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INFLUENCE OF GENDER, SCHOOL LOCATION AND THE USE OF PLAY-SIMULATION ON SCHOOL ACHIEVEMENT IN CHEMISTRY

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Abstract
This study looked at influence of gender and school location on achievement in chemistry when the innovative teaching method of play-simulation was used. Eight intact classes of (SS 1) students were used, each class from each of the eight sampled schools. Four schools were randomly selected from each of the groups of Boys and Girls only schools from four Local Government Areas. The school types were further grouped into rural-urban dichotomies –four each with two from each school type. A sample of 177 students participated in the study (99 males and 78 females with 92 of them from urban schools and 85 from rural schools). The sampled schools comprised of two boys only schools and two girls only schools. Each of the two school types was selected from among urban and rural schools. Each intact class received chemistry lesson on organic chemistry after pre-test, each also participated in a post-test. A teacher made tested formed the research instrument. ANCOVA statistical test was used to test the two hypotheses and means were used to answer the research questions. The result showed that male students achieved significantly better than female students and also that the students from urban schools achieved significantly better than students from rural schools when play-simulation is used to teach SS1 chemistry students organic chemistry. Based on these findings, recommendations were made to the effect that school location and gender should not be a barrier in the application of innovative teaching strategies in science classes.

Keywords: Play-simulations, gender, location, school type, achievement

Introduction

According to Agbowuro (2008) cognitive achievements and meaningful learning are strongly linked. Onwukwe and Onwukwe (2010) maintain that play-simulation is one way to help students learn science more meaningfully especially as it builds up students analogical thinking processes. Ijoma and Onwukwe (2011) opined that the analogical thinking processes of science students are most influenced if play-simulations are based on cultural millieux of both students and teachers of a science class. In this way science students are able to overcome difficult concepts that hamper achievement in chemistry. When learning becomes meaningful, students will achieve at their optimum potentials.

Play, as an innate characteristic of all life is an active learning tool, especially for children and young adults. Being devoid of all rules and regulations, it enables the learner to loose him/herself in the learning process without stress. Simulations help the learner to understand complex systems in simplified, risk-free set ups. Play-simulations, and basically in the sense of "Creative Drama"

(Bracha, 2007) create an enabling environment or medium through which knowledge is transferred from the familia to the unfamilia – analogical process. This may be why Onwukwe (2009) listed it as a major component of what he termed "Art –in-science technique" – any planned use of an art form in communicating science. Art-in-Science Technique, as a teaching tool, aims at helping science students have insight in how science and scientists work, enjoy science lesson and engender creativity among teachers and learners of science. Many researcher have investigated the cognitive, personality and social issues in the use of plays to teach science (Rigas and Valanides, 2002, Abraham 2004, Vankateswaran, 2008). Play-simulation technique is already an acclaimed method of leading students to higher achievements in science.

Despite all efforts, including the use of other innovative teaching methods to help science students achieve higher, such factors as sex and school location still may pose problem. Many studies show that male students consistently achieve higher than their female counterparts in science (Okonkwo and Eke, 2005, Njoku, 2007, Okigbo and Akusoba, 2009)

The present researchers are poised to investigate how the factors of gender and school location may influence achievement in chemistry if a highly articulated and innovative technique as play simulation is used in imparting chemistry knowledge to students. This is because of the authors' believe that knowledge and practice of science and technology should not be hampered among student populations by any form of disparity. Whether males or females living in rural or urban settings, survival and wealth creation skills are best enhanced by science and technology. Every barrier against general acquisition of such empowerment skills should be investigated and properly addressed.

Purpose of study

The purpose of this study was to determine the influence of gender and school location on students achievement in chemistry with play-simulation as a teaching strategy. Specifically, the study was designed to find out the difference in mean gain in pre-test and post-test scores of male and female students located in different school settings- urban and rural, having been taught chemistry with play-simulation techniques.

Research questions

The following research questions guided the study:

- What are the difference in the pre-test and post-test mean scores of male and female students after receiving chemistry lessons with play-simulation teaching technique?
- What are the differences in the pre-test and post-test scores of urban and rural chemistry students after receiving chemistry lessons with play-simulation technique?

Hypotheses

The study hypothesized that

- There is no significant difference in the mean scores achieved by male and female students after receiving chemistry lessons with play-simulation teaching technique.
- There is no significant difference in the mean achievement scores of chemistry students from rural and urban schools after receiving chemistry lessons with play-simulation teaching technique.

Method

A quasi experimental design was used in this study. The area of study was Owerri Education Zone, Imo State. Out of the 11 Local Government Areas in the zone, four were

randomly selected: Owerri West, Mbaitoli, Owerri North and Owerri Municipal. All the rural secondary schools in all four LGAs were grouped together and four were randomly selected such that gender was balanced: Girls Secondary School Ifeakala, Girls Secondary School Ubomiri, Boys Secondary School Amakoha-Ubi and Boys Secondary school Ogbaku. This was repeated school for the urban secondary school thus: Bishop Labery Girls secondary School, Irette, Akwakuma Girls Secondary School, Government Secondary School Owerri and Holy Ghost Secondary School, Owerri (both are Boy Schools).

The population of study was all SS1 students in the selected secondary schools, which was 2,750 (all offered chemistry). In each school an intact SS1 class was used for the study. In all the schools, the sample summed up to 190 – 102 males and 85 females. However, six males and seven females missed the pre-test and post-tests, reducing the actual sample size to 177 – 92 from urban and 85 form the rural schools.

A Teacher Made Test in Chemistry, TMT-C, comprising of 40 objective questions with four options each (A-D) was used to collect data. The scope of the study was restricted to SS1 Organic chemistry as prescribed by their O'level syllabus.

Treatment procedure

Eight teachers, one from each school (the normal class chemistry teachers) were trained in a center for two weeks. The exercise comprised of generating a uniform lesson plan, (six lesson plans were generated) application of the play-simulation strategy and assessment techniques. However, only the researcher prepared the question items on TMT-C and kept it secret from all the teachers. Using the common lesson plans, each teacher taught the topic organic chemistry in his/her class for six weeks.

Each intact class was made to watch the DVD recorded play – Queen Ester's Father, acted by seasoned Nigerian artists from the drama book of the same title (Onwukwe, 2005). The play personified organic substance and acted out their properties, uses and consequences of their abuses.

The drama was projected on a 21" TV screen using a DVD player and lasted or 45 minutes. After watching the play, the students discussed the play with their teachers-their personal questions were answered, the possible implications of the play for learning chemistry was also discussed. Any question or explanation that need rewinding a particular part of the play was obliged. This formed the first contacts of each intact class with their teachers.

After the play-simulation exercise, each teacher now taught four lessons in the following weeks and held a one revision lesson to wind up. During the lessons, impressions from the play were used to explain chemistry content. All the lessons were taught after the normal school period (between 2pm-4pm) and lasted for one hour each time. At the expiration of the four week treatment period, TMT-C was rearranged and used as post-test. All intact classes were administered with pre– and post– tests the same day/time by the researcher and the assistants in their various schools.

Results

Table 1: Pre-and post-test mean scores of male and female students taught chemistry with play-simulation.

Score of Variation	*N*	*PR.X*	*Po.X*	*XG*	*Rmks*
Male	99	8.98	29.72	20.74	Better
Female	78	8.22	21.58	13.36	

Key: N = No of participating students according to gender
Pr. X = Pre-test mean score
Po. X = Post text mean score
XG = Mean gain of each gender group

Table 1 above revealed that male chemistry students achieved better than their female counterparts, 20.74 as against 13.36.

Table 2: Pre and post-test mean score of students taught chemistry with play-simulation according to urban and rural locations.

Score of Variation	*N*	*PR.X*	*Po.X*	*XG*	*Rmks*
Urban	92	9.24	29.10	19.86	Better
Rural	85	8.00	2.92	14.92	

Table 2 showed a mean gain of 19.86 students from urban schools as against the mean gain of 14.92 for their counterparts from rural schools. Students from urban schools therefore achieved higher in chemistry when taught with play-simulation.

Table 3: ANCOVA Statistical analysis of students' achievements according to gender/ location who were taught chemistry with play-simulation

Score of Variation	*Ss*	*df*	*Ms*	*F-cal*	*F-crit*	*P>0.05*
Corrected model	466.10	4	1166.53			
Intercept	13880.28	1	13880.28			
Gender	2212.62	1	2212.62	94.67	3.84	0.05
Location	820.35	1	820.35	35.10	3.84	0.05
Residual	4019.91	172				
Total	129537.00	175				

In table 3 under gender with Ss equals 2212.62 and Ms equals 2212.62, it was observed that 0.05 level of significance with 1-degree of freedom, the calculated F-ratio (F-cal) 94.87>3.84, the critical value of F-ratio (F-crit) therefore, null hypothesis (Ho_1) is

rejected. The researchers then concluded that there was a significant difference in achievement of male and female students who were taught with play-simulation approach.

For null hypothesis 2 (Ho_2), with f-cal>F-crit (35.10 and 3.54 respectively as revealed by table 3 at 0.05 level of significance and 1-df. This led the researchers to reject Ho_2 and conclude that there was a significance difference in the achievements of students located in rural schools who were taught chemistry using play-simulation approach.

Discussion

The conclusion of this study in respect to a significant difference in achievement in chemistry in favour of male students when play-simulation approach was used is consistent with literature (Okoye, 2007, Njoku, 2007). This trend has remained fairly consist over many years. (Njoku 1997).

Many researchers have tried to offer explanations why male students consistly out perform their female counterparts in science subjects. Some relate it to interest, that boys are more interested n subjects with number and instrument manipulations (Njoku, 1997). Okeke (1990) rather attributes it to gender stereotyping in our society. Male children are trained to tackle difficult problems while female children are trained to see attendant to knotty problems as a treat to their feminine features and tendencies prettiness, gentleness and beauty.

However, in this particular study, where teaching and assessment focused mainly on the cognitive domain, with play-simulation provided to whet appetite and stimulate interest equally, how then could this disparity be explained. The answer lies rather in the quality of mind of male and female students. Research suggests that male students are rather more reflective than female students (Okonkwo and Eke, 2005). As the play-Queen Ester's Father was showing on screen, depicting such social interactions as courtship, marriage, beauty–contest, kingship, power, honour as well as disappointments and intrigues (as portrayed by the elements and compounds personified in the drama) the males may have remained more reflective. While the females may have remained more at the level of fun and relaxation provided by the play-simulation, the males may have been more burdend at using these impressions to explain the prosperities and reactions of chemical substances personified in the play and explained in the class. This certainly will lead to greater achievements in cognitively-skewed assessments.

The higher and significant difference in achievement of students from urban and rural schools in chemistry also call for explanation.

According to Ingles and Jennings (1981), Hassan (2001), the disparity in resources between urban schools and rural ones explains the higher achievements of students from urban schools.

However, according to Jegede (2007) students in rural schools are more apprehensive and science-phobia stricken than their urban counterparts. In direct relation to play-simulation approach used in teaching the chemistry lessons, the finding is consistent with Odubumi and Balogun (1983) that students from urban schools are more at home with technological devices than their rural counterparts. Probably, for students in the rural schools this study was their first encounter with electronic gadgets in their classrooms. Excitements may have overwhelmed them, such that the gadgets were rather distractions. For teaching and assessment techniques that explored cognitive abilities, surely any form of distraction will be a disadvantage.

Recommendations

Based on the findings of this study, the researchers made the following recommendations

1. That more analogical inputs in the use of play-simulations in teaching science should be made. This will help students both to retain learning and more able to transfer same to novel situations irrespective of gender and school location.

That the influence of play-simulation teaching approach should be investigated at the various levels of cognitive abilities: Recall, transfer of knowledge, application and so on. This will help to understand where the strength of the approach lies more for male and female students.

3. That rural schools should be provided with electric power especially in these days of many alternatives and their teachers encouraged to use electronic media in teaching as often as possible.
4. That more research should be carried out with experimental and control group designs in the areas of male and female students achievement in science with a view to addressing the issue of urban-rural student dichotomies and achievements in science properly.

Conclusion

The researchers reached the following conclusions after careful observation of the outcome of this study:

1. Male chemistry students in SS1 who were taught the topic-organic chemistry as prescribed in their O'level syllabus in Owerri Education Zone of Imo State, significantly achieved higher mean difference between pre- and post-test than the females both having been taught with play-simulation approach.
2. SS1 students from urban schools in Owerri Education Zone of Imo State, who were taught organic chemistry using play-simulation approach, significantly achieved higher mean difference between pre-and post-test scores than their counterparts from rural schools.
2. The potentials of the play-simulation teaching approach have not been fully explored as there may be the need to combine the approach with the Teaching-With-Analogy (T.W.A) technique in a science classroom.

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