formal school system? Who counts as experts or innovators in this process? It is only when educators and teachers address such questions critically that they may empower themselves and in turn be able to empower students' knowledge construction by building on indigenous knowledge base that students bring with them into the classroom settings. Unfortunately many teachers and educators still privilege Western ways of knowing and interpretation of the world over indigenous knowledge especially in the face of globalization (Dei, et al, 2002; Shiva, 2002).

When children regularly spend many hours in the company of an early childhood educator, the early childhood educator is a proximal and highly influential element of the child's evolving social and cultural ecology (Cohrssen, Church & Tayler 2016). Early childhood educators' *attitudes* are pervasively important: positive, enthusiastic attitudes to problem solving are likely to engender enthusiasm and positivity in children's approaches to learning, but the corollary holds true as well negative attitudes and avoidance of concepts are likely to lead to negativity and avoidance in children (Gupta, 2014).

In the context of early childhood education, this influence occurs very early in a child's learning trajectory and thus potentially affects children's perception of their own abilities as they continue into formal school-based education (Lake & Kelly, 2014) and onwards. Changing beliefs and attitudes requires an individual to make personal, cognitive adjustments to incorporate new ideas. This is particularly difficult in the teaching environment if the changes do not align with the

individual's personal beliefs and goals for learners (Owour, 2007). The resistance may be a personal response to negative memories rather than denial that supporting children's mathematical thinking is in children's interests (Joseph, 2005). This is important, because studies have found a connection between educators' attitudes to Mathematics and the attitudes of their students to Mathematics (Kaino 2013).

In exploring the mechanisms at work that contributed to the change in teachers' attitudes (Cohrsen, Church & Tayler, 2016) employed a multiple case study on early childhood educators' implementation of a suite of play-based Mathematics activities with children aged 3 to 5 years in six different early childhood education and care programs in Melbourne, Australia. Potential participants were selected according to room-level Instructional Support scores recorded for educators employed at early childhood education and care (ECEC) centers in the state of Victoria during the first round of E4Kids' data collection. Educators approached the enactment of the activities differently; however, those educators who used the activities reasonably frequently and with attention to the underpinning mathematical concepts reported an increase in their self-confidence in supporting children's mathematical thinking. For these educators, increasing self-confidence, in conjunction with children's enthusiasm, led to increased frequency and further gains in self-confidence. Some educators did not implement the activities and no change in attitude was observed. New ways to support early childhood Mathematics teaching practice, as a means to challenge entrenched attitudes and beliefs, are needed.

Mbeva, (2014) conducted an ethnography research Geometry is very important part of Mathematics in school level. It effects in achievement of Mathematics but most of teachers and students feel difficulty in teaching and learning geometry. To address the issue, the dissertation concern attentions the exploration of ethno-geometrical knowledge and its possibility to incorporate in curriculum development. As well as, the study was for the purpose of exploring the ethno-geometrical practices in Tamang community and its relevance with school curriculum.

Previous studies of teacher conceptions about Mathematics noted that views about the nature of Mathematics fall into variations of an internal and external continuum (Gitari, 2003). External views regard Mathematics as an externally existing body of knowledge, facts, principles and skills available in syllabi or curriculum material while internal views regard Mathematics as a personally constructed or internal set of knowledge, where Mathematics is a process or a creation of the mind. There is a third perspective which states that mathematical knowledge (facts, concepts and skills) results from social interaction that relies heavily on context (Gitari, 2003).

Similarly, the study found that there were several ethno-geometrical knowledge in socio-cultural activities of Tamang community such as cultural foods Aalum, Goleng weaving, sketch of Thangka, Bonbo and Buddha la kewa re, that enabled to incorporate in school curriculum and the government also has kept positive attitudes regarding ethno-knowledge on the basis of mother tongue based education. The study showed that context of the Nepal, students are from multilingual and multi-cultural background. And being under developed country, Nepal should use cultural diversity as opportunity of curriculum resource and teaching materials which are got by students 'foreground' and 'background' of knowledge. Ethno-mathematical knowledge or curriculum can guide for this. This kind of curriculum can play main role for enhancing students emotional, intellectual and deeper understanding of Mathematics phenomena from their own lived experience, local and

cultural activates. Moreover, it improves teacher, student and parents fair relation as well helps students to build confidence from dominant group.

Thus, to complement the integration of indigenous knowledge in formal education, it is important to inquire into teachers' and learners' perceptions of indigenous knowledge with a view to understanding their capability in developing appropriate pedagogical approaches and materials for implementation of such curriculum reforms. The pluralistic approach to knowledge systems requires educators to embrace their own logic and epistemological foundations and acceptance that one system of knowledge cannot act as a standard of measure for all knowledge systems.

Teacher's Knowledge about Indigenous Knowledge

Shumba (1999) carried out a quantitative research study in Zimbabwe, whose objective was to measure the extent to which secondary Science teachers are oriented towards traditional culture and how their orientation towards indigenous culture is related to instructional cultural ideological preferences. Shumba's (1999) study design assumed that teacher's commitment to indigenous cultural values and beliefs would bear a relationship with their instructional ideology preferences. The study found that secondary school teachers were not strongly traditional but maintained a fairly traditional posture with regards to aspects of traditional authority, religion, view of nature, and social change. Additionally, the study revealed that secondary school teachers shifted further off from tradition with regards to sex roles, causality and problem solving. In summary, this study revealed a transformation of secondary school teachers in Zimbabwe (a former British colony) that led to loss of some traditional values.

Thomson (2003) contends that all indigenous cultures are harboring tones and tones of knowledge in their languages. However, he laments that unfortunately schools never think about teaching using local languages, which would unlock the buried knowledge. Again, Thomson's (2003) documentation of Keiyo knowledge of snakes revealed that local people knew more snake species than Western scientists did. Although the stories that he collected about snakes were mixed up with myths and legends, valuable information was discerned from the stories. Spirituality and beliefs were also reflected in many stories that he collected. Thomson was surprised to discover that students were not being allowed to learn about the local snakes. In that study, the researcher also realized the need for Science educators to become researchers in order to document indigenous knowledge and its development for classroom learning which is lacking in many locales.

Michie (2002) also pointed out that teachers, especially in secondary schools, tend to lack knowledge on indigenous Science. This is why teachers are encouraged to conduct research in communities surrounding their schools as a way of upgrading their background knowledge in indigenous knowledge as also recommended by (Gonzalez, Moll & Amanti (2005). Michie (2002) further contended that secondary schools might not be a good site for indigenous knowledge since the content, at that level, is more compartmentalized than holistic. For Michie, the best site for indigenous knowledge is primary schools, which tend to have integrated curricula.

RESEARCH METHODOLOGY

Research Design

The study was conducted in public primary schools in Kenya. This study used a cross-section survey design to understanding teachers' perception towards integration of indigenous knowledge in teaching of mathematical concepts.

Population and Sample

The research population constituted teachers of mathematics in class six in Vihiga County, Kenya. To get a representative sample, proportionate sampling was used to select 10% (40) of the schools in the county. The sample comprised all the class six teachers of mathematics in the selected schools.

Instruments and Procedures

Questionnaire for teachers containing 10 items which measured the extent to which IK is applied on a 5-point likert scale was used. The research instruments were administered to the participants by the researcher. Permission to collect data was obtained from head teachers and teachers involved.

Data analyses

The completed instruments were coded and the responses scored and keyed in to a computer data file. All the statistical analyses were run using the Statistical Package for Social Science (SPSS) computer programme. Descriptive statistics was used to analyse quantitative data while Pearson Product Moment Correlation was used to test the hypotheses.

Ethical Considerations

The researchers explained the reason of the study to the participant. The researcher requested them to read and sign the informed consent letter. Participants were also assured of the anonymity and confidentiality of their responses and they were not required to write their names on the research instrument used to collect data.

STUDY FINDINGS

Demographic Information of Teachers

This section discusses the demographic characteristics of the respondents based on question items Q1 (what is your gender?), Q2 (age), Q3 (how long have you been teaching Mathematics in Vihiga County?) and Q4 (what is the highest level of your academic qualification). The findings would assist the study categorize the respondents by demographic details.

Gender of Respondents

The gender of the respondents was sought since its findings would assist the study in categorizing respondents based on gender and their perception on indigenous knowledge and teaching of mathematical concepts. The findings are as shown in table 1 below.

Table 1: Teachers Gender

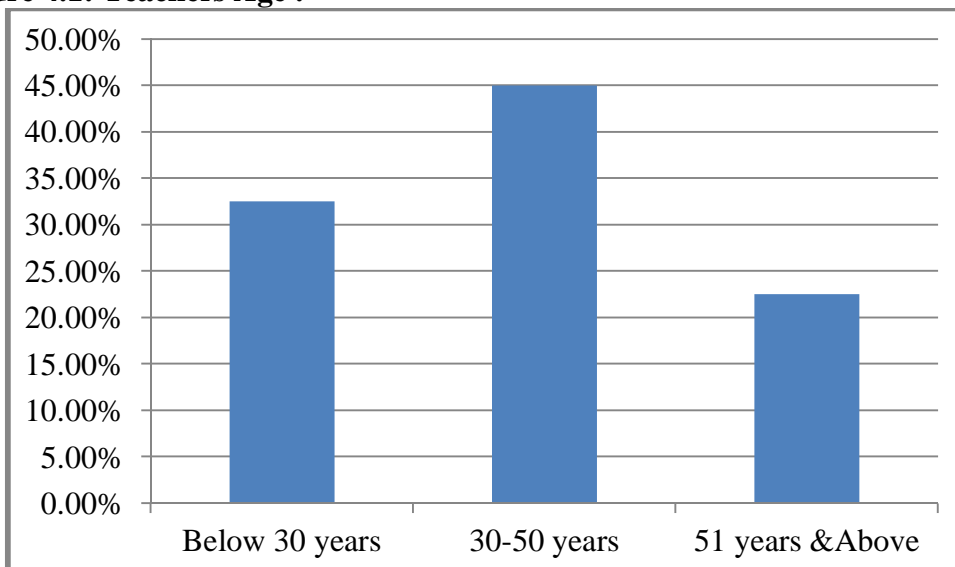
Gender	Frequency	Percent	Cumulative Percent
Male	27	67.5	67.5
Female	13	32.5	100.0
Total	40	100.0	

Source: Field Data 2018

Table 1 shows that majority of class six Mathematics teachers respondents 27 (67.5%) were male, while female teachers were 13 (32.5%). Male teachers are presumed to be many since they come from the community around the school. Collectively the body of literature available to date suggests that, first, despite lack of conclusive evidence, male teachers have positive perception towards Mathematics. The studies tend to stereotype Mathematics as a male domain subject. This leads us to believe that there are small, subtle, interactive and cumulative links between teachers' beliefs and gender differences in Mathematics education teaching which also reflect on the perception of integrating indigenous knowledge in Mathematics curriculum (Brophy, J. 1985)

Age of the respondents.

When asked about their age question item Q2 (what is your age?), the responses were as shown in Figure 1 which shows that, 13(32.5%) of the respondents were below 30 years, 18(45%) of the respondents were 30-50 years and 9(22.5%) of the respondents were above 51 years, making a total of 40(100%). This shows that most of class six Mathematics teachers are in the age bracket of 30-50 years due to the long period taken before they are employed after college.

Figure 4.1: Teachers Age .

Source: Field Data 2018

Since majority of the respondents are over 30 years, it's believed that they have acquired more knowledge and skills on IK through life experiences. Herbert, (2009) asserts that older teachers

have interacted with pupils for a longer period hence they are able to connect with them due to continued interaction; as a result such teachers are able to understand pupils background.

Experience in Teaching Mathematics in Vihiga County

This section discussed question item Q3 (how long have you been teaching Mathematics in Vihiga County?). The findings are as shown in table 2.

Table 2: Teachers Experience in Teaching Mathematics in Vihiga County

Description	Frequency	Percent	Cumulative Percent
Below 5 years	12	30.0	30.0
6-10 years	23	57.5	87.5
Above 10 years	5	12.5	100.0
Total	40	100.0	

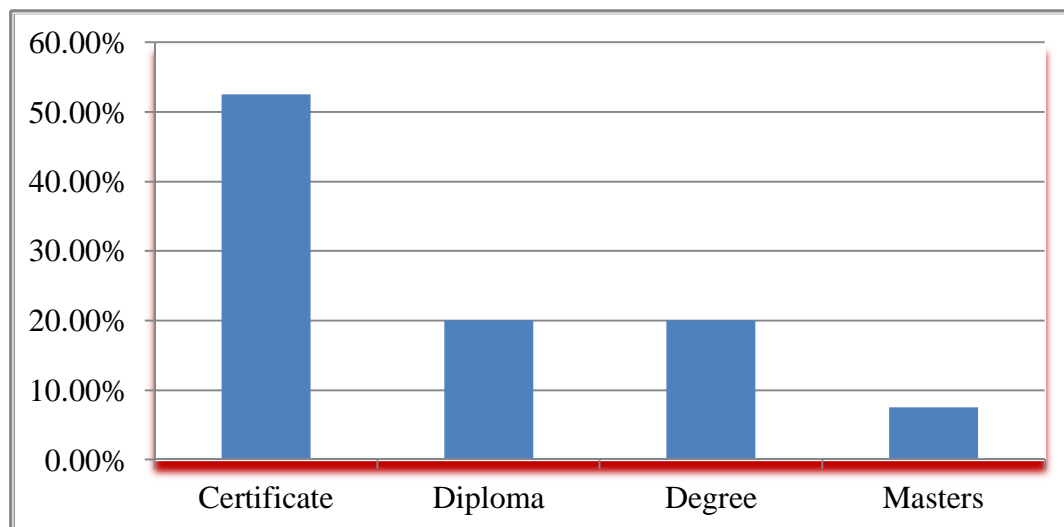
Source: Field Data 2018

Table 2 indicates that 12(30.0%) of the teachers had taught Mathematics in Vihiga County in less than 5 years while 5(12.5%) of the teachers had taught for above 10 years. Majority of the teachers sampled 23(57.5%) had taught Mathematics in Vihiga County for 6-10 years making a total of 40(100%). This shows that most of the teachers had stayed in the county for a good period of time and therefore had understanding of indigenous knowledge.

The research believes that experiential knowledge is always acquired through personal exploration and practicality based on everyday lived experiences. Indigenous education involves the expertise of multiple teachers given the multiple natures of roles and responsibilities in life through which the youths need to be mentored and guided. This is summed up by a proverb that is commonly used across Kenyan ethnic communities, which states, “it takes a whole village to educate a child”. The communal responsibility of education forms the basis for indigenous pedagogy in most Kenyan ethnic communities especially in some parts of the rural, arid, and semi-arid areas (Dei, Hall & Rosenberg, 2002).

Academic Qualification of Teachers

Question item Q4 (what is the highest level of your academic qualification?) revealed the following findings as shown in figure 2.

Figure 2: Academic Qualification of Teachers

Source: Field Data 2018

On the teachers academic qualifications the responses in figure 2 revealed that majority of the teachers 21(52.5%) of the teachers had certificate qualification 8(20.0%) of the respondents were diploma holders, 8(20.0%) were degree holders and 3(7.5%) of the respondents were master's degree holders.

These findings show that most teachers are qualified to teach Mathematics in primary schools. Few of the teachers have masters but with time and the changing trends most teachers are likely to be holders of Masters Degrees in a few years to come. The study noted that the primary schools have employed and retained trained staff since their activities requires the use of knowledge, skills and abilities obtained during training.

Teachers' Perception on Integration of IK in Mathematics Curriculum

Objective two sought to find out find out teachers' perception towards integration of indigenous knowledge in teaching of mathematical concepts. To complement the integration of indigenous knowledge in formal education, it was important to inquire into teachers' perceptions of indigenous knowledge with a view to understanding their capability in developing appropriate pedagogical approaches and materials for implementation of such curriculum reforms. At the forefront of any implementation process are the teachers, which is why the research examined teacher perception towards integration of IK within mathematical concepts.

Correlation Between Teacher's Perception Towards Integration of IK and Teaching of Mathematical concepts.

In this section a correlation analysis was used to examined teachers' perception towards integration of IK within mathematical concepts. The researcher conducted Pearson product moment correlation coefficient so as to test the relationship between teacher's perception on integration of indigenous knowledge and teaching of mathematical concepts. Teachers perceptions were measured by eight items, after running the correlation, the composite mean for the eight items was obtained. Teachers were asked to indicate the extent of their perception towards integration of indigenous knowledge

within mathematical concepts. Their responses were coded as 1= strongly disagree, 2= disagree, 3= neutral, 4= agree and 5= strongly agree. The correlations coefficients are presented in Table 4.10. *Significant at $P < 0.05$;

Table 3. Correlation Between Teacher's Perception Towards Integration of IK and Teaching of Mathematics.

Teachers' Responses	R	Sig
Mathematics identified in traditional cultural activities should also be taught in schools.	0.394	0.034
When teaching Mathematics teachers should take into account students' prior knowledge learnt out of school.	0.188	0.025
In schools, teachers should teach only the Mathematics that is prescribed in the syllabus and textbooks	0.37	0.051*
Traditional practices such as counting, measuring, drawing are also mathematical	0.34	0.05*
Indigenous knowledge is relevant in teaching Mathematics concepts.	0.247	0.014
School Mathematics should teach pupils how to apply the concepts in real life situation.	0.21	0.05
Pupils come to school to learn "school Mathematics", not cultural Mathematics	0.235	0.027
Indigenous knowledge consists of experimental knowledge as opposed to theoretical knowledge.	0.343	0.042
All eight constructs combined	0.182	0.026

The results in Table 3 reveal that teachers' perception towards integration of IK has a very positive and significant relationship when teaching mathematical concepts. Teachers' attitudes toward and beliefs about the value and potential contribution of indigenous knowledge to sustainable development define how they integrate this form of knowledge into the formal school curriculum (Gachanga, 2007). Educators' attitudes are pervasively important: positive, enthusiastic attitudes to problem solving are likely to engender enthusiasm and positivity in children's approaches to learning, but the corollary holds true as well negative attitudes and avoidance of concepts are likely to lead to negativity and avoidance in children (Kaino 2013).

Testing of Research Hypothesis

H01: There is no significant relationship between teacher's perception towards integration of indigenous knowledge and teaching of mathematical concepts.

Pearson's product moment correlation analysis was used to assess the correlation between the variables (teachers' perception towards integration of IK and mathematical concepts). The results in table 4.10 indicate that, there is a low positive relationship between teacher's perception and the level of integrating indigenous knowledge in Mathematics curriculum ($r = 0.182$, $p < 0.026$). Given the $p < 0.05$, therefore, the researcher rejects the null hypothesis.

DISCUSSIONS

The researcher also sought to establish teachers' perception on integration of indigenous knowledge in Mathematics curriculum. As evidenced in the table 3, most teachers have a positive attitude towards integration of indigenous knowledge in Mathematics curriculum.

The response showed that, more than 50.0% agreed on the statement that Mathematics identified in traditional cultural activities should also be taught in schools. 55.0% of the teachers agreed on the statement that when teaching Mathematics teachers should take into account students' prior knowledge learnt out of school. 75.0% of the respondents disagreed on the statement that in schools, teachers should teach only the Mathematics that is prescribed in the syllabus and textbooks. Majority, 80.0% of the respondents agreed on the statement that traditional practices such as counting, measuring, drawing are also mathematical.

Also more of the respondents 80.0% agreed on the statement that indigenous knowledge is relevant in teaching Mathematics concepts. More than 50.0% of the respondents agreed on the statement that school Mathematics should teach pupils how to apply the concepts in real life situation. Also, more than 50.0% of the respondents agreed on the statement that indigenous knowledge consists of experimental knowledge as opposed to theoretical knowledge. Finally, majority of the respondents disagreed on the statement that pupils come to school to learn "school Mathematics", not cultural Mathematics.

CONCLUSIONS

In this study, the researcher also concluded that most teachers have a positive perception towards integration of indigenous knowledge in Mathematics curriculum. Teachers are positive about taking into account students' prior knowledge learnt out of school when teaching and they agreed that indigenous knowledge is relevant in teaching Mathematics concepts. Teachers' perception about the value and potential contribution of indigenous knowledge to sustainable development define how they integrate this form of knowledge into the formal school curriculum.

RECOMMENDATIONS

Teachers and educators need to examine their practices and develop ways to authentically engage and legitimise indigenous knowledge forms into the formal education system. The purely Western models of education and economy are not capable of addressing the current socio-economic problems at the micro level, especially in the rural regions of Kenya. Hence, there is a need to revitalize the presence of ethnic indigenous ways of knowing, pedagogy and practices in the educational system if Kenyans are to redefine and re-shape their own socio-economic framework within their own terms of development at the micro level.

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