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Demographic Variables and Pupils Reasoning Ability: A Critical Analysis

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Abstract: The study examined demographic variables and reasoning ability of primary school pupils. It drawn on 200 pupils from 6 purposefully selected private primary schools in Ibadan, Nigeria. The age of these pupils ranged from 9-11 years. A Reasoning Assessment Test developed by Sokan 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. 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. 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.

Key words: Demographic variables, reasoning ability, pupils, primary school, Nigeria

INTRODUCTION

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).

More than a century ago, Dewey had asserted that all which the school can do or need to do for pupils as far as their minds are concerned is to develop their ability to reason. Geogakakios (1995) asserted that reasoning is used to denote consistent logical thought patterns which are employed during the process of inquiry that enable individual pupils to propose relationships between observed phenomena, to design experiments which test hypotheses concerning relationships to determine all possible alternatives and outcomes to consider probabilities of occurrences, to predict logical consequences, to weight evidence, or proof; and to use a number of instances to justify a particular conclusion.

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 *et al.* (1976) and 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. In the light of this, the present 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.

Demographic variables are widely used in the study of behaviour. Mowday *et al.* (1982) have a category of variables labeled personal characteristics and four of the 5 characteristics-education, tenure, age and gender-included under this category are demographic variables. Demographic variables are social categories for individuals. The 5 variables cited from the Mowday *et al.* (1982) ducation, tenure, age, gender and job level-are examples of these variables (Price, 1996). Demographic variable can refer to social systems as well as individuals.

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It has been agued that demographic variables are nonsense variables. Some researcher (Price, 1995) has also argued that the concept is often used inappropriately in research.

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 (Berk, 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. 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 and 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 the same Hopson 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 (1979) 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 (Flaval) 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 (Ihelder and Piaget, 1958). Prior knowledge (Resnick and Gelman, 1985) processing capacity (Finegold and Mass, 1985) cognitive styles (Stucssy, 1984) age (Helgeson) sex (Hernandez and Mwamwenda) social economic status (Acuna, 1983) majority/minority status (Lawson and Bealer, 1984) as well as a number of individual aptitude (Owen, 1987) achievement and personality factors (Cloutier and 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 Welman extended their studies on the child's theory of mind. Flavel *et al*. (1995) claimed that not until the early school years do children conceived the idea of an independent active mind. Wellman and Hickling (1994) revealed that only at the age of 8-10 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 year 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 (2001) 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 Flavel 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 view 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.

Also Vygotsky (1979) and Rogoff (1993) Wertsch and 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) believe 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 Feminet (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 *et al.* (2004) reported 20 years follow up of 1,975 mathematically gifted adolescents whose assessment at age 12-14 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:

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

MATERIALS AND METHODS

Research design: This study employed an expost-facto research design. This is known as causal comparative, explanatory observational or descriptive research.

Kerlinger described it as asystematic empirical enquiry in which the investigator does not have direct control of independent variables 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.

Population and sample: The population of this study comprised the primary school pupils in Ibadan, Nigeria. A total of ten private primary schools were purposefully selected from Ibadan North Local government of Ibadan, the Capital of Oyo state Nigeria. From each of the selected school a total of 20 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 100 were male and 100 were female. Further, it was shown that 80 of them 40% were selected from primary 5 and 120, 60% were selected from primary six. On age of the respondents, it was shown that 60, 30% were 8 years old; 60, 30% were 9 years old; 40, 20% were 10 years old and another 40, 20% were 11 years old. Additionally, the data reveals tribes of the pupils. It was shown that 128, 64% of the pupils were Yoruba, 60, 30% were Igbo and 12, 6% were Hausa.

Instrument: The instrument used for the collection of data on this study was a validated instrument named Reasoning Assessment Test (RAT) by Sokan (1998). 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 sec. 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 of administration of the instrument: 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.

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.

The intercorrelation between the independent variables (the demographic variables) shows that age has the highest and positive correlation with reasoning ability (0.6374). This is followed by class (0.1767) and gender (0.1469). 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 (Table 1).

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 2 shows that all the demographic variables made 54% prediction of pupils reasoning ability. From the analysis of variance in Table performed on multiple regression, it is seen that the calculated F value = 6.6268, $p<0.05$ when the 5 variables were regressed with the pupils reasoning ability. These indicate that all the demographic variables were good predictors of pupils reasoning ability.

Table 1: Intercorrelation martix of the relationship among the demographic variables and pupils reasoning ability

Variables	No	Mean	SD	R.A	Gender	Age	Class	Religion	Tribe
Reasoning ability	200	4.145	1.67	1.0000	.1469	0.6374	0.0767	0.0827	0.0883
Gender	200	2.567	0.89	0.1469	1.0000	-.1201	0.3181	0.1145	-.2271
Age	200	2.441	0.83	0.6374	-.2565	1.0000	0.2151	-.0491	0.2355
Class	200	2.347	0.68	0.1767	0.7514	-.1758	1.0000	0.0622	-.4225
Religion	200	2.123	0.56	0.0827	0.1207	0.3008	0.0622	1.0000	0.2575
Tribe	200	2.103	0.47	0.0883	-.4057	0.5811	-.4225	0.2575	1.0000

Table 2: Demographic variables: Gender, age, tribe, class and religion will not significantly predict pupil's ability

Multiple R	0.38197
R. square	0.54590
Adjusted R square	0.14158
Standard error	0.39948

Analysis of variance

	Df	Sum of squares	Mean square	F
Regression	5	5.39750	1.0795	6.6268
Residual	194	31.59750	0.1629	
Total	199			

Table 3: Co-efficient of the prediction

Variables	B	SE.B	Beta	T.	Sig.T
Gender	0.131064	0.058339	0.221182	1.982	S**
Age	0.042375	0.056645	-0.154778	3.206	S**
Class	-0.016163	0.056873	-0.040321	2.068	S**
Religion	0.015825	0.066737	0.020850	0.283	NS
Tribe	0.115307	0.056034	0.198376	0.525	NS
Constant	32.964039	4.118007		6.829	0000

Table 3 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.

The Table 3 above shows that 3 of the independent variables had significant predictive effect on the pupils reasoning ability. Age had the greater effect (Beta = 0.1548, t = 3.206; p <0.05). This is followed by Class with (Beta = -.-0403; t = 2.068; p<0.05) and gender (Beta = 2212; t = 1.982; p <0.05), respectively. The predictive effect of religion and tribe were so low and hence could not enter the analysis.

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.* (2000) that gender correlate with overall success of pupils in mathematics reasoning. So also gender has been found to be correlated with reasoning by Hernandez *et al.* (1984). Similarly, the report by Helgeson, reveals that age had significant correlation with pupils reasoning ability and Ziegler's *et al.* (1976) 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 by 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. 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.

CONCLUSION

However, this study has its won limitation. First, the sample of the study was selected only from one local government area. 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.

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