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EFFECTS OF A DEVELOPED INSTRUCTIONAL GAME ON STUDENTS ACHIEVEMENT IN CHEMISTRY

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Abstract

Considering the necessity to vary methods and introduce non-conventional methods in science classes, the study developed a card and board game for teaching organic chemistry. The developed game was evaluated to determine students' attitude towards learning with it, compared its effectiveness with the traditional method, adopting a two group randomized pre-test, post-test experimental design. It was found out that the instructional game affected the interest of the students irrespective of their sex, and more importantly, students exposed to the instructional game achieved significantly higher than those exposed to the traditional chalk and talk method

Introduction

With advances in technology, the world is fast becoming a global village and knowledge explosion is perhaps at exponential rate. This trend must be maintained in the education sector since education and development are two sides of a coin and they depend on one another to excel. The development of scientific and technological skills of individuals in the society is a responsibility of the school. One way of ensuring this is the introduction of non-conventional methods such as games, simulation, play etc.

A game is an activity in which participants follow prescribed rules that differ from those of reality as they strive to attain a challenging goal (Henich, Molienda and Russell, 1986). The use of gaming and simulation techniques in instruction is by no means a new idea. According to Henich et-al (1986), the simulation of battlefield strategy in the form of games can be traced back to china. Games such as Chess and Go are the residue of these ancient training.

A simulation is an abstraction or simplification of some real life situation or process. In simulations, participants usually play a role that involves them in interactions with other people/or with elements of the simulated environment.

Simulation can vary greatly in the extent to which they fully reflect the realities of the situation that they are intended to model. According to Reiser and Gerlach (1977), simulation

model a process or mechanism relating to input changes to outcomes in a simplified reality but may not have a definite end point. They are sub-set and their educational applications often depend on the learner reaching conclusions through exploration of input changes on outcome.

A simulation game combines the attributes of a simulation (modeling the reality) with the attributes of a game (striving towards a goal, obeying specific rules)

The use of games in learning has been reported by various educators. Anikweze (1992) expressed that games provide fascinating challenges to the learners and add interest, activity and novelty to the lesson and using games to teach science will increase students' participation in class, while Adediran (1994) reported that games enhance the teaching of mathematics concepts and skills, and also was very useful for reinforcing or practicing the concepts. Afuwape(1 999) identified the exclusion of games as instructional method in teacher training programmes as one of the limitations against its adopting schools generally.

The non achievement of desired results by the conventional methods being used in schools necessitated the call for the use of non-conventional methods (Carew & Ajewole, 1993). An attempt to arrest this situation which leads to decline in academic performance of students in sciences is the development games for teaching and ascertaining its effectiveness, a task embarked upon by this study.

Statement of the problem

It has been observed that students' achievement in chemistry is on the decline and such will lead to inadequate scientific skills. To tackle this menace Chemistry, being the benchmark of science and technology therefore, requires proper and qualitative instruction in schools.

This study therefore sought to find out the extent to which a developed instructional game will sustain students' interest in chemistry and as well have a positive effect on their achievement in chemistry.

Research Hypotheses

As guide to the study, the following hypotheses were tested:

i. There is no significant difference in attitude of male and female students towards the game
ii. There is no significant difference in the achievement of students exposed to the game and those taught by the conventional method.

Research Design

Two groups randomized Pre-test, Post-test experimental research deign was employed in the study.

Population

The target population for the study comprised chemistry students in Lagos State Secondary schools while the accessible population comprised selected secondary schools in Eti-Osa local government area of Lagos State.

Sample and Sampling Technique

The sample used in the study consisted of all SS2A students of two secondary schools in Eti-Osa local government area of Lagos State. The schools were selected from all secondary schools within the accessible population using simple random sampling technique; by balloting. The SS2A students in each of the two schools were divided into two groups to serve as experimental and control group respectively.

Instruments for Data Collection

The following instruments were employed in the study:

I. The Instructional Game: The instructional game "The Quest" is an interactive 2-dimensional instructional game developed by the researchers for reinforcing concepts taught and learnt in chemistry.

It is a colourful board game partitioned into ten columns and ten rows, it has a total of one hundred spots with different inscriptions such as pictures of apparatus, chance, reagents, laws etc.

The Quest is played with tiles, dice and cards. To start the game, each player picks a tile for identification with inscription of symbols of elements on them. Each player must throw six on the dice to advance on the board, and subsequent throws will be counted on the board following the directional arrows, and responding to information on the various spots.

The question cards is a major component of the game with questions carefully selected on the relevant concept. It is usually selected before the commencement of the game. A question correctly answered is rewarded by moving forward three steps, while for every wrongly answered question, the player remain on the same spot. There are fifty questions cards in all. (See appendix I for the cards)

The Chance Spots and Chance cards: These are part of the entertaining elements of the game because introduce fun, luck, reward and ill-luck to the game.

The Rule of the Game: The rule of the game was provided in a pamphlet accompanying the game. They covered the following sub-topics

- General Rule
- Starting the Game
- The Play Rule

- Special Features Rules

The developed game is presented in figure I below:

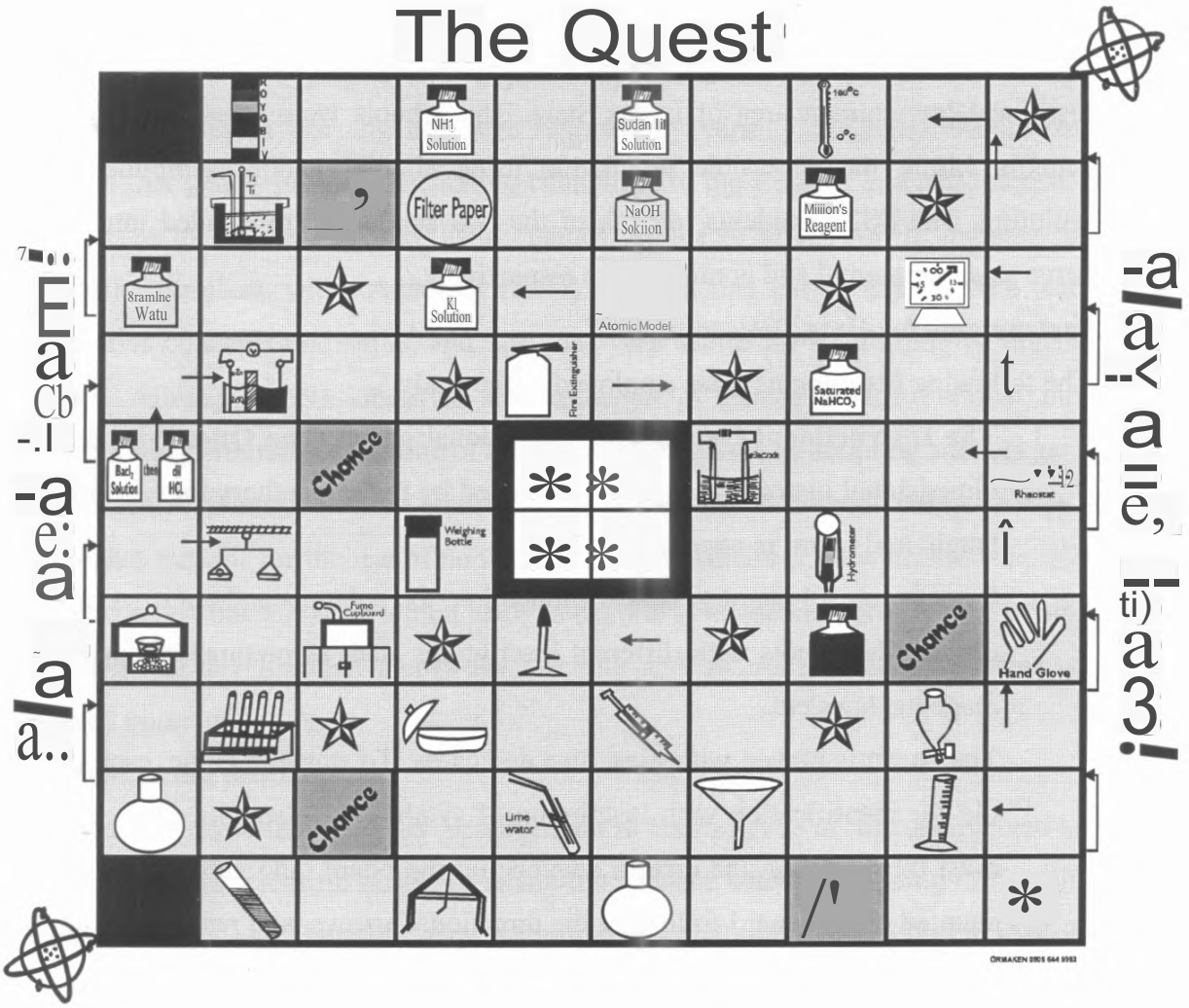

Fig. I: The Quest Instructional Game

2. Lesson Plans: Lesson plans were drawn up on the same concepts on which the game was developed. They were used to instruct both the experimental and control groups respectively.

The concepts covered are listed below:

- Introduction and component of organic compound
- Characteristics features of organic compound
- Terms in organic chemistry
- IUPAC Nomenclature
- Classification of organic compounds
- Hydrocarbon and sources
- Alkanes

- Alkenes
- Alkynes

3. Test items: Twenty test-items were chosen at random from fifty questions incorporated in the game. These questions were used as pre-test and post-test.
4. Attitude Questionnaire: A questionnaire was developed to ascertain the attitude of students towards the game.

Procedure for Data Collection

The selected schools were visited for permission and arrangements with teachers and students used in the study. The pre-test was administered on students in the two groups; this was followed by teaching the control group using the conventional teaching method, while the experimental group was exposed to the instructional game. The post-test was later administered on all students in both groups. This procedure was repeated in both schools.

Data Analysis Technique

The pre-test and post-test scripts were marked over 20 (1 mark for each correct answer). The achievement (Gain) score was determined by: Achievement = Post-test Score - Pre-test score.

Also, responses from the attitude questionnaire were pooled together for analysis.

The various hypotheses were tested using descriptive and inferential statistics such as the mean, standard deviation and t-test.

Results

The first null hypothesis of the study was tested by comparing responses to items on the questionnaire based on gender. The result obtained is presented in table I below:

Group	N	Mean	t-cal	t-critical	Decision
Female	8	16.13	0.86	2.10	Not Significant
Male	12	15.42			

Table I above shows that t-calculated is less than t-critical at 0.05 level of significance, Nl +N2-2 degree of freedom (0.86<2.10). This implies that there is no significant difference in the mean attitude score of male and female students towards the instructional game. There fore, the first null hypothesis of the study should not be rejected. Similarly, responses from the attitude questionnaire for students in the experimental group revealed showed that they have positive attitude towards playing the game and learning from them.

To test the second null hypothesis of the study, gain scores of students in the experimental and control groups were subjected tot-test analysis at 0.05 level of significance and Nl +N2-2 degree of freedom. The result obtained is presented in table II below:

Table II: Effects of Instructional Game on Students' Achievement

School	Group	N	Mean	S.D	t-cal	t-critical
1	Experimental	10	4.6	1.58	3.21	2.101
	Control	10	3.4	2.12		
2	Experimental	10	6.1	2.88	2.93	2.101
	Control	10	4.3	3.25		

As shown in table II above, the calculated t-test value is greater than the t-critical in both schools (3.21 > 2.101; 2.93 > 2.101). These results implied significant difference in the achievement of students exposed to the instructional game and those exposed to the conventional chalk and talk method. Therefore, the second null hypothesis of the study should not be accepted but rejected.

Discussion of Results

It has been established by this study that students learn significantly when taught with game and more importantly, they learn better than those taught with the traditional chalk and talk method. This attempt to evaluate the developed game is a fundamental step in instructional system development. The results of this study therefore corroborated the fact that interactive method of teaching facilitate learning and will therefore serve as a rescue to the reported (Carew and Ajewole, 1993; Jegede and Okebukola, 1996) decline in academic performance associated with the use of conventional methods. Also from the findings of this study, students exposed to the Quest game showed a positive attitude towards learning with the game. This also agrees with the opinions of Ladon (1991) that play (another non-conventional method) loosens tension and reduces boredom and give children opportunities for physical activities, exploring, discovering and learning.

Conclusions

Based on the findings of this study, the following conclusions were drawn:

- Science (Chemistry) teachers should look inward by developing simple instructional games or adapting existing ones to improve the teaching and learning of chemistry (Science) in schools.
- Students expressed a high positive attitude towards instructional game and learning through it.
- There is no significant difference in students' attitude towards the instructional game based on gender.
- Students exposed to instructional games achieved significantly better than those exposed to the traditional chalk and talk method.

Recommendations

The following recommendations are put forward

- Science teachers must keep abreast with science and technological innovators, and be prepared to serve as managers of instruction.
- Teachers' education programme should aim at developing teaching skills and other specific skills to enhance creativity and ingenuity
- Creative teachers should be encouraged by funding the publication of developed games and mass produce them for use in schools.
- Further research should be encouraged/commissioned into other non-conventional ways of effective teaching and learning of science in schools

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