



# Relationship Among Demographic Variables and Pupils' Reasoning Ability

**Adeyinka Tella<sup>1</sup>, Adedeji Tella<sup>2</sup>, L.O. Adika<sup>2</sup>,  
Majekodunmi Oluwole Toyobo,<sup>3</sup>**

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<sup>1</sup>Dept of Library and Information Studies, University of Botswana,  
Gaborone

<sup>2</sup>Faculty of Education, University of Ibadan, Nigeria

<sup>3</sup>Department of Guidance and Counselling, Tai-Solarin University of  
Education, Ijebu-Ode, Nigeria.

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**Botswana / Nigeria**

[tellayinkaedu@yahoo.com](mailto:tellayinkaedu@yahoo.com)

Postal Address: Department of Library and Information Studies. Faculty of Humanities. University of Botswana.  
PB 0022, Gaborone, Botswana.

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## Abstract

**Introduction.** Pupils reasoning ability is a sine-qua-non to the evaluation of their performance in learning and an indicator of their potential predictors of future performance.

**Method.** The study examined the relationship among demographic variables and reasoning ability of primary school pupils. It drew four hundred pupils from ten (10) purposefully selected public primary schools in Ibadan, Nigeria. The age of these pupils ranged from 9-11 years. A Reasoning Assessment Test developed by (Sokan, 1998) with  $r = 0.89$  cronbach alpha was used for the collection of data. Two hypotheses were developed to guide the study. These were analysed using Pearson Multiple Correlation Matrix and Multiple Regression statistical methods.

**Results.** The results indicate that demographic variables like age, class, and gender correlates positively with pupils reasoning ability and that these three variables significantly predict pupils reasoning ability better than other variables.

**Discussion and Conclusion.** Based on these findings teachers and parents are called upon to see to it that they start stimulation of the children thinking at an early age as soon as they enter school through provision fascinating toys, computers and simulation games.

**Keywords:** Demographic variables, reasoning ability, pupils, primary school, Nigeria.

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## Resumen

**Introducción.** El razonamiento del estudiante es una habilidad sine-quantum para evaluar su aprendizaje y un indicador potente para predecir futuros logros.

**Método.** El estudio examina la relación entre variables demográficas y la capacidad de razonamiento de alumnos de educación primaria. Participan 400 alumnos pertenecientes a 10 centros públicos elegidos de la zona de Ibadan, Nigeria. La edad de los alumnos oscila de los 9 a los 11 años. Para la recogida de datos se utilizó el Test de Evaluación del Razonamiento (Sokan, 1998) (Cronbach's Alpha=0.89). Las hipótesis establecidas en el estudio son analizadas utilizando métodos de regresión múltiple y matrices de regresión múltiple de Pearson.

**Resultados.** Los resultados indican que las variables demográficas como la edad, clase y sexo correlacionan positivamente con la capacidad de razonamiento del alumnado y que todas ellas predicen, mejor que otras variables, dicha capacidad de razonamiento.

**Discusión y Conclusiones.** Basándose en estos resultados, el profesorado y las familias es invitado a revisar la forma en la que estimulan el pensamiento de los niños desde edades muy tempranas tan pronto como acceden a la escuela facilitándoles juegos lúdicos, ordenados y otros juegos estimulantes.

**Keywords:** variables demográficas, razonamiento, alumnado, educación primaria, Nigeria.

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## **Introduction**

Reasoning ability is a term that refers to nonverbal, deductive, inductive, or analytical thinking. Pupils reasoning ability is a sine-qua-non to the evaluation of their performance in learning and an indicator of their potential predictors of future performance. The challenge to improve children's reasoning and language lies in the heart of education. It is also lies in the heart of the World-wide philosophy for children movement which uses philosophical enquiry to enhance thinking, learning and language skills of pupils of all ages and abilities in more than thirty countries around the World (Fisher, 1998).

Reasoning skills develop gradually through a person's lifetime and at different rates for different individuals. Early investigations on cognitive development and children's reasoning ability typically define the level of cognitive functioning in terms of performance on one test or the other related measures. Zigler, Levine and Gould in Sokan (1998) define cognitive development with age and found that comprehension consistently increased with age. Other researchers (Sokan, 1998) asserted that cognitive development and reasoning ability of an individual pupil do vary across demographic variables as gender, culture, religion etc. One question that seems pertinent based on this assertion is that what does reasoning ability have to do with demographic variables? It is in the search of answer to this question that this study is conceived. While it is assumed that studies of this nature might have been conducted perhaps in Europe and some other part of the world, it is still considered a new area of study in developing countries of which Nigeria is one. Therefore, study of this kind is very important in the sense that its outcome is expected to further strengthened pupils learning. Furthermore, this study is considered to be important in view of the fact that it will contribute to body of literature on the study of demographic variables and pupils reasoning ability from the perspective of Africa particularly Nigeria where studies of this nature is considered very new.

### *Literature review*

Demographic variables are widely used in the study of behaviour. Mowday, Porter and Steer (1982) have a category of variables labeled "personal characteristics" and four of the five characteristics – education, tenure, age and gender – included under this category are demographic variables. Demographic variables are social categories for individuals. The five variables cited from the Mowday et al. – Education, tenure, age, gender, and job level – are examples of these variables (Price, 1995). Demographic variables can refer to social systems

as well as individuals. It has been argued that demographic variables are nonsense variables. Some researcher (Price, 1995) has also argued that the concept is often used inappropriately in research. Whether demographic variables are nonsense variables or not used appropriately in research, the fact still remain that they are very relevant in many research endeavour.

Many researchers have conducted follow-up studies of formal operational thought asking some pertinent questions: Are young children capable of abstract reasoning? Pre-operational children show the glimmerings of abstract reasoning but they are not as competent as adolescents and adults (Beck, 1997). As an instance, 6 years olds understand that hypothesis must be confirmed by appropriate evidence. They also realized that once supported a hypothesis shape predictions about what might happen in the future (Ruffmal, Perner, Olson, & Doherty in Faloye, 2005). But unlike adolescents; pupils cannot sort out evidence that bear on three or more variables at once. This is a clear indication that adolescents reason much more effectively than do their younger counterparts.

While working in Binet's intelligence Quotient (I.Q) laboratory in Paris, Piaget became interested in how children think. He noticed that young children's answers were qualitatively different from older children which suggested to him that the younger ones were not dumber but instead answered the questions differently from their older peers because they thought differently. To Piaget, development is a systematic structural process. While Omomia (2005) asserts that it is not just the amount of knowledge which distinguishes a young child from an older child. There is actually a qualitative difference in their thought. Piaget goes further to say that changes in the way a child thought about the world signified a change in cognitive or intellectual development. As the child's intellect develops it becomes increasingly capable of carrying out actions upon its environment, which will ensure its survival (Samuel & Bryant, 1984).

Norris and Poirot in Omomia (2005) notes that educators no longer believe in a knowledge of the basics in our ever changing world and thus the teaching of problem solving, critical thinking, and higher order. Thinking is at the top of many educational agendas. According to Hams in Diamond and Hopson (1998) maintained that information age citizen must learn not only how to access information but more importantly how to manage, analyse, critique, cross reference, and transform it into usable knowledge.

Thinking or reasoning cannot only bring pleasure; it can be useful (Fisher, 1998). Many of the reasons for seeking to develop thinking, reasoning and learning skills are instrumental or pragmatic and are to do with the success of individuals and society. Thought is closely link to language. According to Vygotsky (1978), linguistic communication is the primary vehicle for human thinking, reasoning and leaning, not that all depends on words. Vygotsky was among those who first realized that the conscious reflective control and deliberate mastery were essential factors in school learning. He suggests two factors in the development of reasoning and knowledge. First, its automatic unconscious acquisition by a gradual increase in active conscious control over that knowledge which was essentially a separation between cognitive and meta-cognitive aspects of performance. Second, some researcher like (Flavel, 1985) argued that meta-cognitive ability changes with age and that older child simply become more successful learners because they have internalized over time a greater quantity of meta-cognitive information. Others like (Donaldson, 1978) considers that reasoning development is not much depend on age but on experience and that young children can be helped to develop some of the meta-cognitive strategies to successful reasoning, problem solving, and learning.

Relating pupils reasoning ability to some demographic variables (Elder, 2004) posited that no matter what issue one is reasoning through, the part of thinking embedded in the reason and the intellectual standards that determine the quality of that reasoning apply. These according to him apply independent of whether one is thinking about culture, ethnicity, race, social class, gender, intellectual development, emotional development, special disabilities, special interests, personality, social adjustment, self esteem, knowledge, maturity, motivation, degree of conformity to peer group or creativity. The development of reasoning ability in individual has been shown to correlate with a multitude of variables. Some related directly to Piaget's cognitive theory of development (Inhelder & Piaget, 1958). Prior knowledge (Resnick & Gelman, 1985), processing capacity (Finegold & Mass, 1985), cognitive styles (Stucssy, 1989), age (Helgeson, 1992), sex (Hernández, Marek and Renner 1984), social economic status (Acuna, 1983), majority/ minority status (Lawson & Bealer, 1984) as well as a number of individual aptitude (Owen, 1987) achievement and personality factors (Cloutier & Goldschmid, 1976). All have been found to influence the development of reasoning. Many of these variables are pre-existing attributes pupils bring with them to school. However, limited efforts have been made to discover what influences the development of reasoning ability once the pupils enrolls in school (Geogakakios, 1995).

In the 1990s, both Flavell and Wellman extended their studies on the child's theory of mind. Flavell, Green and Flavell (1995) claimed that not until the early school years do children conceive the idea of an independent active mind. Wellman and Hickling (1994) revealed that only at the age of 8 to 10 do children begin to move toward a conception of the mind as an independent active processor. Perner and Davies (1991) also found that even 4 years olds understand the mind as an active information processor but they used the term mind to refer to specific mental states rather than the mind as a separate conceptual construct. Fabricius and Alexander in Annevirtal and Vauras (1995) found that mental process was much more important to 10 than 8 years olds, and that even 10 year olds did not believe that mental processes were important during information acquisition.

Despite the fact that Flavell as early as 1979 called for research to describe and to explain spontaneous developmental acquisition of meta-cognitive, only some longitudinal studies exist to describe the development of meta-cognitive knowledge in young primary school pupils. Schneider and Sodian (1991) carried out a study of young children's memory behaviour and performance in a short-recall task. In the meta-memory part, children at the age of 4 and then later at the age of 6 were asked to choose among given alternatives, which strategies were the best to remember some toys. The children were also asked to justify their choices. The results indicated no age trends i.e. the children of both age used organizational strategies and had a conscious awareness of their effectiveness. However, the short term stability of meta-memory judgments seemed to be extremely low for the 4 years olds. In sum, young children improved at different rates thereby considerably changing their relative standing within their group between the two measurement points.

In the Munich Longitudinal study, Schneider and Weinert (1995) explored the memory development of about two hundred children between 4 -13 years of age. They used repeated measurements on a variety of memory variables such as intra-individual differences in short term memory capacity, strategic memory and memory primarily based on scripted knowledge and world knowledge. Only few developmental trends could be found. For example the inter-correlation among memory variables did not increase in strategic skills; it masked the actual variability of individual acquisition patterns.

Strand, Deary and Smith (2005) analyses the Cognitive Abilities Test (CAT) scores of a large and representative sample of UK pupils to determine the extent of any sex differences. A nationally-representative UK sample of 320,000 school pupils aged 11-12 years was assessed on the CAT (Third Edition) between September 2001 and August 2003. The CAT includes separate nationally standardised tests for Verbal, Quantitative and Non-Verbal reasoning. The size and recency of the sample is unprecedented in research on this issue.

The sheer size of the sample ensures that any sex difference will achieve statistical significance. Therefore effect sizes ( $d$ ) and variance ratios (VR) are employed to evaluate the magnitude of sex differences in mean scores and in score variability respectively. The mean verbal reasoning score for girls was 2.2 standard score points higher than the mean for boys, but only 0.3 standard points in favour of girls for NVR, and 0.7 points in favour of boys for QR. However for all three tests there were substantial sex differences in the standard deviation of scores, with greater variance among boys. Boys Sex Differences in Cognitive Abilities Test Scores 3 were over-represented relative to girls at both the top and the bottom extremes for all tests, with the exception of the top 10% in verbal reasoning. They concluded that given the small differences in means, explanations for gender differences in wider domains such examination attainment at age 16 need to look beyond conceptions of 'ability'. Boys tend to be both the lowest and the highest performers in terms of their reasoning abilities, which warns against the danger of stereotyping boys as low achievers.

A study carried out by Vandeploeg, Schinka, Baum, Tremont and Mittenberg (1998) adopted a similar methodology to the original Reynolds study, utilising WISC-IIIUK standardisation data and a brain injured sample. The authors employed a Best-2 method similar to that successfully employed in an adult sample (Vanderploeg, Schinka & Axelrod, 1996) but in this case combining demographic and 'hold' subtests from the WISC-IIIUK. Results of the study indicated strong predictive correlations superior to using demographic data alone for the standardisation sample. However, when predicting group membership in a test of its clinical utility, the Best-2 method was no more effective in identifying those children with brain injuries than Estimation of Intellectual abilities in Children 7 method using only demographic variables. The authors suggest the reason for the disappointing clinical utility of the Best-2 method may lie in the assumption underlying 'hold' tests i.e. that such tests are resilient to the adverse effects of brain injury. Although such measures appear to reflect stable, crystallised



abilities in adults, this may not be the case in children and performance on these subtests may be adversely affected by neurological damage.

Hyde, Fennema and Lamon (1990), performed a meta-analysis of 100 studies and reported an overall effect size of only  $d = 0.05$ , and in favour of females. However, the results suggested significant interactions between student age, type of ability and the selectivity of the sample. Thus differences favouring males tended to be restricted to the area of problem solving, emerged only at high school age (15-17 years), and were largest for self-selected samples, such as the US Scholastic Aptitude Test-Maths (SAT-Maths) compared to general population samples. There is considerable variability in the outcomes of the many small studies included within the Hyde and Linn (1988) and Hyde, Fennema and Lamon (1990) meta-analytic reviews. Perhaps the most compelling evidence in relation to sex differences will be found in the analysis of norms from standardised tests, where the sample is large and nationally representative on key demographic, educational and other relevant criteria. Two studies are particularly eminent in meeting these criteria. Feingold (1992) reviewed test norming statistics for four standardisations of the Differential Aptitude Tests (DAT) between 1947 and 1980 with US students aged 14-17+ do not reveal the substantial male advantage in numerical ability, or the female advantage in verbal reasoning, that might be expected from Maccoby and Jacklin's (1974) conclusions, although the female advantage for language and spelling, and the male advantage for spatial relations, are more congruent.

Tobin and Capie (1982) examined relationships between formal reasoning ability, locus of control, academic engagement and integrated process skill achievement. Twelve pupils from each of thirteen middle school science classes participated in the study. Measures were obtained for each pupil on nine engagement modes. Two engagement measures, attending and generalizing, together with formal reasoning ability, were related to process skill achievement and retention. Formal reasoning ability was the strongest predictor of process skill achievement and retention, accounting for approximately 36% of the variance in each case. Formal reasoning ability and locus of control were each correlated with specific engagement modes. Formal reasoning ability was positively related with rates of generalizing and comprehending. Locus of control was significantly related with rates of attending and total engagement.

Also Vygotsky (1979), Wertsch (1988) and Rogoff (1993), among others have defended the fact that capability to think develops in a social milieu. It is social interaction that

makes a person develops a form of reasoning adequate for their transforming adaptation to their environment. Different forms of social interaction in diverse cultural contexts will have different effects on development. Instead of the Piagetian metaphor of the child scientist, Rogoff (1993) proposes the child apprentice who learns with participating in problem solving tasks with the help of others with greater expertise. Aguilera (2001) believes there is no sense in stating that thinking is cultural and is construed in interaction and then proceeding to assess it individually. Concept such as the zone of proximal development does not refer to individual aspects, but to a space that appears during interaction, a shared space of common cognition that is more than the addition of individual thinking. But rather this researcher believe that the assessment of thinking skills is incomplete if individual are not observed in interaction with others with higher lower or equal cognitive level. On the other hand the study of thinking skills in dyadic situation is complicated enough methodologically to discourage further broadening of the field.

When reporting their finding at the annual meeting of the society for neuroscience in Toronto, psychologist, Hampson in Femenet (2005) administered tests on three groups of girls. His results showed that muscular coordination and verbal facility increased by as much as 10% during period of the month when levels of estrogen were high. At the same time, the women's ability to solve problems involving spatial reasoning fell by a similar amount. Benbow, Lubinski, Shea and Eftekhari-Sanjani (2000) reported 20 years follow up of 1,975 mathematically gifted adolescents whose assessment at age 12 to 14 revealed robust gender differences in Mathematical reasoning ability. Both sexes became exceptional achievers and perceived themselves as such. They reported uniformly high levels of degree attainment and satisfaction with both their career direction and their overall success. Ibeagha and Owolabi (1996) report a significant positive influence of self-concept on students' critical thinking ability. Similarly, Sokan (1998) reported that pupils with higher cognitive ability performed significantly better in both age groups on the humour tasks than their intellectually disadvantage counterpart. In the light of the above review of literature, the study aims at examining the relationships between some demographic variables and pupils reasoning ability. To achieve these objectives, two hypotheses were developed. These are:

1. There will be no significant relationship among demographic variables: gender, age, tribe, class, religion and pupils reasoning ability.
2. Demographic variables: gender, age, tribe, class and religion will not significantly predict pupil's reasoning ability.

## Method

### *Participants*

The population of this study comprised the primary school pupils in Ibadan, Nigeria. A total of ten public primary schools were purposefully selected from Ibadan, the Capital of Oyo state Nigeria. From each of the selected school a total of 40 pupils were selected from class 5 and 6. The age of these pupils ranged from 8 – 11 years with a mean of 14.5 years. The demographic information reveals that 200 were male and 200 were female. Further, it was shown that 160 of them 40% were selected from primary 5 and 240, 60% were selected from primary six. On age of the respondents, it was shown that 120, 30% were 8 years old; 120, 30% were 9 years old; 80, 20% were 10 years old and another 80, 20% were 11 years old. Additionally, the data reveals tribes of the pupils. It was shown that 256, 64% of the pupils were Yoruba, 120, 30% were Igbo and 24, 6% were Hausa.

**Table 1. Pupils demographis data**

<b>Demographics</b>	<b>Sample</b>	<b>Percentage</b>
<b>Schools</b>		
1	40	10
2	40	10
3	40	10
4	40	10
5	40	10
6	40	10
7	40	10
8	40	10
9	40	10
10	40	10
	400	100
<b>Class</b>		
Primary 5	160	40
Primary 6	240	60
<b>Age</b>		
8 years old	120	30
9 years old	120	30
10Years old	80	20
11 years old	80	20
<b>Gender</b>		
Male	200	50
Female	200	50
<b>Tribe</b>		
Yoruba	256	64
Igbo	120	30
Hausa	24	6

### *Instrument*

The instrument used for the collection of data on this study was a validated instrument named Reasoning Assessment Test (RAT) by Sokan (1986). The reliability coefficient of the instrument was found to be 0.82 via split half method with spearman Brown formula for correction. The instrument contains picture absurdity cards which design to elicit reasoning ability in children. The items in the instrument are speeded tests. Respondent's time of response is assessed along with the option chosen. The maximum time allowed in a testing situation for an item is 60 seconds. A stopwatch was used to determine this. Pupils who get the picture corrects at the specified time was score 1; while wrong was score zero. There are ten cards in all.

A demographic questionnaire was used to collect data on the demographic information of the respondents. These include gender, age, class, religion and tribe.

### *Procedure*

The instrument was administered to the respondents in their respective schools after the permission from the various authorities of the schools. The instrument was administered in each school with the help of some teachers. Instruction on how to go about responding to the instrument was read to the respondents before the commencement of the exercise. This ensures proper response to the instrument by respondents.

This study employed an ex-post-facto research design. This is known as causal comparative, explanatory observational or descriptive research (Best & Kahn, 1998, 2006; Ezeani, 1998). Kerlinger (1975) described it as a systematic empirical enquiry in which the investigator does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulable. Inferences about relations among variables are made without direct intervention from concomitant variation of independent and dependent variables. The study could have employed experimental research design to establish the cause and effect of the use of Internet on perceived academic performance. Rather an ex-post facto research design is chosen because the study is interested in finding the causal relationship between the variables and in observing what has happened to the sample subjects without any attempt to control or manipulate them.

## Results

The results of the analysis on the study are presented as follows.

*Hypothesis 1:* There will be no significant relationship among demographic variables: gender, age, tribe, class, religion and pupils reasoning ability.

**Table 2. Intercorrelation Matrix of the relationship among the demographic variables and pupils reasoning ability**

Variables	N	Mean	SD	R.A	Gender	Age	Class	Religion	Tribe
<b>Reasoning Ability</b>	400	4.145	1.67	1.0000	.1469	0.6374	0.0767	0.0827	0.0883
<b>Gender</b>	400	2.567	0.89	0.1469	1.0000	-.1201	0.3181	0.1145	-.2271
<b>Age</b>	400	2.441	0.83	0.6374	-.2565	1.0000	0.2151	-.0491	0.2355
<b>Class</b>	400	2.347	0.68	0.1767	0.7514	-.1758	1.0000	0.0622	-.4225
<b>Religion</b>	400	2.123	0.56	0.0827	0.1207	0.3008	0.0622	1.0000	0.2575
<b>Tribe</b>	400	2.103	0.47	0.0883	-.4057	0.5811	-.4225	0.2575	1.0000

RA = Reasoning Ability

The intercorrelation between the independent variables (the demographic variables) shows that Age has the highest and positive correlation with reasoning ability (.6374). This is followed by class (.1767) and Gender (.1469). Religion and tribe show no significant correlation with reasoning ability. The results suggest generally that age, class and gender significantly relate with pupils reasoning ability. The results also reveal the mean and standard deviation for each of the dependent variables. Gender has the highest ( $\bar{x}$  = 2.0; SD, 0.9); followed by age ( $\bar{x}$  = 2.4; SD, = 0.8). Others followed in this order: Class ( $\bar{x}$  = 2.3; SD, 0.7); Religion ( $\bar{x}$  = 2.1, SD, =0.6) and Tribe ( $\bar{x}$  = 2.1, SD, = 0.5).

*Hypothesis 2:* Demographic variables: gender, age, tribe, class and religion will not significantly predict pupil's ability.

A stepwise multiple regression analysis on the data obtained on independent (Demographic variables: Gender, age, class, religion, and tribe) and dependent (pupils reasoning ability) variables were run. Table 3 shows that all the demographic variables made 54% prediction of pupils reasoning ability. From the analysis of variance in table performed on multi-

ple regression, it is seen that the calculated F value =6.6268, P< .05 when the five variables were regressed with the pupils reasoning ability. These indicate that there is no significant difference in all the demographic variables and pupils reasoning ability.

**Table 3. Multiple regression on demographic variables and pupil’s ability**

<p><b>Multiple R</b> .38197  <b>R. square</b> .54590  <b>Adjusted R square</b> .14158  <b>Standard error</b> .39948</p>				
<b>Analysis of variance</b>				
	<b>Df</b>	<b>Sum of squares</b>	<b>Mean square</b>	<b>F</b>
<b>Regression</b>	5	5.39750	26.9875	0.002
<b>Residual</b>	394	31.59750	12449.415	
<b>Total</b>	399			

Table 4 provides the co-efficient of the extent of the prediction. The essence of this is to know which of the variables best predict pupils reasoning ability.

**Table 4. Co-efficient of the prediction**

<b>Variables</b>	<b>B</b>	<b>SE.B</b>	<b>Beta</b>	<b>T.</b>	<b>Sig.T</b>
<b>Gender</b>	.131064	.058339	.221182	1.982	S**
<b>Age</b>	.042375	.056645	-.154778	3.206	S**
<b>Class</b>	-.016163	.056873	-.040321	2.068	S**
<b>Religion</b>	.015825	.066737	.020850	.283	NS
<b>Tribe</b>	.115307	.056034	.198376	.525	NS
<b>Constant</b>	32.964039	4.118007		6.829	0000

The table 4 above shows that three (3) of the independent variables had significant predictive effect on the pupils reasoning ability. Age had the greater effect (Beta = .1548, t = 3.206; P <.05). This is followed by Class with (Beta = -.0403; t = 2.068; P<.05) and gender

(Beta = 2212;  $t = 1.982$ ;  $P < .05$ ) respectively. The predictive effect of religion and tribe were so low and hence could not enter the analysis. This indicates that age, class and gender are good predictors of pupils reasoning ability. This shed more light on the results in table 2 where gender age and class pulled the highest correlation with pupils reasoning ability.

## Discussion

The result of the first hypothesis reveals that significant relationship exist among age, class and gender and pupils reasoning ability. This result lends a good credence to the finding by (Benbow et al., 2004) that gender correlates with overall success of pupils in mathematics reasoning. So also gender has been found to be correlated with reasoning by (Hernandez, Marek & Renner, 1984; Hernandez & Mwamwenda, 1988). Similarly, the report by (Helgeson, 1992) reveals that age had significant correlation with pupils reasoning ability, and (Ziegler et al., 2008) report that comprehension consistently increase with age. The assertion that young children improve in reasoning at different rates can be the explanation for the correlation with class. But it can be said that since age correlates with pupil's ability, the correlation between class and age also is not surprising. This is because the result can be interpreted bby saying that as pupils increase in age; their reasoning ability also is on the increase. The same might apply to class; that as pupil's progress from one class to the other, their reasoning ability also increases. Actually knowledge gain at one level or what the pupils learn in one level is quite different and as they progress from one level to the other knowledge gain is on the increase. This may responsible for the correlation of pupils reasoning ability with class.

The second result on the study reveals the predictive capability of the demographic variables and pupils reasoning ability. It was shown that age, class and gender best predict pupils reasoning ability at the expense of tribe and religion with age exerting the most prediction followed by class and gender. Following the explanation above, the prediction of age and class are not also surprising. This is because as there is progression from one age level or from one class to the other under normal circumstances; this influences the development of pupils reasoning. The correlation of gender has been assumed by some earlier researcher (e.g. Helgeson, 1992). This confirms the finding on gender and pupils reasoning ability on this study. But it should be noted that this is still subject to verification to determine which gender develop and correlate with reasoning ability than the other. This is left for the future researcher to decide.

It should be noted that development of pupils reasoning is very important at this digital age. This is because one of the things needed to survive at the digital age is the ability to reason very well so that interaction with the digital world will not be difficult. In the light of this fact and based on the results of this study, it is recommended that schools should make provision for materials that can stimulate their reasoning ability. Things like computers, fascinating object, simulation and games of different kinds can be provided. The parents as well are called upon to endeavour to provide some of these things in the home. The teachers also have their own part to play by teaching the pupils in a way by which their reasoning ability will develop rapidly.

However, this study has its own limitation. First, the sample of the study was selected only from Ibadan, the capital of Oyo State, in Nigeria, the state which comprises of about 32 local government areas. Only pupils in primary 5 and 6 took part in the study. Additionally, there are many tribes in Nigeria but only pupils from the three prominent tribes were given opportunity to take part in the study. Therefore, future research is needed that will take care of these identified limitations.

## References

- Acuna, J.E. (1983). Acculturation, social class and cognitive growth. Quejon city, Philippine: Philippines University, Science Education Center (ED 239-751). Addenda and a few words on alternative and conditional approaches. *Archives of Clinical Neuropsychology*, 12(8), 769-778.
- Aguilera, A. (2001). Shared thinking: concept and assessment. *European Journal of Psychology of Education*, 15(2) 283 – 298.
- Annevirtal, T. & Vauras, M. (2001). Meta-cognitive knowledge in primary grades: A longitudinal study. *European Journal of Psychology of Education*, 16(2), 257-282.
- Benbow, C.P., Lubinski, D., Shea, D.L. & Eftekhari-Sanjam, H. (2000). Sex differences in mathematical reasoning g ability at age 13: status 20 years later. *Psychological Science*, 6, 474 -480.
- Beck, L.E. (1997). Child development. Fourth edition. Massachusetts: Allyn & Bacon.
- Best, J.W. & Khan, J.V. (1998). *Research in Education. Ninth Edition*. Boston: Allyn and bacon Publishers.



- Best, J.W. & Khan, J.V. (2006). *Research in Education. Tenth Edition*. Boston. Allyn and Bacon Publishers.
- Cherian, U.I., Kibria, G.F., Kariuki, P.W. & Mwamenda, T.S. (1988). Formal operational reasoning in African University Students. *The Journal of Psychology*, 122(5), 487-498.
- Chrickering, A.W., & Gamson, Z.F. (1987). *Seven principles for good practice in undergraduate education*. Washington, DC.: American association for Higher Education (Eric Document Reproduction Service No. ED 282 491).
- Cloutier, R. & Goldschmid, M.L.(1976). Individual differences in the development of formal reasoning. *Child development* 47, 1097-1102.
- Diamond, M., & Hopson, J. (1998). *Magic trees of the mind: How to nurture your child's intelligence, creativity, and healthy emotions from birth through adolescence*. New York: Dutton.
- Donaldson, M.(1978). *Effects of a technology enriched learning environment on student development of higher order thinking skills*. Doctoral Dissertation. University of North Texas, Denton.
- Elder, L.(2004). Diversity: Making sense of it through critical thinking. Available at: <http://www.criticalthinking.org/> [Accessed 08 March 2005].
- Ezeani, S.I. (1998). *Research methods: A Realistic Approach*. Ibadan, Nigeria. Elohim Publishers.
- Faloye, J.O.(2005). *Piaget's concept of development*. A Seminar Paper. Department of Guidance and counseling, University of Ibadan, Nigeria.
- Feminet, I.(2005). Hormone linked to reasoning ability. Available at: <http://www.julie@GenderWeb.org> [Accessed 08 March 2005].
- Feingold, A.(1992). Good-looking people are not What We Think. *Psychological Bulletin* 111(2), 304-341.
- Finegold, M., & Mass, R.(1985). Differences in process of solving physics problem between good physics problem solvers. *Research in Science and technology Education* 3 (1), 59-67.
- Fisher, R.(1998). *Teaching thinking : Philosophical Enquiry in the classroom*. London Cassell.
- Flavel, J. (1985). *Cognitive Development*. Englewood Cliffs, NJ. Prentice-Hall
- Flavel, J.H., & Wellman, H.M.(1977). *Meta-memory*. In R. Kail & J. Hagen (Eds), *Perspectives on the development of memory and cognitive*. Hilldale, N.J: Erlbaum.

- Flavel, J.H., Green, F.L., & Flavel, E.R. (1995). Young children's knowledge about thinking. *Monographs of the Society for Research in Child Development, 60*.
- Geogakakios, J.H. (1995). *Impact of solving research in middle junior high school science education*. Columbus, OH: Eric Clearing House for science, Mathematics and Environmental Education. (ED 351 208).
- Helgeson, S.L. (1992). *Problem Solving in Middle/Junior High school Science Education*. Columbus, O.H: ERric Clearing House for Science, Mathematics, and Environmental Education.
- Hernandez, L.D., Marek, E.A., & Renner, J.W. (1984). Relationship among gender, age and intellectual development. *Journal of Research in Science Teaching 1(4), 365-373*.
- Hyde, J. S., & Linn, M. C. (1988). Gender differences in verbal ability: A meta-analysis. *Psychological Bulletin, 104, 53-69*.
- Hyde, J. S., Fennema, E., & Lamon, S. J. (1990). Gender differences in mathematics performance: A meta-analysis. *Psychological Bulletin, 107, 139-155*.
- Ibeagha, E.J., & Owolabi, H.O. (1996). Critical thinking ability and attitudinal determinant of Nigerian secondary school students' achievement in economics. *Nigerian Journal of Clinical and Counselling Psychology 2 (1,2), 18-27*.
- Inhelder, B. & Piaget, J. (1958). *The growth of logical thinking from childhood to adolescence*. New York: Basic Books.
- Kerlinger, F.N. (1975). *Foundations of behavioural research*, Rinehart and Winston, London, Holt.
- Lawson, A.E. (1982). Formal reasoning, achievement, and intelligence: an issue of importance. *Science Education 66 (1), 77-83*.
- Lawson, A.E. & Bealer, J.M. (1984). Cultural diversity and differences in formal reason ability. *Journal of Research in Science Teaching. 21 (7), 735- 743*.
- Maccoby, E. E., & Jacklin, C. N. (1974). *The psychology of sex differences*. Stanford, CA: Stanford University Press.
- McGee, P.C. (1981). Cognitive development and children's comprehension of humour. *Child Development 42, 123- 130*.
- Mowday, R.T., Porter, L.W., Steers, R.M. (1982). *Employee-Organization Linkages*, Academic Press, New York, NY.
- Omomia, T.A. (2005). *Development of thought in Children*. A seminal paper. Department of Guidance and Counselling, University of Ibadan.

- Owen, D. (1987). *The SAT and social stratification*. In J.W. Noll (Ed) *Taking sides: Clashing views on controversial educational issues* (4<sup>th</sup> ed). Guilford, C.T: The Dushkin Publishing Group Inc.
- Perner, J. & Dennies, G.(1991).Understanding the mind in cognitive growth. *Contemporary Psychology* 12, 532-533.
- Price, J.L.(1995). A role for demographic variables in the study of absenteeism and turnover. *International Journal of Career management* 7 (5), 26-32.
- Resnick, L.B.& Gelman, R.(1985).Mathematical and scientific knowledge: An overview. Pittsburg, P.A: Pittsburg University. Learning Research and Development Center (ED 258 808).
- Rogoff, B. (1993). *El desarrollo cognitive en el contexto social (Cognitive apprentice's cognitive development in the social context)*. Barcelona Paidos.
- Samuel, J.& Bryant, P.(1984). Asking only one question in the conservation experiment. Available at: <http://www.findarticles.com> [Accessed 11 March 2005].
- Schneider, W. Weinert, F.E. (1995). Memory development during early and middle childhood. Finding from the Munich longitudinal study (LOGIC). In F.E Weinert & G.Schneider (Eds), *Memory performance and competencies: Issue in growth and development* (pp. 263 -279) NJ: Lawrence Erlbaum Associates.
- Schneider, W.& Sodian, B. (1991). A longitudinal study of young children's memory behaviour in a short-recall task. *Journal of Experimental Child Psychology* 51, 14 -29.
- Scores: A UK National Picture. *British Journal of Educational Psychology*. Available at: <http://www.warwick.ac.uk/fac/soc/cedAr/staff/stevestrand/stranddearysmithbjep.pdf> [Accessed 14 April 2007].
- Sokan, B.O. (1998). *Reasoning Assessment Test (RAT)*. Ibadan. Stirling-Horden Publishers (Nig.) Ltd.
- Sokan, B.O. (1998).The role of operational thinking in some Nigerian children's comprehension of humour. *Nigerian Journal of Applied Psychology* 4 (1), 72-77.
- Strand, S., Deary, I.J.,& Smith, P.(2005). Sex Differences in Cognitive Abilities Test
- Stuessy, C.(1984). Path analysis: A model for the development of scientific reasoning abilities in Adolescents. *Journal of Research in Science Teaching* 26 (1), 41-53.
- Stuessy, C.(1989).Correlates of scientific reasoning in adolescents: Experience, locus of control, age, field dependence-independence, rigidity/flexibility I>Q and gender. Columbus, OH: Doctoral Dissertation. The OHIO State University (ED 244 838).

- Tobin, K.G., Capie, W.(1982).Relationship between formal reasoning ability, locus of control academic engagement and integrated process skills achievement. *Journal of Research in Science Teaching* 19 (2), 113-121.
- Vanderploeg, R. D., Schinka, J. A., & Axelrod, B. N. (1996). Estimation of WAIS-Rpremorbid intelligence: Current ability and demographic data used in a bestperformance fashion. *Psych. Psychological Assessment*, 8, 404-411.
- Vanderploeg, R. D., Schinka, J. A., Baum, K. M., Tremont, G., & Mittenberg, W. (1998). WISC-III premorbid prediction strategies: Demographic and best performance approaches. *Psychological Assessment*, 10(3), 277-284.
- Vygotsky, L.S.(1979).El desarrollo de los process psicologicos superiores (The development of higher psychological processes ). Barcelona: In Wertsch , J.V. & Vygotsky, L.S. *La formation social de la mente* (Vygotsky and the social formation of mindI. Madrid: Paidos.
- Vygotsky, L.S.(1978). *Mind in society*. Cambridge Mass. Harvard University Press.
- Wellman, A.M.& Hicking, A.K (1994).The mind's "1". Children's conception of the mind as an agent. *Child Development*, 65, 1564 1580.
- Wertsch, J (ed). (1988). *Cognition Bgotskian Perspectives*. Cambridge: Cambridge University Press.
- Zigler, E., Levine, J., & Gould, L.(1976). Process in the development of children's appreciation of humour. *Child Development* 37, 507-518.