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GENOTYPE, BLOOD GROUPS AND SOCIO-ECONOMIC STATUS: RELATIONSHIP WITH STUDENTS' ACADEMIC ACHIEVEMENT AND IMPLICATION FOR SCIENCE EDUCATION

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Abstract: The study examined the place of genotype, blood group and socio-economic-status on students' academic achievement in sciences in tertiary institution in Rivers State. Over the years the factors responsible for the improvement or poor academic achievement of students in school science has been studied in some details, however, available research records showed that the only factor or area where the study has not been fully done is the role or contribution of heredity to students' academic achievement. This study which juxtaposed the place of students genotype, blood groups and the SES with their academic achievement adopted an Ex-post facto survey design where the genotype and history of students were collected from the students medical records as the way the medical records reported about the students, while the Cumulative Grade Point Average (CGPA) were also collected from the senate approved semester results of the students. The study was guided with four research question and a corresponding four null hypotheses. The population of the study was restricted to only year one students because of the medical history. The result of the findings include,1. Sex and genotype have a strong relationship 2.genotype of the learner determines to a large extent the abilities and achievement of students in the sciences courses 3. That as well, the blood group of the individual compliments the genotype as well as the achievement of students in sciences. However, the SES of students never influenced the outcome of students.

Keywords. Genotype**, a**cademic achievement, blood group, SES, polymorphism, student

Background

There are numerous factors that influence or are responsible for students' academic achievement in schools, whether positive or negative, at the primary, secondary, or tertiary education levels. These factors include both intrinsic and extrinsic factors relating to the students (the level of Socio-economic standing, their IQ, the school location, the school environment and so on). Other factors include parental variables (parents' level of education, attitude toward science and their children's education, cultural beliefs, and so on). When these factors are taken into account, other issues such as the school learning environment, hereditary (genetic) disposition, and teacher factors are all perceived to have influenced students' achievement in various dimensions, either negatively or positively. Available research studies and a plethora of literature have indicated that almost all of the factors mentioned above have been thoroughly investigated to determine their contributions to students' achievement in the sciences, with some clearly indicated as positively influencing or responsible for the difference in achievement, while others have yet to be associated with their contributions to the student. Although two children in the same family may bear striking physical resemblances, siblings are more different than alike in intellect and personality (Enoch et al., 2009). Genetic inheritance found to have a significant impact on both intellectual ability and specific abilities. Adoption and twin studies have provided evidence that genetic factors plays a role in intelligence. Heredity appears to play a larger role in cognition ability as people age, with heritability reaching as high as 80%. The only aspect about which there is little knowledge and contribution is the role of nature (Hereditary) on academic achievement in schools. The conjecture about hereditary factor has been that,

- Could a student perform better than others if his/her genotype is different from the other students?
- Why are students from the same parents raised in the same environment and exposed to the same learning opportunities perform differently during their school days?
- Why students from the same parents or background choose to study different specializations in schools?
- What is responsible for these observed variations or individual difference?

These and other questions beacons for answers with a view to understanding the role of hereditary to students' academic achievement. It is therefore necessary to further investigate the influence of genetic makers and their contribution to students' achievement in science in secondary schools since the individual differences still exist.

Many factors influence students' development and academic achievement. Some are the result of heredity (genetic factors), which is an inborn genetic endowment that humans receive or inherit from their biological parents. Others come from the outside world, from the world beyond the self. The gene is the fundamental unit of heredity; it contains all of the hereditary materials passed down from biological parents to children. The term "genotype" refers to the genetic component of a child that they inherits from their parents at birth; the child inherits from both parents the genes that cause variation, and even monozygotic twins have some remarkable individual differences. There are specific genes and gene system that are linked to a wide range of behavioural personality and cognitive phenotypes (Plomin et al., 2006; Ruther, 2006), All cognitive activities take place in the brain of humans. In the brain, there is a part that is responsible for cognition which is called the frontal lobe of the foramen acumen. Again, the child inherits the parents genes embedded in the brain.

There are specific generic markers who create a readily identifiable genetic trait that can be used in family and demographic studies, as well as linkage analysis. Generic markers are DNA sequences that have been linked to specific chromosomal loci and are linked to specific traits. Genetic variation was discovered, which means that different organisms of the same species have different biomarker. The region of DNA that codes for blood type A, B, and O is a classic example of this type of marker in humans. All humans have and require blood, but the blood of individual humans can vary greatly due to polymorphism in the genome that code for blood. Another example is the sickle cell anemia gene (SS) as well as the AS carrier genes, or the normal cell (AA). Biomarkers can be applied in a number of ways. One of the most obvious is tracing the inheritance and history of traits ranging from eye colour to genetic diseases. Understanding which regions of the genome are involved in the inheritance of popular traits can help researchers better understand factors which influence students' academic achievement that are associated with these compostable traits, and this knowledge can sometimes be applied to diagnosis of diseases. It also has impact on the students' academic opportunities. Several genetic markers, for example, have been linked to an increased risk of breast cancer in women who studied science in secondary school, and women with these markers can choose more aggressive preventative care to address this threat.

A gene or nucleotide sequence that can be used to identify a person or a species based on their known location on a chromosome is known as a biomarker. It is described as an obvious difference (which may result from a modification or alteration in the genomic loci). Genetic markers can be created from short or long DNA sequences, like the one surrounding a single base pair alteration (Single Nucleotide Polymorphism, SNP). Two categories of molecular genetic markers are recognised. Molecular markers that identify changes in DNA, such as nucleotide alterations, deletion, duplication, inversion, and/or insertion, and biochemical markers that identify changes in gene products, such as protein and amino acid modifications. There are several applications for markers. If a marker exhibits both dominant and recessive or co-dominant of process in homozygotes at the same time, it is said to be co-dominant. Co-dominant markers typically provide more information than dominant markers. The association between an inherited disease and its genetic cause can be investigated using genetic markers (for example, a particular mutation of a gene that results in a defective protein). It is known that DNA segments that are adjacent to one another on a chromosome are inherited together. This characteristic makes it possible to utilise a marker, which may then be used to pinpoint the specific inheritance pattern of an unlocalized gene. Genetic markers are used in hereditary DNA testing for genetic lineages to estimate the genetic separation between individuals or communities. Researchers examine a single parental marker to identify either the maternal or paternal lineages (on mitochondrial or Y chromosomal DNA). Autosomal markers are employed for all ancestries. Because homozygotes offer little information, genetic markers must be clearly identifiable, connected to a specific locus, and heavily parameterized. Via alloezymes, the marker can be located directly or indirectly using RNA sequencing. Genetic markers have been applied to animals to evaluate the transcription response to selection. Selection, both natural and artificial, modifies a cell's genetic make-up. The existence of several alleles implies a distinction between selected and unselected livestock due to skewed segregation at genetic markers. Guo and Streans (2002) discovered that the interaction between education level and genetic influences on verbal intelligence vanished when other environmental indicators, such as earnings, parental occupation, lack of biological parents, and race, were taken into account in their study of adolescent verbal intelligence. The relationship between genetic variation and socioeconomic advantage through cognitive ability has previously been studied using single SES benchmarks, such as educational levels (Haworth et al. 2008), parental occupational status (Vaden Oord & Rowe 1997), and poll tract characteristics (Barntt et al.,2007), as well as linear combinations of the aforementioned (Chang & Cheng 2008). With the exception of Guo and Streans,(2002) differences in indicators' capacity to alter genomic expression have not been studied. Barntt et al. (2007) found no evidence of a direct association with census tract characteristics, while Van Den Oord and Rowe (1998) found no evidence of a direct interaction with parental occupational position. Interpreting a genotype-socioeconomic status interaction is challenging since SES is assumed to represent both parental genetic differences and changes in the calibre of the environment in which children are nurtured (Chang & Cheng, 2008). Therefore, observed changes in heritability with money and education may indicate an interaction with genetic differences between the more and less affluent families rather than showing a play with environmental quality (gene-gene interaction). In contrast, genetic variation has less of an impact on income. It is more strongly correlated with parental education or employment than parental intellect. Rowe et al. (1998) found a 0.25-0.66 within-person association between education and IQ as well as a 0.26-0.38 within-person link between income and IQ in a representative sample of people aged 28 to 35. Additionally, income has a lower propensity (0.422 versus 0.68), and the bulk of the cumulative genetic variance in income is not shared with either education or IQ, despite the fact that 75% of the total genetic variance in education is shared with IQ (71 percent). Because parental IQ is mostly unaffected by genetic influences on wealth, we can be certain that the observed association is a genotype by environment interaction. We are interested in understanding more about the genetic relationship between parental socioeconomic position and children's and adolescents' learning capacities. Due to the fact that twin children are not often illuminating about parental traits that are not necessarily similar, it was difficult to determine this in the current study. Many studies have been done on how different elements of the reward pathway can make someone more or less susceptible to addiction because the brain's reward system has been connected to many functions, including addiction. This system is triggered when tasks like feeding or sex are carried out. Induced neurons (brain cells) in the ventral tegmental area (VTA) release chemicals into the nucleus accumbens, (NA) a brain structure in this scenario. The frontal cortex, which controls the majority of decision-making, receives these impulses after travelling through synapses (tiny spaces between neurons). (Stephen et al., 2007). A considerably stronger signal can be transmitted as a result of an increase in the synapse of the recipient neurons or neurotransmitters. Conner et al. (2010) argued that because people respond to nicotine and other chemicals differently in these neurons, distinct hereditary features may have an impact on individual disparities in academic performance. An alternative explanation for why people report varying levels of addiction has been proposed: "hereditary differences" which postulates that; the human brain develops in a socioeconomic context and childhood socioeconomic status (SES) has an impact on neural development. SES has been shown to be highly predictive of a variety of outcomes, including physical and mental health, cognitive ability, and academic achievement, when measured during childhood (Adler & Rhkopt, 2008). SES must influence academic achievement in part by influencing the neurocognitive systems that underpin these behavioural outcomes. It is in the light of the above that this study is conceptualized to examine the connection between students' genotype, blood group and SES with their academic achievement. .

Research Questions

1: What is the mean difference in the academic achievement scores of students' based on their different genotypes?

2 What is the mean difference in the academic achievement of students based on their different blood groups?

3 is there any relationship between students SES, Genotype and Academic Achievement?

Hypotheses

H01: There is no significant mean difference in the academic achievement scores of students based on genotype.

H02: There is no significant mean difference in the academic achievement scores of students with different blood groups based on genotype.

H03: There is no significant difference in the academic achievement of students based on based on parental socio-economic status

Methodology

An Ex-post factor design was used in this study. The students' genotypes were determined using climate data. A comprehensive medical examination was conducted at the hospital where the students were examined. Electrophoresis was used to determine each student's genotype, while the A, B, and O methods were used to determine blood groups, with each student's blood group being recorded and labeled for the study. The study's population included 1,045 students from the university's five faculties and 20 departments. Active participants were limited to students with complete medical records and matriculation numbers. The results approved by the Senate are needed to truly understand the role of genotype in student achievement. This data was gathered in order to match the students' medical information. This information came straight from primary sources. The students' medical records were obtained from the university hospital, and their results were obtained from the senate-approved second semester results from the various Heads of Departments, from which the CGPA was extracted for analysis. The genotype marker (AA, AS, SS, SC) was the

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independent variation (IV) in the study, while academic achievement was the dependent variation (DV). Sex, blood group, and the department of study were also considered and controlled as interfering variables.

Results

Research question 1: What is the mean difference in the academic achievement scores of students based on genotype?

Table .1 Mean differences in the academic achievement scores of students based on genotype

Genotype	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
AA	140	2.3956	.99355	.08397	2.2295	2.5616
AS	44	2.5960	.90283	.13611	2.3215	2.8705

Table 1 shows that the mean score of students with genotype AA(M=2.3956, SD=.99355) was slightly lower than that of the AS(M=2.5960, SD=.90283) counterparts.

Research question 2: What is the mean difference in the academic achievement scores of students with different blood groups based on genotype?

Table 2: Mean difference in the academic achievement scores of students with different blood groups

Blood group		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
A+	AA	40	2.3575	1.01637	.16070	2.0325	2.6825
	AS	8	3.1725	.85344	.30174	2.4590	3.8860
B+	AA	26	2.5115	1.07582	.21099	2.0770	2.9461
	AS	5	2.2980	.60821	.27200	1.5428	3.0532
AB+	AA	2	2.4150	.91217	.64500	-5.7805	10.6105
	AS	1	1.2200	.	.	.	.
O+	AA	66	2.3739	.94860	.11677	2.1407	2.6071
	AS	30	2.5378	.89776	.16391	2.2026	2.8731

Table 2 shows that students with blood group A+ and genotype AS(M=3.1725) had the highest mean achievement score, this was followed by those with blood group O+ and genotype AS(M=2.5378). The least mean score was obtained by students with blood group AB+ and genotype AS(M=1.2200).

Research question 3: What is the mean difference in the academic achievement of students based on based on parental socio-economic status?

Table 3: Mean difference in the academic achievement of students based on based on parental socio-economic status

SES	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	Upper Bound
Employed	92	2.6817	.96735	.10085	2.4814	2.8820
Unemployed	17	2.0065	.56163	.13621	1.7177	2.2952
Private businessman	57	2.2430	1.07541	.14244	1.9576	2.5283
Farmer	18	2.2739	.65827	.15516	1.9465	2.6012

Table 3 shows that the students whose parents were employed had mean score of 2.6817, this was followed by those whose parents were farmer (M=2.2739) and that of the unemployed was 2.0065.

Research question 4: What is the mean difference in the academic achievement scores of students based on gender and genotype?

Table 7 Mean difference in the academic achievement scores of students based on gender and genotype

Gender		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	Upper Bound
Male	AA	56	2.3293	1.06138	.14183	2.0450	2.6135
	AS	20	2.7110	.72407	.16191	2.3721	3.0499
Female	AA	84	2.4398	.94959	.10361	2.2337	2.6458
	AS	24	2.5002	1.03426	.21112	2.0635	2.9369

Table 7 shows that male students with genotype AS (M=2.7110) outperformed their counterpart with AA (2.3293). The female students with AS(M=2.5002) outperformed their AA counterparts (M=2.4398).

H01: There is no significant mean difference in the academic achievement scores of students based on genotype.

Table 4. Summary of one-way ANOVA on the mean difference in the academic achievement scores of students based on genotype.

Source of variation	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.345	1	1.345	1.421	.235
Within Groups	172.262	182	.946		
Total	173.607	183			

Table 4 shows that there is no significant mean difference in the academic achievement scores of students based on genotype (F1, 182=1.421, p=.235). The null hypothesis 1 was retained.

H02: There is no significant mean difference in the academic achievement scores of students with different blood groups based on genotype.

Table 5: Summary of ANOVA on the difference in the academic achievement scores of students with different blood groups based on genotype

Blood group		Sum of Squares	Df	Mean Square	F	Sig.
A+	Between Groups	4.428	1	4.428	4.488	.040
	Within Groups	45.386	46	.987		
	Total	49.814	47			
B+	Between Groups	.191	1	.191	.182	.673
	Within Groups	30.414	29	1.049		
	Total	30.606	30			
AB+	Between Groups	.952	1	.952	1.144	.479
	Within Groups	.832	1	.832		
	Total	1.784	2			
O+	Between Groups	.554	1	.554	.636	.427
	Within Groups	81.863	94	.871		
	Total	82.417	95			

Table 5 shows that there is no significant mean difference in the academic achievement scores of students with different blood groups based on genotype. The null hypothesis four was retained.

H03: There is no significant difference in the academic achievement of students based on based on parental socio-economic status

Table 6: Summary of ANOVA on the difference in the academic achievement of students based on based on parental socio-economic status

Source of variation	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	11.276	3	3.759	4.168	.007
Within Groups	162.331	180	.902		
Total	173.607	183			

Table 6 shows that there is significant difference in the academic achievement of students based on parental socio-economic status ($F_{3, 180}$=4.168, p=.007). The null hypothesis five was rejected.

H04: there is no significant mean difference in the academic achievement scores of students based on gender and genotype

Table 8: Summary of ANOVA on the mean difference in the academic achievement scores of students based on gender and genotype

Gender		Sum of Squares	Df	Mean Square	F	Sig.
Male	Between Groups	2.147	1	2.147	2.209	.141
	Within Groups	71.921	74	.972		
	Total	74.068	75			
Female	Between Groups	.068	1	.068	.073	.788
	Within Groups	99.446	106	.938		
	Total	99.515	107			

Table 8 shows that there is no significant mean difference in the academic achievement scores of students based on gender and genotype. The null hypothesis three is retained.

Discussion of Finding

The study examined the role of students' genotype, blood group and the socio-economic status of parents on their academic achievement in the sciences. The study focused on the students in the faculty of sciences. The genotypic distributions of the students who participated in the study revealed that only two polymorphic alleles were identified. The two genetic markers polymorphism are AA and AS distributed among the entire population used in the study. No student with SS and or SC allele found. To justify our sets of genetic markers, AA, AS, SS, and SC and their polygenic interactions with academic achievement, we design by examining whether there were differences in the academic achievement between individuals with different genetic markers. The study shows that more students (140) had the AA polymorphic alleles while only 44 students were AS alleles. The study further revealed that mean (x) achievement scores of the students with genotype AA (x = 2.396) was lower than than those of AS (X = 2.5960) indicating that the students' with AS alleles outperformed those students with AA alleles. The result agrees with the findings of (Beaver et al., 2010).However,, the finding of current study contradicts the finding of Joseph (2019) who found that the mean achievement scores of students favoured those with AA alleles.

The result of study also revealed that students with genotype AS had better mean scores in all the sciences than those with genotype AA. However, the reverse was the case, genotype AA had better mean than the AS counterpart. This agrees with the findings of (Beaver et al 2010; Egweteng, 2013). There was also a linkage between blood group, genotype and academic achievement. The findings revealed that students with blood group A with genotype AS had the highest mean score followed by blood group O- and Genotype AS indicating that genotype AS relates to the blood group and academic achievement of the students. There was a clear indication that blood groups A^+, O^+, B^+, and AB^+ and genotype AS had better mean scores than the genotype AA. This was deduced from their achievement using the cumulative grade point average CGPA to determine the level of achievement for each genetic marker. The implication was that students with a particular blood group matched with a particular genotype can be visibly noticed of the aspect of science that student would like to study.

On gender, the finding indicated that male student with genotype AS outperformed others as well as the male genotype AA students has some varying effect on the genotype markers and academic performance, in this study. The interesting revelation in the study was that even among the female students, the AS genotype had better mean achievement score that the AA genotype. In other words there is a relationship between the sex and genotype

on academic performance. The finding corroborates the result of Johnson et al. (2006) who opined that student's heritability estimate between gender genotype and achievement over time. Also, the result of the findings of Joseph (2019) alludes to the facts that students with genotype AA alleles outperformed their AA counterparts.
Examination of the effect of Socio-economic status (SES) of the students with the polymorphism revealed that the students genotype and blood group vis-à-vis the students' academic achievement, it clear that the SES of the students play a significant role in expressing the heritability. Polymorphism the table appears to indicate that there is no established relationship between the student's genotype and academic achievement. This indicated that the genotype of student was not a significant predictor of students' achievement, significant differences were identified among the three genotype groups or AA, AS, SC with respect to the various subject. This study confirmed the findings of Bueno, (2019) except in the case that an established significant relationship was found only in Biology that the genotype of the students in Biology showed a clear cut performance differences with respect to their composite CGPA achievement. Furthermore, the result showed a significant relationship between the SES and genotype of students. Implying that though, genotypes are inheritable, the SES of students plays a significant role in the expression of the alleles in terms of academic achievement of the students.Beaver,et al (2010) assert that the observed significant difference in heritability with parental socioeconomic status may reflect an interaction with genetic differences between more and less affluent families, rather than an interaction with environmental quality.

CONCLUSION

Although it is not perfectly drawn that the type of genotype a student possesses dictates the type of subject or course that will be best for them, the study has clearly shown that academic achievement has some relationship with academic achievement. When compared to the AA counterpart, genotype AS was found to have slightly higher academic achievement. Over the CGPA This hypothesis, on the other hand, states that students with an AS genotype and a positive Rhesus (A+, O+, AB+, O+) are more likely to perform well in the sciences than in the humanities, vocational, and social sciences. There was a link between socioeconomic status and academic achievement.

Recommendations

The findings of the study were quite revealing, consequently, the following recommendations are made.

1. Early detection of students' genotype is very necessary in that it may guide the child in the academic pursuit.
2.

References.

Abar-or,L.(2014). Relationship between genotype and Socia-Economic Status on academic achievement of science students in Ignatius Ajuru University of education. Unpublished Project, Ignatius Ajuru University of Education.

Adler, N.E., Rakpof, M. D.H. (2008). United States disparities in health. Description, causes and Mechanisms. *Annual Reviews of Public Health*, 29, 235-252

Barntt J.H. Heron, J Rings,S. M, Golding J. Golddman D.,Xu K Et Al.(2007). Gender Speciic Effects Of The Catechol-O Methyltransferase Val (108)/(158) Met Polymorphism On Cognitive Function In Children. *American Journal Of Psychariatry*, 164, 142-149

Beaver, K. M., Sak, A., Vaske, J.,& Nilsson, J (2010).Genetic Risk, Parent-Child Relations, And Antisocial Phenotypes In A Sample Of African-American Malea. *Psychiatry Reasearch*, 175, 160-164.

Bueno, D.(2019). Genetics And Learning. How Genes Influence Educational Attainment. *Front, Psycol*. 10-1627

Chang, C. Y., & Cheng, W. Y. (2008). Science Achivement And Student Self-Coonfidence And Interest In Science: A Taiwanese Representative Sample Study.

International Journal of Science Education, 30, 1183-1200.

Conner, B. T., Hellemann, G.S., Ritchie, T.L, & Noble, E.P. (2010). Genetic, Personality, And Enviromental Predictors Of Drug Use In Adolescents. *Journal of Susbstance Abuse Treatment*, 38, 178-190.

Egweteng, H. L.(2013). Relationship between students genotype and academic performance in Ignatius Ajuru University of Education. Unpublished project, Ignatius Ajuru University of Education

Enoch, M. A..Waheed. J. F., Harris. C. R., Albaugh, B., & Goldman, D. (2009). COMTVal 158Met and Cognition: Main Effect And Interaction With Educational.

Guo, C., Roetger, M. E., &Shih, J. C. ((2007). Contributions Of The Dati And Drd2 Genes To Seerious And Voilent Delinquency Among Adolescent And Young Adults. Human Genetics, 121, 125-136.

Haworth, C.M.A., Kovas,Y.. Dele, P.S. & Plomin, R.(2008). Science in elementary schools. Generalist genes and school environment. *Intelligent*

Johnson, W., Mcgue, M., & Iacono, W. G. (2006). Genetic And Enviromental Influences On Academic Achievement Trajectories During Adolescence. Developmental Psychology, 42, 514-532.

Joseph, E. A.(2019) Genotype polymorphism and students' academic achievement of science students in tertiary institution: The analytical approach. *International Journal of Innovative Social and Science Education Research, 7* (1),125-136.

Plomin, R. (2003). Genetics, genes, genomics and molecular. *Psychiatry*, 24, 53-77

Plomin, R. Kennedy, J.K.J. & Graig, I.W.(2006). The quest for quantitative trait loci associated with intelligence. *Intelligence* 34, 513-526

Ruther, M.(2006). Genes and behavior.Nature –Nurture interplay explained. Blackwell

Stephen, A.P. & Bassie, W. (2000).Intelligence and achievement. A behavioural genetics perspective. *Educational Psychology Review* 12, 85-99

Vanden Oord, J. C. G. & Rowe, D.C. (1998).An examination of genotype-environment interaction for academic achievement in an U.S. national longitudinal survey. *Intelligence*, 25, 205-228