CULTURAL PRACTICES AND MATHEMATICAL THINKING ABILITY AMONG HAUSA AND YORUBA SECONDARY SCHOOL STUDENTS IN KANO AND OYO STATE, NIGERIA

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ABSTRACT

This study examines cultural practice, and mathematical thinking ability based on Activity Theory Dimension as a booster to Science and Technology Education with particular reference to Hausa and Yoruba secondary school students in Kano and Oyo states. A non-experimental causal-comparative design was employed for the study. The populations comprised all the secondary schools in Kano and Oyo states. 10 secondary schools were randomly selected five from each state out of the 517 senior secondary schools in Kano and 805 senior secondary schools in Oyo states. In addition, a sample comprising 370 teachers and students were purposively selected from the target population of 246,746 teachers and 579,744 students. Two instruments were used to collect data namely, the Teachers Evaluation of Mathematical Thinking Ability Questionnaire (TEMTAQ) and the Students Mathematical Thinking Ability Questionnaire (SMTAQ). Three Research questions and two research hypotheses were generated and formulated to guide the investigation. Data collected were analysed using descriptive and inferential statistics. The findings indicate that the level of mathematical thinking ability among both groups of students is good and their cultural practices can be seen to be an influencing factor in promoting this ability. While no difference in mathematical thinking ability between Hausa and Yoruba, statistically significant difference was obtained between urban and rural students irrespective of ethnicity. Rural students irrespective of ethnicity have been found to have greater mathematical thinking ability compared to urban students which may be attributed to differences in urban and rural culture. In conclusion, Yoruba and Hausa culture equally support mathematical thinking development of secondary school students in Kano and Oyo states, and living in rural area is associated with higher mathematical thinking ability of either groups.

Keywords: Cultural practices, Learning and Mathematical Thinking Ability, and Teachers Evaluation of Mathematical Thinking Ability

1   INTRODUCTION

Science and Technology are major cultural products of human history and all citizens and learners independently of their society, culture and occupational needs them as elements of human culture. Obviously Science and Technology are very important for economics as well as social well-beings and they must be seen from the perspective of a broadly based liberal education. This is partly because of the need of sound understanding of basic scientific ideas and ways of thinking, as well as the universal interest in mathematical literacy as a result of computational demands. In many countries, admission into science and technology is falling and students' interest in the subjects including mathematics was noticeably decreased. There is also concerned on the quality of students productivity and many higher institution cannot fill their places with students of satisfactory quality particularly credits passed in some relevant subjects including Mathematics. Scientific, Mathematical and technological skills and knowledge are acquired and developed in many different contexts and including informal setting like local or cultural set up. Mathematics is successfully applied not only to natural sciences but also to economics and technical science as an indispensable tool.

Nevertheless Mathematics is unknown, hated, misunderstood and feared by students and adults. One source of this problem might be in the nature of mathematics itself and the other is inherent in the methodology of teaching mathematics. To this length if mathematics is well understood by students and adults there shall be sound development of science and technology, sound economy and better well-being to all citizens of that community or culture. It was discovered by Radford & Michael (2011) that students solve problems with help of their speech, eyes and hands. Meaning that, efforts put forward in giving meaning or during learning mathematics objects is one way of dealing with problem referred to as Objectification which emphasised the historical and cultural dimension of knowledge and knowing.

For instance the history of Algebra and Algebraic thinking, the influence of families interaction on the way each member thinks about himself in relation to others and his environment as well as the impact of Hausa and Yoruba games, riddles and visual discriminations in the development of mathematics. Accordingly the cultural and historical dimension referred to as activity theory attempt to describe not only the theoretical tools of the problem in context based on what students are doing in a particular classroom activity, but also to be able to understand this activity against the background of a cultural and historical setting as well (Michael, 2002). In a mathematics classroom activity, the tales about Gizo, Fowl and Hyena as well as the tales of Lion, Jackal and Hyena involve some aspect of mathematics and mathematical problem solving. This idea of relating mathematics teaching and learning with tales, stories, and cultural practices facilitate and consolidate students' mathematical thinking ability. It was opined that cultural practices encourage and sustain certain kinds of cognitive processes, which then perpetuate the cultural practices (Nisbett and Norenyazan, 2002).

Drawing on this direction is knowledge schema of Piaget to build the idea of cultural-mathematics schemas, patterns of mathematics schemas that make up the mathematics system of a cultural group usually referred to as Ethno mathematics. The

easiest way to understand these cultural-mathematics schemas may be on the schemas of shared mathematics' knowledge structure involve in buying and selling in a cultural group like Hausa setting. For instance if a Hausa man wanted to buy groundnut the mathematics schemas consist of knowing the number of 'Mud' or 'Sacks' to buy, the price of each 'Mud', the market to go to purchase, the kind of transport to use for going there, the cost of transport, the distance and time to get there as well as the total cost for buying the needed amount of ground nut.

To this extent the writer is of the opinion that cultural practices, learning strategies via activity theory may have a significant impact on mathematical thinking ability. Specifically, this paper intends to examine the role or relationship between cultural practices, learning strategies and mathematical thinking ability from the activity theory dimension as a booster to science and technology education.

2   RELATED WORKS

In this age of accountability, space exploration, information technology among others, teachers need more and more varied data about their students' understanding of mathematics (Wendy and Nicole, 2004). In the first place students only memorize procedures that enabled them to produce correct answers without thinking about why the processes work and what the answer means. Indeed teaching for thinking has always been central to the very concept of a liberal arts, humanities, social and management sciences above all science and technology disciplines. The emphasis on thinking reflected in current approaches to education can be traced back to the philosopher John Dewey who wrote on the centrality of reflective thinking in the educational process. He is of the view that educators should view the nurturing of the scientific attitude of mind at the core of their endeavours when teaching child.

2.1   Cultural Practice, Learning Strategies and Mathematical Thinking Ability from Activity Theory Dimension

There is a growing body of study which pinpoint cross-cultural difference not only in the ways teachers teaches but also in the nature and sources of instructional material utilise in their classroom. For example Kaiser et al. (2006) have provided summaries of the distinguishing characteristics of English, French, German and Japanese mathematics teaching, particularly in respect of proof and the structural properties of mathematics. Huegener et al. (2009) examined differences in the ways teachers presented the theorem of Pythagoras in Germany and Switzerland, while Santagata (2005) highlighted substantial differences in the ways teachers handle students' mathematical errors in Italy and the US. In addition Campbell and Kyriakides (2000) and Haggarty and Pepin (2002) demonstrated how school texts reflect differences in systemic expectations and traditions.Similarly, there are several local and international studies (Kamal, 2001, Berlin, 1998, Oloko, 1976, Jorma, 2005) which examined classroom discourse have characterized mathematics teaching as teacher-centred with procedural approach being the main teaching strategy. However when students and teachers mathematical activity

takes place in an inherently social or cultural context, where they work as individuals, as members of small groups and as participants in whole-class activities (Schoenfeld, 1992) tend to encourage and supports students development of mathematical arguments and representation. Since the schemas of the shared culturally oriented mathematics knowledge structure influence the line of thinking of the learner that enable him to understand classroom mathematics better.

For instance ability of the teacher and students to use varied local objects, shapes, figures and events to teach and learn Geometry, Algebra, Statistics and Measurement may facilitate proper understanding of mathematics and develop sound mathematical thinking ability and boost participation in science and technology education. This means students must have the strategies of doing and applying mathematics that include among others: - Systematic, analytic, deductive, inductive, open-mindedness, logic and so on. At the same time they should know where, when and how to apply them, justify and verify their solutions. Accordingly the idea of cultural and historical dimension referred to as activity theory attempt to describe not only the theoretical tools of the problem in context based on what students are doing in a particular classroom activity, but also to be able to understand this activity against the background of a cultural and historical setting as well (Radford & Michael, 2011).

From the cognitive perspectives, Ball (2001) provides three perspectives of teacher's learning: -
(i)   Learning through acquiring new knowledge
(ii)   Learning through collegial interaction
(iii)   Learning in and four practices (that is classroom context).

All these three forms of learning may be classified under Tall (2008) set-before and met-before abilities. A set-before is a mental ability that we are all born with (innate learning) which take a little time to mature as our brains make connotation in early life and usually operate in society and culture. Hence mathematical thinking grows in three distinct ways related to the three set-before. These are as follows: - (1) Recognition and language allows people to name points, lines and figure, for example triangle, cylinder and sphere. It also helps us to classify. (2) Repetition and language assist us to name actions, such as counting, measuring and the results of those actions such as number, weight and volume. (3) Language in particular becomes more powerful and as we build up sophisticated relationships it can be used to define mathematical concepts and prove mathematical arguments.

A met-before is a personal mental structure in our brain as a result of experiences met-before. Many different met-before are possible depending on experience available in our society and culture at the time. For example, practical measurement, counting, geometry and number representation have developed over the time and varied according to the needs of the society. Further, every culture had its own perception, practical recognition and action that give its unique mathematical concepts, such as concepts of rectangle, circle and number, leading to symbolism, representation and thinkable concepts or abstractions. Contending that proper learning or understanding of mathematics is

enhance when there is congruence or peace between what student already know (met-before) and what he is expected to learn (New-knowledge). It is even more so when the learner have more confident and fluent language to think, discuss and express mathematics that can be regarded as mathematical thinking ability.

This was similar to Sam, Mon and Meng (2008) observation that both teachers and pupils in their study showed much more confidence and fluency in using Mandarin Language, to think and communicate mathematically. From social constructivist perspectives learning is conceived as a fundamentally social activity (Vinner, 2006). According to him learning is getting acquainted with the language, rules and practices that govern the activities in a certain community be it a social or academic community. Through this engagement in practices of this community people or learners uses language and rules to discover meaning, understanding and skills.

Piaget contended that learning is subordinated to development and categorized into four hierarchical stages of cognitive development and the passage through these stages depends on the four main factors of maturation, experience, social-cultural transmission and equilibration. The equilibration may tend to be an adequate description of a way of constructing individual knowledge in mathematics. Since it involve the internal organization and build-up of mental schema. The mathematics schemas model contending by the writer is such that where the Mathematics learner is actively engage in doing mathematics facilitated by proper understanding of the task through some number of historical and cultural resemblances. In other words the writer intend to build a model that will account for the way in which students learn mathematics in a much culturally and historically forms of knowing and being (existence).

For instance in Fishing hatchery or blacksmithing events understanding develop by fisherman or blacksmith at a time about the kinds of fish catch or hoe to make, makes estimate or measurement, looks at the size of the fish or hoe. All the two cultural activities have some historical connotations they all used particular forms of mathematical representation and relationship in terms of population for the different graphical and figure distributions of the fish or hoes, all are based on scientific and technical know-how. The diagram below illustrates the model as in Figure 1:

The model the writer has developed is based on the fact that classroom teaching is a complex activity. The mathematics learning classroom is dynamic and on-going (circle). It is an evolving network consisting of the school setting, the learner, the mathematics learning tasks, the mathematical thinking potentiality, the wider education system, the learner's local community containing historical and cultural resemblances of mathematically related events and activities as well as the mathematics learning itself (either effective or ineffective). The understanding of a close relationship between social processes and conceptual development also forms the basis of Lave and Wenger's (1991) cited by Glenda & Margaret (2009) well-known social practice theory, in which the idea of a community of practice and the connectedness of knowing are emphasised. In that perspective, individual and collective knowledge emerge and evolve within the dynamics of the spaces people share and within which they participate.
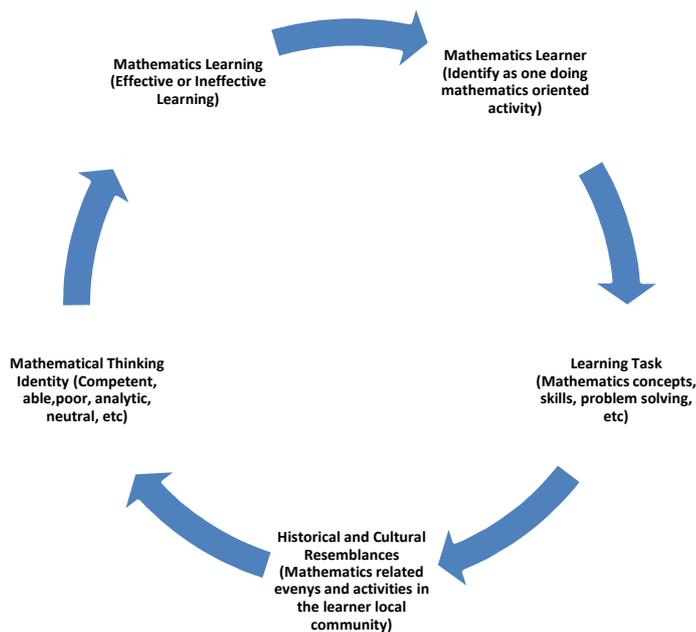
Figure 1: Mathematical Thinking Ability Development Model

As in this paper the focus is on the understanding that teachers who facilitate positive student learning of mathematics do so through having quality mathematics education derived from the forms of historical and cultural activity dimensions. In order to fosters their understanding of mathematics and an appreciation of their historical-cultural mathematical heritage and application of mathematics in everyday life. It is pertinent to consider the contribution of social interaction as reflected through language and cultural environment. In this line, there are: (1) Piaget (1964) who claims that social transmission is fundamental but insufficient factor in developing knowledge. (2) Vygostsky (1986) who claims that cognitive development results from social interaction and education by means of language. He emphasizes that knowledge is socially constructed. (3) Similarly Harvard (1997) observes that social activity and cultural practice are sources of thinking.

Similarly Kagan (1974) cited by Shuaibu (2005) pointed out that urban-rural environment effects students' progress in school. However Bichi (1982) cited in Shuaibu (2005) study revealed a contrary finding indicate that urban environment had more significant influence on pupils' school performance than rural environment. In line with Kagan (1974) as cited in Shuaibu (2005) is the work of Guberman (1994) that showed urban and rural differences in Latino and American children performance in mathematical thinking ability. Basically, it may be connected to the multi-variety of socio-cultural resources existing in the rural areas relevant to mathematics teaching and learning. For instance the language fluency and richness of the rural learners out weight that of the urban learners, socio-cultural objects, events, activities and developments are numerous in the rural areas than urban centres putting all together will facilitate the development of mathematical thinking in particular and mathematics education in general.

2.2   Statement of the Problem

There has been so much concern and complains from all nooks and corners of the Nigeria's society that the standard of education has fallen (Barkie, 2002). Students' performance in Senior Secondary School Examination administered by both WAEC and NECO continues to deteriorate from year to year in both Science and Social Sciences. For instance Rabi'u (2005) asserted that, according to WAEC chief Examiner's report (2003) students' performance varied from one subject to another and the marks ranged from high, average, low, to very low. The performance was generally poor in English language and below expectation in Chemistry, Mathematics and physics. Based on the above backdrop, this study is designed to investigate the mathematical thinking ability among Hausa and Yoruba secondary schools students in Kano and Oyo States. That is to say the study intend to find out the level at which the two cultures, Hausa and Yoruba, in Nigeria differ in favouring or disfavouring mathematical thinking ability among their children. This is with a view to unravelling the obstacles and menace affecting the effective development of mathematical thinking ability on one hand and influencing the teaching, learning and good students' performance in mathematics on the other as well as improve students' admission into science and technology, in the Nigerian school systems.

2.3   Objectives of the Study

The objectives of this study are as follows:

(i)   To determine the level of mathematical thinking among Hausa and Yoruba secondary school students.
(ii)   To find out the extent to which Hausa and Yoruba cultures promote mathematical thinking in their children.
(iii)   To determine the rural and urban difference in mathematical thinking between Hausa and Yoruba secondary school students.

2.4   Research Questions

This study intends to find out answer to the following questions:

(i)   What is the level of mathematical thinking among Hausa and Yoruba students in secondary school?
(ii)   To what extent do Hausa and Yoruba cultures promote mathematical thinking in their children or otherwise?
(iii)   Is there a rural and urban difference in mathematical thinking between Hausa and Yoruba secondary school students in Kano and Oyo states?

2.5　Hypotheses

The study seeks to test the following hypothesis:

Ho₁:　There is no statistically significant difference between Hausa and Yoruba secondary schools students in terms of mathematical thinking ability.

Ho₂:　There is no statistically significant urban and rural difference in mathematical thinking ability between Hausa and Yoruba secondary schools students in Kano and Oyo states.

3　METHODOLOGY

3.1　Research Design

This study chose to use descriptive survey technique of research because according to Shua'ibu (2005) it is an attempt by a researcher to collect data from members of a population which determine the current status of that population with respect to one or more variables. It is also similar to what Kolo (2003) described descriptive research technique as a situation where the investigator collects data on two (or more) variables and through statistical analysis determine the type of relationships that exists between them.

3.2　Population and Sample

In this study, the population includes students in secondary schools and their mathematics teachers in Kano and Oyo states. As indicated by the Federal Ministry of Education Abuja (2005) reported by National Bureau of statistics the population are as follow bellow.

Table3: Teachers and Students Population in Secondary Schools

State	No of schools	Teachers		Total Teachers	Students		Total Students
		Male	**Female**		**Male**	**Female**	
Kano	517	61479	20729	82208	158639	66793	225432
Oyo	805	91481	73059	164538	188817	165495	354312

SOURCE: National Bureau Of Statistics, Abuja (2005) FMOE.

3.2.1   Sample Size

The summary of the sample size used in this study is presented in Table 4.

Table 4: Sample Subjects

State	Name of school	No. of teachers	No. of students	Total
Kano	Rumfa college	7	30	37
	GGC[WTC] Kano	7	30	37
	GSS Panshekara	7	30	37
	GSS Bichi	7	30	37
	GGSS Kabo	7	30	37
Oyo	Govt. College Ibadan	7	30	37
	GSS Atisbo	7	30	37
	AMSS Ibadan	7	30	37
	CSS Parapo	7	30	37
	St. Lukes GS Ibadan	7	30	37
Total		**70**	**300**	**370**

3.3   Sampling Techniques

This study employs the use of purposive sampling procedure. This technique is usually referred to as Judgmental sampling (Sambo, 2005). Under this technique sampling elements which are judged to be typical or representative are selected from the population. The use of this technique is cost effective, convenience and usually useful in attitude and opinion survey. In addition this technique was used in order to give each and every individual member of the sampled population equality of representation. That was the purpose of selecting equal representative sample from both Kano [185] and Oyo [185] states to make up 370 sampled populations. A total of ten secondary schools were selected, five from each state, two from rural areas and the remaining three schools from urban areas. Then thirty students were selected randomly from each school. The other research subjects, in this regard are mathematics teachers, were selected using stratified sampling methods from the sampled schools. The stratum here was subjects who were involved in teaching mathematics in the secondary schools selected.

3.4   Measuring Instruments

Two instruments were used in the study, Student Mathematical Thinking Ability Questionnaire (SMTAQ) and Teachers Evaluation of Mathematics Learning Questionnaire (TEMLQ). SMTAQ was modified from Olubadewo and Stella, (2005,) Sanchez and Ice, (2004,) Jenni (2001) and Jorma (2005) and developed in order to examine students' mathematical thinking ability and views of mathematics. The instrument was based on some closed-ended, open-ended and good questioning techniques as well as Likert's scaled statement. TEMLQ was developed from the

modified instrument of Jorma (2005) to assist the researcher obtained teachers perspective on mathematics learning in secondary schools especially among Hausa and Yoruba children. It also includes teachers' evaluation of Secondary Schools mathematics curriculum and the nature of the students' mathematical thinking ability.

3.5   Methods of Data Analysis

The data of this study were analysed using simple percentage, frequency table, mean, standard deviation, Cross-tabulation and t-test, note that 273 students' questionnaire and 54 teachers questionnaire where only retrieved out of the 300 students questionnaire and 70 teachers questionnaire distributed to the respondents.

3.5.1   Research Question One

What is the level of mathematical thinking ability among Hausa and Yoruba secondary school students in Kano and Oyo states?

Based on research 1, the research hypothesis 1 was formulated as: *there is a statistically significant urban and rural difference in mathematical thinking ability among the Hausa and the Yoruba secondary school students in Kano and Oyo states*. This question and hypothesis were addressed through the students' responses on SMTAQ that were summarized and analysed using Cross-tabulation and simple percentage among the mathematical thinking ability scores in table 5 below.

Table 5 Cross-tabulation on Level of Mathematical Thinking Ability [MTA] among the Hausa and the Yoruba secondary school students in Kano and Oyo states [N=273]

Ethnicity	LMTA 0-39%	MMTA 40-49%	GMTA 50-69%	VGMTA 70% & Above	Total	Mean	SD	*df*	Chi-square Value	Chi-square Critical	*p*
Yoruba											
Count	2	9	67	54	132	65.61	12.86	3	5.48	7.815	0.05
% W. Eth.	1.5%	6.8%	50.8%	40.9%	100.0%						
%W.SMTA	66.7%	50.0%	55.4%	41.2%	48.4%						
% of Total	7%	3.3%	24.5%	19.8%	48.4%						
Hausa											
Count	1	9	54	77	141	67.89	11.26				*n.s*
% W. Eth.	7%	6.4%	38.3%	54.6%	100.0%						
%WSMTA	33.3%	50.0%	44.6%	58.8%	51.6%						
% of Total	4%	3.3%	19.8%	28.22%	51.6%						

Key: W. Eth= Within Ethnicity, W. SMTA= Within STMA, LMTA= Low MTA, MMTA= Moderate MTA, GMTA= Good MTA and VGMTA= Very Good MTA

The result on table 5 above showed that 132 subjects comprising 48.35% of the respondents were Yoruba, while 141 subjects comprising 51.65% of the respondents were Hausa subjects. Majority of the Yoruba subjects [50.8%] had "Good" mathematical thinking ability. Whereas most of their Hausa counter-part 54.6% were within "Very Good" mathematical thinking ability level. However the mean scores of the Yoruba subject was 65.61%, while Hausa subject had 67.89% with respective standard deviation of 12.86 and 11.26. Likewise, the obtained chi-square value=5.477 which is less than the table value of chi-square=7.815 at p=0.05, showed lack of significant difference between the subjects. This indicated that both subjects had the same high level of mathematical thinking ability within the category of 50 -69% which is "Good" mathematical thinking ability Level.

3.5.2   Research Question Two

To what extent do Hausa and Yoruba cultures promote mathematical thinking in their children or otherwise?

More than 65% of the teachers and students while responding to the research question (2) indicated that the two cultures Hausa and Yoruba promote mathematical thinking among their children in many numbers of ways such as: counting, measurement, time reckoning, classification, tracking and some mathematical ideas in, riddles, games, tales, buildings, clothes, furniture, technology, craft and many others that are relevant to science and technical education. Dawakin kudu rock paints in kano (Hausa culture) and Wood carving of Oyo Empire (Yoruba Culture) developed very good visual discrimination and visual memory as needed for survival in the environments. Specifically the respondents cited some examples of Mathematical ideas promoted by the two cultures namely:

(i)   Counting practices and numeration system in Hausa and Yoruba culture.
(ii)   Number symbolism such as two folds objects evoking good/bad, three folds objects evoke hierarchies and fourfold are associated with direction in space, basket makers in Hausa and Yoruba cultures refers to odd numbers or odd quantities of plant strips 'ugly', estimate the size of a plot of land by number of footsteps or average walking steps relevant to technical education.
(iii)   Symmetries pattern of Hausa and Yoruba cultures range from the weaving of handbags, hats, calabash, clothes and baskets to the fabrication of brooms (very relevant to technical education).
(iv)   Riddles and games such as a man wanted to pick a mongo inside a garden with ten gates each gate have a gate man and each gate man wanted him to share the mangoes he picked equally with him. How many mangoes would he pick if he wants to come out with one mango? In order to solve this problem or to explain its solution, auxiliary drawings are made in the sand or the idea of distribution, arrangement or sequence of number of mangoes logically to come up with total number of mangoes to collect which is very relevant to formal mathematical topic of geometric progression. Ayo, dara, gala-gala and Okwe are good examples of games in Hausa and Yoruba cultures cited by the respondents that develop person reasoning skills, chance, learning strategies and tactics, visual

memory and concentration as necessary for success in the games. In addition they facilitate the development of traditional knowledge of probability and mathematical aspects of mental or verbal games in Hausa and Yoruba cultures in Kano and Oyo states (Nigeria).

(v)   Geometric shapes and patterns 'Rumbu', 'Tsangaya', home compound and fish traps portray the knowledge about the properties and relations of circles, angles, rectangles, squares, regular pentagons and hexagons, cones, pyramids, cylinders, symmetry, etc., that was involved in the invention of the production techniques by the producers.

3.5.3   Research Question Three

What is the level of mathematics teachers' evaluation of their students' mathematical thinking ability among Hausa and Yoruba secondary school students in Kano and Oyo states?

Table 6: Hausa and Yoruba Mathematics Teachers' Responses on Their Students' Level of Mathematical Thinking Ability in Kano and Oyo States [N=54].

Ethnicity	N	%	Mean	SD	df	t_{cal}	t_{crit}	p
Yoruba	22	38.88	40.74	9.78	52	2.48	1.96	0.05
Hausa	32	61.11	59.26	18.59				
Total	54	100	100					

From the table 6 above it can be seen that 22 subjects consisting 38.88% of the respondents are Yoruba subjects while 32 subjects consists of 61.11% of the respondents are Hausa subjects. However the means score of the Yoruba mathematics teachers is 40.74, SD=9.78 while Hausa teachers had the mean scores of 59.29, SD = 18.59. This revealed that Yoruba teachers' evaluation of their students' mathematical thinking ability (40.74) is less than that of Hausa teachers (59.26). The mean score of 40.74 is indicating that the students had moderate mathematical thinking ability and 59.26 mean score is indicating that the students had good mathematical thinking ability.

The research hypothesis two was formulated as: there is a statistically significant urban and rural difference in mathematical thinking ability among the Hausa and the Yoruba secondary school students in Kano and Oyo states.

From table 7 on descriptive statistics and t-test results, one can deduce that 106 subjects comprising 38.83% of the respondents were from the rural areas, while 167 subjects comprising 61.17% were from the urban areas. The subjects respectively had mean scores of 70.21%, standard deviation of 11.02 and mean scores of 64.61%, standard deviation of 11.02. These percentages show that the subjects from the rural areas had "Very Good" mathematical thinking ability while subjects from the urban areas had "Good" mathematical thinking ability level.

Table 7: Urban and Rural Differences in Mathematical Thinking Ability among the Hausa and the Yoruba secondary school students in Kano and Oyo states [N=273]

Location	N	%	Mean	SD	df	t_{cal}	t_{crit}	p
Rural	106	38.83	70.21	11.02	271	3.92	1.96	0.05
Urban	167	61.17	64.61	11.72				
Total	273	100						

The result of the *t*-test supports the rejection of H_{o2} and the acceptance of research hypothesis two; there is a significant urban and rural difference in mathematical thinking ability among the research subjects. This is evident by the computed *t*-test value = 3.92 that is greater than that of the table value of *t*=1.096, at *p*=0.05.

Generally, it was discovered from the study that both the Hausa and the Yoruba secondary schools students in Kano and Oyo states had the same level (Good) of mathematical thinking ability. The result of *t*-test analysis shows that there is no statistically significant difference in mathematical thinking ability between the Hausa and the Yoruba secondary schools students in Kano and Oyo states indicating that both cultures provide similar support for mathematical thinking development. In other words, most likely, both Hausa and Yoruba culture are rich enough with traditional aspects that promote mathematical thinking among their children. However, the finding of this study shows that there is a statistically significant urban and rural difference in mathematical thinking ability between the study subjects. While the urban subjects had "Good" mathematical thinking ability, the rural subjects had "Very Good" mathematical thinking ability.

4   DISCUSSIONS

The first and second research questions are answered on the level of and differences in mathematical thinking ability among the Hausa and the Yoruba secondary school students in Kano and Oyo states. The results showed that (Table 4) 132 subjects comprising 48.66% of the respondents had mean scores of 65.61% which is within the category of good mathematical thinking ability. While 141 subjects consisting of 51.65% of the respondents had mean scores of 67.89%fall also within the category of good mathematical thinking ability. This result together with the obtained *t*-test value=1.60 which is less than the critical *t*-test Value=1.96, at *p*=0.05 shows and tested the first research hypothesis and proved that there is no significant difference in mathematical thinking ability between the Hausa and the Yoruba secondary school students subjects. This result is in agreement with most of the studies conducted on mathematical thinking ability. For example Jorma (2005) study shows that successful students have good mathematical thinking ability. Also Sexe (1987) study showed considerable mathematical thinking ability among his research subjects. Again, Ginsburg et al (1981) study showed cultural similarities in mathematical thinking ability between the African

and the USA children. In addition the second research question demonstrated that both Hausa and Yoruba culture promote mathematical thinking through many number of ways such as riddles, games, language, geometric and symmetric patterns in line with Vygostsky (1986) who claims that cognitive development results from social interaction and education by means of language. He emphasizes that knowledge is socially constructed. Likewise in line with Harvard (1997) who observed that social activity and cultural practice are sources of thinking. Thus similar cultural practices in Yousa and Housa

The second research hypothesis was used to address the urban and rural differences in mathematical thinking ability among the Hausa and the Yoruba subjects. The results indicated (Table 7) that 106 subjects consisting of 38.83% of the respondents are rural subjects with the mean scores of 70.21 representing "Very Good" mathematical thinking ability. While 167 subjects comprising 61.17% of the respondents are urban subjects with the mean scores of 64.61% which fall within the category of "Good" mathematical thinking ability. This result, plus the calculated t-test value = 3.92, at P =0.05 level of significant, tested and accepted that there is a significant rural and urban difference in the subjects mathematical thinking ability. Fundamentally, the view that rural areas are bless with more socio-cultural resources relevant to mathematics teaching and learning than the urban areas can be the promo of that differences in mathematical thinking ability among the sample subjects. This view is in agreement with Kagan (1974) cited in Shuaibu (2005) that urban–rural environment affect students' progress in schools. However, Bichi (1982) cited in Shuaibu (2005) maintains that urbanization has influences on pupils' school performance because it makes them perform better than the rural schools pupils. This contradicts the present study where the rural subjects are found performing better than urban schools subjects. This study is also in line with the research and work of Guberman (1994) that discovered urban and rural environmental differences in the mathematical thinking ability of Latino and American children.

6   CONCLUSION

Based on the data presented and analysed as well as the discussions of results, there is no difference in the mathematical thinking ability between Hausa and Yoruba students in Kano and Oyo states. It can be concluded that both groups may be from different cultures, but each group have cultural practices that promote mathematical thinking to the extent that similar aged students from both Kano and Oyo states attain similar mathematical thinking ability. Interestingly, living locations either rural or urban seems to influence mathematical thinking ability and the data seems to support the conclusion that living in rural areas contribute to higher mathematical thinking ability disregarding the cultural background of the students. Greater participations in traditional practices could be hypothesised to promote mathematical thinking ability among Hausa and Yoruba Students in Kano and Oyo states, which can be the focus of future research.

7   RECOMMENDATIONS

The following recommendations are hereby made by the researcher:

(i)   In order   to maintain   and improve on the nature and level of mathematical thinking ability among these research subjects, teachers, students and parent alike should allow cordial human relationship to exist among them in order to give room for more learning opportunities, assistance and encouragement.

(ii)   Lack of ethnic or cultural differences among the subjects indicate that most of the subjects have interest in the study of mathematics, particularly because of its position among required subjects for further studies in science and other related areas. Hence, all the parties concerned should play a role in creating awareness on the need and importance of studying mathematics likewise its simplicity.

(iii)   Mathematics teachers should to strive hard to see that they encourage and assist their students for excellent mathematical thinking ability. This should be through employing multiple and varied learner-centre approaches to teaching and learning, utilisation of multi-varied historical and culturally oriented instructional materials, assigning and marking homework, assignment and test, organizing quiz competitions and so on.

(iv)   Since there is no cultural differences in mathematics thinking ability' among the subjects parents and guardians should feel comfortable to encourage their children to study mathematics at any urban or rural school.

(v)   All the stakeholders in secondary school mathematics education should notes the implication of urban and rural differences in mathematical thinking ability among the cultural group. In terms of the factors that made rural subjects perform better than urban subjects, the priority given to urban school and their teachers more than the rural schools and their teachers as well as the need for teachers posted to rural schools to heartedly accept and go to the school.

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