

# CORRELATING THE COGNITIVE ACHIEVEMENT AND INTEREST OF GIRLS IN SCIENCE DISCIPLINES USING COOPERATIVE LEARNING STRATEGY

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## **Abstract**

The purpose of this study was to determine the relationship between the cognitive achievements and interest of the students exposed to cooperative learning strategy. The design was a quasi — experimental followed by descriptive correlation studies. Forty female students in senior secondary II in Mater Amabilis secondary school, Umuoji in Idemili North Local government Area of Anambra State were randomly purposively selected as sampled for the study. One research question and two null hypotheses were formulated to guide the study. The instruments for data collection were a 30-item achievement test and a 40-item interest scale developed by the researcher. Pre-test, treatment, post-test procedure was used for data collection. Data collected were analyzed using product moment correlation coefficient ( $r$ ) and a test of significance relationship using student t-test. The result revealed that there is negligible relationship between interest and cognitive achievement of girls in chemistry. *The* implication is that interest or no interest the girl -child should be empowered to study sciences to enable females assume their unoccupied positions in the development of the nation.

## **Introduction**

Women are poorly represented in physical sciences and technology. That was why Adavbiele and Adevbiele (2005), lamented the relative paucity of women in engineering education in Nigerian Universities and opined that attention be given to girl child in science and technology education. Since about fifty percent of the population of Nigeria are women, it is not easy for the nation to properly advance in any direction with half the citizen lagging behind.

A lot of studies have been done on ways of motivating the girl-child to achieve both cognitively and affectively in science disciplines. Nwachukwu (2005), reported that exposing female students to small groups cooperative interaction learning style makes them attain high cognitive achievement in chemistry. Nwachukwu and Chukwunke (2006), also reported that exposing girls to small group competition and cooperation enhanced their cognitive achievement in chemistry. In addition, Okoli (1995) and Nwachukwu (1998), reported that use of cooperative and competitive classroom interaction motivated the interest of female students. Despite all these efforts by researchers to investigate ways of motivating the girl-child, it is necessary to investigate the cognitive achievement as "correlates" of achievement in interest of females in science disciplines in the "same environment". A study of this nature designed as a quasi-experiment in combination with correlational studies could therefore be considered as a welcome departure from the earlier methods adopted.

Girl-child's difficulties in embracing science and technology should be uprooted. If the difficulties stem from interest, ways of triggering off interest in girls ought to be explored. The present study is an attempt to correlate the achievement in interest with the cognitive achievement of secondary school students exposed to cooperative learning strategy. If a positive relationship exists, the possible means of promoting the girl-child interest in sciences will be utilized so as to empower the females to take up their vacant positions in nation building. To this effect, it is necessary to briefly highlight the theoretical framework of cooperation and interest.

## **Theoretical Framework of Cooperation and Interest**

Cooperative learning strategies are based on the principle that knowledge is co-constructed through interactions with others. When learners exchange ideas with peers and the teacher, they develop shared meanings that allow group members to communicate effectively with one another. Flick (1993), observed that cooperative group arrangements and the need to interact with a variety of new materials provide opportunities for students to develop social (interpersonal) skills as well as

intra-personal skills. On the other hand, interest has been defined in the dictionary (Webster's 2000 and Longmans 1995), as feeling, quality, activity, advantage, "curiosity. Precisely, the intellectual or emotional involvement in something for one's own advantage or profit and the power to arouse these feelings are regarded as interest. This then leads to the purpose of study.

### **Purpose of the Study**

Cognitive achievement and interest of secondary school students have been enhanced by use-of cooperative learning strategy in sciences (Okoli 1995; Nwachukwu 1998). This study wishes to find out the degree of relationship between the gain in cognitive score and gain in interest of girls exposed to cooperative learning situation in sciences. One research question and two null hypotheses are formulated to guide the study.

### **Research Question**

What is the relationship between the cognitive achievement and interest of female students exposed to cooperative learning strategy?

### **Hypotheses**

H.01: There is no significant relationship between the mean cognitive test score and the mean interest score of female students exposed to cooperative learning style in chemistry.

H.02: There is no significant relationship between the cognitive achievement and interest of female students exposed to cooperative learning strategy in chemistry.

### **Research Method**

**Design and Area:** The design was a quasi-experimental, combined with descriptive correlation studies. A pretest-treatment-posttest design was used for the study. The study covered pre-war public girl's secondary schools in Idemili North local government area of Anambra State.

**Population and Sample:** The population consisted of all the senior secondary (SS) year 2 students studying chemistry in pre-war Girls Secondary Schools in Idemili North local government area of Anambra State. A probability purposive random sampling was adopted in drawing the forty female students for this study. Intact classes were used so as not to disrupt the school time table. Sample was randomly drawn from pre war schools to ensure that fairly standard chemistry laboratories were available. SSII students are not WAEC examination students, but have been exposed to chemistry lessons for one year. The teachers used are graduates with minimum of five years teaching experience.

**Instrument:** For the collection of data, cognitive test instrument (CAT) which consisted of a 30-item, multiple choice question, was used. Also, a 40-item interest scale (CIS) was used. The same instrument was used for both pretest and post test. The test covered topics on enthalpy of chemical reactions, and, the scale covered interest in chemistry.

**Validation:** Two lecturers from Science Education department, and two secondary school teachers validated the instruments. Based on this exercise, some items were refrained.

**Reliability:** This was ascertained by administering a sample of the questions and interest scale to 30 SS II Chemistry students in another school not used for the study. From their responses, a possession of reliability coefficient for (CAT)  $r^c=0.83$  (Split half method), of facility indices of 0.20-0.80 (upper and lower 27% computations); item discrimination index of  $> 0.10$ ; and positive distracter index was established for the questions. For the interest (CIS) the scores generated were applied in the modified Kuder Richardson (K-R21) formula and the reliability coefficient  $r^1 = 0.86$  was obtained.

**Procedure:** The procedure was pretest-treatment-posttest process. The teachers who helped were trained by the researcher on the role to play. The researcher mapped out the modalities for the (5-membered) small groups cooperative interaction for the exercise. The researcher also prepared

a detailed lesson plan and students learning tasks based on the selected chemistry concepts and covering a period of six weeks. Intact classes were used so as not to disrupt the school system.

First a pretest was administered. Thereafter, the treatment was administered. Students were pre-assigned to five member heterogeneous groups and treated as a group throughout the exercise.

Finally, at the end of the exercise which lasted for six weeks, the posttests (CAT) and (CIS) were administered. The same instruments were used for the pretests and post tests, but there was a reshuffling of the order of questions and change in the colour of the paper as check for sensitization effect.

### Method of Analysis

The obtained data were analysed using means, gain in means, correlation coefficient and student t-test.

### Results

The results are tabulated in the Table I

Table 1: Interest and Cognitive test scores of 40 Girls Exposed to Cooperative learning style

Student	Pre-Interest Test Score Max. 160	Post Interest Test Score Max 160	Gain Interest Score (X)	Pre-Cognitive Achievement Test Score Max 30	Post-Gog. Achievement Test Score	Gain in Cognitive Score (Y)	XY	X <sup>2</sup>	Y <sup>2</sup>
1	81	107	26	03	14	11	286	676	121
2	140	143	03	05	19	14	42	9	596
3	63	91	28	02	14	12	336	784	144
4	71	80	09	03	15	12	108	81	144
5	133	141	08	07	13	06	48	64	36
6	24	94	70	08	17	09	630	4900	81
7	84	89	05	06	17	11	55	25	121
8	44	74	30	04	19	15	450	900	225
9	94	118	24	11	23	12	288	576	144

10	119	131	12	05	20	15	180	144	225
11	34	94	60	04	19	15	900	3600	225
12	47	107	60	05	18	13	780	3600	169
13	7!	133	62	08	23	15	930	3844	225
14	14	80	66	01	14	13	858	4356	169
15	91	127	36	08	22	14	504	1296	196
16	94	133	39	16	27	11	429	1521	121
17	130	139	09	06	19	13	117	81	169
18	57	124	67	12	18	16	1072	4489	256
19	137	146	09	07	21	14	126	81	196
20	78	126	48	10	20	10	480	2304	100
21	128	134	06	08	22	14	84	36	196
22	107	120	13	05	16	11	143	169	121
23	77	US	41	05	17	12	492	1681	144
24	119	139	20	03	19	16	J20	400	256
25	129	139	10	08	19	11	JJ0	100	121
26	134	142	08	08	20	12	96	64	144
27	134	143	09	07	21	14	126	81	196
28	71	93	22	02	14	12	264	484	144
29	125	133	08	05	19	14	112	64	196
30	89	107	18	04	17	13	234	324	169
31	129	155	26	01	18	17	442	676	289
32	91	127	36	06	20	14	504	1296	196
33	115	127	12	06	19	13	156	144	169
34	78	107	29	06	14	08	232	841	64
35	107	126	19	09	15	06	114	361	36
36	117	125	08	05	17	12	96	64	144
37	36	91	55	01	15	14	770	3025	196
38	132	139	07	06	17	11	71	49	121
39	50	89	39	09	19	10	390	1521	100
40	25	71	46	02	15	13	598	2116	169
			1103			498	13979	46827	6434

$$\begin{aligned} \sum X &= 1103 & \text{Mean } (\bar{X}) &= 27.58 \\ (\sum X)^2 &= 1216609 & \text{Mean } (\bar{Y}) &= 12.45 \\ \sum Y &= 498 \\ (\sum Y)^2 &= 248004 \\ \sum X \sum Y &= 1103 \times 498 = 549294 \end{aligned}$$

Computation of Product Moment Correlation Coefficient (r)

$$r = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{[N \sum X^2 - (\sum X)^2][N \sum Y^2 - (\sum Y)^2]}}$$

$$\begin{aligned}
N &= 40 \\
\sum XY &= 13979 \\
(\sum X)(\sum Y) &= 549294 \\
\sum X^2 &= 46827 \\
(\sum X)^2 &= 1216609 \\
\sum Y^2 &= 6434 \\
(\sum Y)^2 &= 248004
\end{aligned}$$

Substituting the values into the equation gives,

$$r = 0.1259$$

The calculated correlation coefficient  $r = 0.1259$ . The calculated t-value  $= 0.7823$ . The level of significance used  $= 0.05$ .

The degrees of freedom  $df = 38$ .

t-critical  $= 2.021$

### Discussion

From the results, the mean gain in interest achievement is 27.58, and that of cognitive achievement is 12.45. Also, the calculated correlation coefficient using Pearson's Product moment formula  $r = 0.3259$  for relationship between the gain in interest and the gain in cognitive score. Again the computation of t-value for student t - test gave a value of  $t = 0.7823$ . t-critical  $= 2.021$ ;  $df=38$ ;  $probability\ level=0.05$

The research question was answered using the values obtained from the gain in means and the correlation coefficient. According to Best and Kaha (1989), the range of correlation coefficient from 0.00 - 0.20 is considered as a negligible relationship. The value for r calculated from this study is 0.1259. This implies that there is a negligible relationship between the interest and achievement in cognitive score for the sample studied. This means that students can have high cognitive scores without being interested in chemistry and vice versa.

The null hypothesis  $H_01$  and  $H_02$  were tested using the student - t test for significant relationship between the interest and cognitive achievement. The calculated t-value is 0.7823. The critical t-value at 0.05 level of significance for  $df = 38 = 2.021$  (for a non-directional two-tailed test). Now the calculated t-value is less than the critical t-value, hence the null hypothesis  $H_01$  and  $H_02$  are upheld. This implies that there is no significant relationship between the achievement in interest and cognitive achievement of female secondary school students exposed to cooperative learning strategy in chemistry concepts. It means that a student who is not interested in the subject can be made to achieve cognitively by exposure to cooperative learning strategy. This revelation has implications for girl-child involvement in science and technology education since technology is application of science. This result seems to portray why the learning theorists Piaget (1958); Gagne (1977); Ausubel (1968) and Bruner (1966), never stressed interest as a driving force or sinequanon for cognitive attainment in their various learning theories. Even though the strategies for improvement of the teaching and learning of sciences in schools have continued to receive considerable attention, much work still remains to be done. Studies on interest of students in relation to achievement in chemistry are very sparse, and none has been carried out in the environment of this study.

However related studies by educators tend to advocate the importance of triggering off interest of students to enhance cognitive achievement contrary to the results of this study. That was why Ezeliora (2005) and Rubin (2002), were of the view that cultivating early interest in science among the primary school pupils is influential in subsequent science involvement, interest and achievement. Infact, Ezeliora (2005), further concluded that it is the responsibility of the teachers to guide the children with some clues on how to find the answers which make them responsible for their own learning.

Again, Okebukola and Jegede (1986), reported that science students do not feel that lack of interest in science is a serious factor that contributes to their poor performance in science. Studies by Nwachukwu (1998) and Okoli (1995), have shown that cooperative learning style has generally the greatest positive effect on student's interest and achievement in sciences and is very favourable to girls in particular. In fact girls out-performed boys in cooperative strategy.

Furthermore, Grace Alele Williams, (cited in Wilson's notes 1993) and Makhubu (1991), noted that secondary school girls in Nigeria seem to favour biology courses as opposed to physics because biology seems to relate to their interests and thinking, whereas physics does not seem relevant. She further noted that if girls do not see any relevance or application of what they are doing in science to their own lives they may be less likely to maintain interest or want to pursue science as a career option. This is a call for guidance counselors to sit up.

The study has revealed that no significant relationship exists between the interest and cognitive achievement of secondary school girls in chemistry. This implies that interest is not the cause for cognitive achievement. Hence, girls can be made to achieve well in sciences by exposure to cooperative learning style (Okoli 1995; Nwachukwu 1998), even though they lack interest in the disciplines. In addition, the following recommendations based on the study form the next subsection.

### **Recommendations**

There is urgent need to involve females in national development through proper education since a study of the census results in the country reveals that females constitute about 50% of the population. This percentage cannot be kept of true race for national development which hinges greatly on science and technology. Such an omission is equivalent to depriving the Nigerian economy of a potentially vibrant labour force. Thus in the interest of rapid national development, the Nigerian girl-child has to be encouraged and assisted to occupy their vacant positions in national development through science education. This is necessary because according to Nyerere (1988), in argument for the; integration of women in national development, no person walks far or fast with only one leg. The two legs are needed. Hence males and females should be made to pursue science and technology education for rapid and sustainable development of the nation. As a matter of fact, science is the bedrock of technologies; hence technology cannot do without science. The two disciplines play big roles in national development. That was why Tailor (1993:147) stated that:

Technology is the fundamental factor of social change and its power is irresistible and oscillatory on society. We must accept this or remain as a third world nation.

Therefore females must be made to compulsorily study science subjects and must be given the opportunity to succeed and team up with men in developing the nation. Their interest in sciences will not stop them from performing well. What matters most is the approach to learning.

### **Conclusion**

Despite the effort spent by researchers on manipulating interest as an important issue in science learning, the present study has shown that a negligible relationship exists between interest and cognitive achievement. This means that interest is not a deterrent to cognitive achievement of girls in science and technology disciplines. Hence, further wastage of efforts should not be made in arousing interests as enhancement to cognitive achievement of girls in sciences. Rather, the views of Adavbiele and Adavbiele (2005) who advocated that aggressive literacy campaign be mounted for society in general, and parent cohort in particular to stir up women meaningful participation in engineering education should be welcomed. Therefore, women should be counseled at their early age to know what is entailed in science and technology education, and the prospects.

## References

- Adavbiele, A.S. and Adavbiele, J.A (2005). Women and engineering education in Nigerian Universities. *International Journal of Forum for African Women Educationalists Nigeria*. 1(1). 255-263.
- Alele Williams, G. (1993). Cited In Amy Wilson's notes from the third world organization for women in science inaugural conference. Cairo January 10-13-1993.
- Ausubel, D (1968). *Educational psychology. A cognitive view*. New York: Holt Rinehart and Winston Inc.
- Best, J.W and Kaha, J.V (1989). *Research in CJucaliou. ()'" Edition*. Englewood Cliffs N.J Prentice-Hall.
- Bruner, J. S. (1966). *Towards a theory of instruction*. Cambridge. Mass: Harvard University Press.
- Ezeliora, B (2005). Cultivating an early interest in science for sustainable development using science career oriented learning centre. *International Journal of Forum for African Women Educationalists Nigeria*. 1(1) 49-56.
- Flick B.L. (1993). The meaning of hands on science. *Journal of Science Teacher Education*. Washington. Winter, 4(1). 1-8.
- Gagne, R. N. (1977). *The conditions of learning*. Third Edition. New York: Holt Rinehart and Winston Inc.
- Inhelder, B and Piaget, J (1958). *The growth of logical thinking from childhood to adolescence*. New York. Basic Books.
- Longman (1995). *Dictionary of Contemporary English*. Third Edition. Longman Group Publishers.
- Makhubu, L. (1991). The contribution of women to science in Africa. In science in Africa: Achievement and prospects. Washington, American 'Association for the Advancement of Science.
- Nwachukwu C.O (2005). Observed gender-related differences in students achievement in chemistry: Implications for Curriculum Change. *Intel-national Journal of Forum for African Women Educationalist, Nigeria* 1(1) 140-146.
- Nwachukwu C.O. (1998). Achievement and interest of secondary school chemistry students exposed to cooperative and competitive learning. Unpublished Ph.D. thesis, Nnamdi Azikiwe University Awka. Nigeria.
- Nwachukwu, C. O. and Chukwuneke, B.U (2006). The effect of cooperative and competitive learning techniques on female students' achievement in science disciplines. *Nigerian Journal of Teacher Education* 1 ' 74-81.
- Nyerere, P.M. (1988). UNEP News, African women in development. *Special Reports*.
- Okebukola, P. A. O. and Jegede, O. (1986). The under-achieving student in science. The etiology of the ailment. *Proceedings of the 27<sup>th</sup> Annual Conference of Science Teacher's Association of Nigeria*. Pp 52-72.
- Okoli, J.N. (1995). Effects of two interaction-learning styles on students achievement and Interest in Biology. Unpublished Ph.D. Thesis, University of Nigeria, Nsukka.

Rubin, P. (2002). Start young. *Science and children*. 40 (2). 25-27.

Taylor, G.O. (19<sup>C</sup>B). .introduction technology as an integrated subject. *Integration and Innovation in Nigeria? Education*. Adaralegbe, Adeniji (ed.). Lagos JAS Publishers and Nigerian Academy of Education.

Webster (200J'). *The New Webster's Dictionary of the English Language*. New York. Lexicon Publishers.