

DEVELOPMENT AND ASSESSMENT OF GAMIFICATION INSTRUCTIONAL PACKAGE ON GENETIC CONCEPTS FOR SENIOR SECONDARY SCHOOLS ACHIEVEMENT AND GENDER IN MINNA, NIGERIA

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Abstract

This study investigated the development and assessment of Gamification Instructional Package on genetics concept for senior secondary schools' achievement and gender in Minna Metropolis, Nigeria. The study adopted pre-test post-test non-randomized quasi experimental research. The population of the study comprises federal government college students in Niger state Nigeria and target population were SSII biology students. Intact class of 90 students (male =50, female=40) were used for the study from two randomly selected federal government colleges in Niger state Nigeria. The Instruments for the study are Genetics Achievement Test (GAT) and treatment material is Gamification Instructional Package (GIP). The GAT comprises of 50 multiple choice objective questions and Gamification Instructional Package comprised of Genetics lesson. The Genetics Achievement Test (GAT) and Gamification Instructional Package (GIP) were validated by three experts in biology education, education technology, cyber security experts and computer scientist by both university and secondary school teachers. Experimental group were given Pretest before the treatment and after treatment posttest were administered on them. Experimental group was exposed to the use of Gamification Instructional Package (GIP) while Control group was exposed to Lecture Method (LM). Mean and standard deviation were used to analyze the research questions while ANOVA was used to analyzed hypotheses. Conclusively, it was established that there was significant difference in the achievement using Gamification instructional package and lecture method and no significant difference in the gender of biology student taught using Gamification instructional package.

Key words: Gamification Instructional Package, achievement, gender

Introduction

The advent of science and Technology has made the standard of living comfortable as it has influence every aspect of human life ranging from the immediate home, school, offices, market areas and politics. Technology can be seen as the application of scientific ways or methods to human lives involving the use of tools, methods systems and procedures to solve challenges. Technology has had much influence on development and has impacted our lives by making it easier. Today, the role of Technology in learning is of importance because of the increase in agitation for the use of various types of information and communication technologies. Kareem, (2003) stated that, in this present digital era, development in various aspects of computer technology has reached a stage beyond human imagination and expectations. Even though the computer has a lot of applications in various fields, one should never forget its application in the field of education as it has been seen to be helpful in the teaching and learning process. Gamification has been seen as one of such ways through which its application of typical elements of game playing can be integrated into the classroom.

Deterding, *et al.*, (2011) defined Gamification as the application of game-design elements to non-game contexts with the intention of modifying behaviours, increasing fidelity or motivating and engaging people. Gamification applies elements associated with video games (game mechanics and game dynamics) in non-game applications. It aims to increase people's engagement and to promote certain behaviors. Although, the concept has been explored primarily in the marketing area, the potential of its application has been extended to other areas such as Health, Environment, Government or Education (Jorge,*et al.*, 2013). It is used primarily

as a tool for marketers, often making use of social media to engage existing and potential customers to increase public profile, market a new product or engage potential customers/stakeholders. Gamification involves adding a game layer into applications or businesses allowing users to collect points, compare stats in leaderboards, and compete in specific tasks.

It is a known fact that science is a tool for scientific and technological advancement of any nation as it is found in the National Policy of Education (Federal Republic of Nigeria, 2004) which states that the teaching and learning of science should among other things empower the students to live effectively in the modern age of science and technology. Biology is one of science subjects offered in Nigerian secondary schools.

Biology is a branch of science that involves the systematic study of living things. It is recognized as one of the core science subjects offered at the senior secondary school level in Nigeria and it is the most preferred subject offered by both science and non- science students this is proven by large number of students' enrolment in the O'level Biology examination (Nsofor, 2001). Among the core topics been taught in biology, questions on genetics is often times asked during the O'level Biology examination as it is an indispensable topic in the Nigerian secondary school Biology Senior Secondary School three curriculum.

Students' academic achievement tends to show the efficacy or otherwise of schools and tends to determine the future of students. Ogundukun, *et al.*, (2010) defined students' academic achievement as the exhibition of knowledge or skills acquired in a subject which is usually determined by scores in test. Academic achievement is defined as the performance of a student in a subject as designated by a score obtained in an achievement test. Achievement is defined as something accomplished successfully, especially by means of exertion skill, practice or perseverance (Umoren, *et al.*, 2007).

Gender influence on the students' achievement in biology has generated a lot of concern by educators. Studies on the influence of gender on students' performance is conflicting. For instance, Nkemdilim, *et al.*, (2014) conducted a study on students' achievement in ecological concepts and found that male students that were taught with computer-assisted instruction (CAI) performed better than female students

Purpose of Study

Specifically, the study is set to:

- 1) Examine the mean difference in achievement scores of students taught genetics using Gamification Instructional Package and those taught with Lecture Method.
- 2) Examine the difference in the mean achievement scores of male and female students taught Genetics using Gamification Instructional Package.

Research Questions:

The following research questions were raised to guide the study:

- 1) What is the mean difference in achievement scores of students taught genetics using Gamification Instructional Package and those taught with Lecture Method?
- 2) Will there be any difference in the mean achievement scores of male and female students taught Genetics using Gamification Instructional Package?

Research Hypotheses:

The following null hypotheses will be formulated and tested at 0.05 level of significance:

H₀₁: There is no significant difference in the mean achievement scores of students taught genetics using Gamification Instructional Package and those taught using Lecture method.

H₀₂: There is no significant difference in the mean achievement scores of male and female students taught Genetics using Gamification Instructional Package.

Methodology

The study adopted pre-test post-test non-randomized quasi experimental research. The population of the study comprises all federal government colleges students in Niger state Nigeria and target population were SSII biology students. Intact class of 90 students (male =50, female=40) were used for the study from two randomly selected federal government colleges in Niger state Nigeria, the schools were randomly selected because Niger state has more than

two federal government colleges that are mixed schools. The Instruments for the study are Genetics Achievement Test (GAT) and treatment material is Gamification Instructional Package (GIP). The GAT comprises of 50 multiple choice objective questions and Gamification Instructional Package comprised of Genetics lesson. The Genetics Achievement Test (GAT) and Gamification Instructional Package (MSI) were validated by three experts in biology education, education technology, cyber security experts and computer scientist in both university and secondary school teachers. Experimental group were given Pretest before the treatment and after treatment posttest were administered on them. Experimental group was exposed to the use of Gamification Instructional Package (GIP) while Control group was exposed to Lecture Method (LM). Mean and standard deviation were used to analyze the research questions while ANOVA was used to analyzed hypotheses. Conclusively, it was established that there was significant difference in the achievement using Gamification instructional package and lecture method and no significant difference in the gender of biology student taught using Gamification instructional package.

Results:

Research Questions One: What is the mean difference in achievement scores of students taught genetics using Gamification Instructional Package and those taught with Lecture Method?

Table 1:

Mean and Standard Deviation of Pretest and Posttest Scores of Experimental and Control Groups

Group	N	Pretest		Posttest		Mean Gain
		\bar{X}	SD	\bar{X}	SD	
Experimental	50	33.50	6.12	77.48	7.92	43.98
Control	40	35.70	5.96	50.70	11.52	15.00

Table 1 shows the mean and standard deviation of achievement scores of experimental group and control group in pretest and posttest. The result revealed that mean and standard deviation scores of the pretest and posttest experimental group are \bar{X} =33.50, SD = 6.12 and \bar{X} = 77.48, SD = 7.92 respectively. This gives a mean gain of 43.98 for Gamification Instructional Package group. On the other hand, the mean and standard deviation of the pretest and posttest of the control group are \bar{X} = 35.70, SD = 5.96 and \bar{X} =50.70, SD = 11.52 respectively and gives a mean score of 15.00 for the Control Group. The results revealed that experimental group and control group had mean gain of 43.98 and 15.00 respectively with the experimental group (Gamification Instructional Package having the higher mean gain than Lecture method.

Research Question Two: Will there be any difference in the mean achievement scores of male and female students taught Genetics using Gamification Instructional Package?

Table 2:

The mean and standard deviation of pretest and posttest scores of male and female Gamification Instructional Package)

Group	N	Pretest		Posttest		Mean Gain
		\bar{X}	SD	\bar{X}	SD	
Male	29	34.38	6.63	76.90	8.84	42.52
Female	21	32.29	5.26	78.29	6.58	46.00

Table 2 shows the mean and standard deviation of the pretest and posttest scores of male and female experimental groups. From the result, it can be seen that mean score of the pretest and

posttest score of the male are $\bar{X} = 34.38$, $SD = 6.63$ and $\bar{X} = 76.90$, $SD = 8.84$, the mean gain is 42.52 in favour of the male posttest achievement score. Similarly, the mean and standard deviation of pretest and posttest score of female are $\bar{X} = 32.29$, $SD = 5.26$ and $\bar{X} = 78.29$, $SD = 6.58$, the mean gain is 46.00 in favour of the female posttest score. Also, the result reveals the difference of 3.48 between the posttest mean gains score of male and female in favour of the female.

Hypothesis One: There is no significant difference in the mean achievement scores of students taught genetics using Gamification Instructional Package and those taught using Lecture method.

Table 3:

Summary of Analysis of Variance ANOVA comparison of the achievement mean achievement scores of the experimental and control group taught Genetics using (GIP)

Groups	Sum of Squares	Df	Mean Square	F	Sig
Between groups	15037.076	1	15937.076	169.648	.000
Within groups	8266.880	88	93.942		
Total	24203.956	89			

Table 3 shows the results of the analysis of variance on achievement test of students who taught genetics using Gamification Instructional Package and Lecture Method. As shown in (Table 4.8) revealed $F(1, 88) = 169.648$ $p = 0.00$. With $p < 0.05$, the null hypothesis was rejected. Therefore, there was significant difference in the mean achievement scores of students taught genetics using Gamification Instructional Package and those taught using Lecture method.

Hypothesis Two: There is no significant difference in the mean achievement scores of male and female students taught Genetics using Gamification Instructional Package.

Table 4:

ANOVA Analysis of Achievement of Male and Female Students Taught Genetics Using Gamification Instructional Package

Groups	Sum of Squares	Df	Mean Square	F	Sig
Between groups	23.505	1	23.50	0.36	0.54
Within groups	3054.975	48	63.64		
Total	3078.480	49			

Table 4 shows the results of the analysis of variance on achievement of male and female students taught Mathematics using Mastery learning strategy and conventional teaching strategy as shown in (Table 4) revealed $F(1, 48) = 0.36$ $P = 0.54$ With $P > 0.05$ the null hypothesis was accepted. Therefore, there was no significant difference in the mean achievement scores of male and female students taught Genetics using Gamification Instructional Package.

Discussion

There was significant difference in the mean achievement scores of students taught genetics using Gamification instructional package and Lecture method. This is in support of findings of Tara and Bindu (2016) who examined the effect of blended learning strategy on achievement

in biology, social and environmental attitude of students at secondary level. The findings reveal that Blended Learning strategy is an effective means for enhancing achievement in Biology, for improving Social Attitude and Environmental Attitude of secondary school students. Also agreed with the work Rabgay, (2018) who investigated the effect of using cooperative learning method on tenth grade students' learning achievement in biology. The test score analysis showed that the experimental group had significantly higher scores than the control group. There was no significant difference in the mean achievement of gender of students taught genetics using Gamification instructional package. Adeleke (2007) who carried out a study that examined the problem-solving performance of male and female students' mathematical problem solving using conceptual learning strategy (CLS) and procedural learning strategy (PLS). Findings of the study showed a non-significant difference in the performance of boys and girls in two learning strategies. This is contrary with the findings of Olumide (2013) who carried out a research to establish computer simulation package and gender as predictors in the teaching of Genetics on students' achievement in Biology. The findings shows there was a significant main effect of gender on students' achievement in Biology.

Conclusion

1. Findings of this study indicates that; students exposed to Gamification instructional package (GIP) improved their level of achievement compared to those taught using Lecture Method (LM).

Recommendations

- 1 Given the evolving nature of the teaching and learning process, succession of studies based on Gamification instructional package (GIP) should be made to further enhance the decision to accept Gamification instructional package into the educational system thereby enabling both the students and teachers familiarize themselves with educational technology.
- 2 The findings of this study provide the basis for conclusion that the use of the package developed for the study (Gamification instructional package) is gender sensitive

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