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Effectiveness of the Use of Gamification by Teachers of Physics in Secondary Schools in Buruku Local Government Area of Benue State

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Abstract: *The study investigated the effectiveness of the use of games by teachers of physics in secondary schools in Buruku Local Government Area of Benue State. Four objectives were set for the study which are to determine the awareness level of teachers on the use of Games in the teaching of physics, determine the use of Gamification among secondary school teachers in Buruku LGA, determine the effectiveness of the use of Gamification among secondary school teachers in Buruku LGA and determine gender differences in the use of gamification. A total of 60 students were used for experimentation (quasi-experiment). The purposive sampling techniques was used with the sample size of 60. Data was analyze using frequency, percentage and paired T-test. The results showed that the awareness level of teachers to the use of Gamification in the teaching of physics is low, Gamification is used among secondary school teachers in Buruku LGA and the use of Gamification can be effective when implemented among secondary school Physics teachers in Buruku LGA and there exist gender difference in the use of gamification in physics in secondary schools in Buruku Local Government area of Benue State. Based on the finding of the study, the study concluded that; There is no awareness among physics teachers in the use of Gamification in the teaching of physics in Buruku Local Government area of Benue State. Gamification is not in use among secondary school physics teachers in Buruku LGA, the use of Gamification among secondary school Physics teachers can be very effective in Buruku LGA and there is a gender difference in the use of gamification in Physics in the local government Area. Recommendations like; awareness should be created in the local government as regards Use of Gamification in the teaching of Physics, Gamification should be used in the teaching of Physics in secondary schools, Professionals should be employed in the use of gamification to boost student performance and gender factor should be considered in physics especially during teaching and learning to enhance the performance of both gender in the local government area in particular and the state at large.*

Keywords*: Effectiveness, Gamification, Teachers, Physics, Secondary Schools*

1. INTRODUCTION

Physics is a branch of science that seeks to construct and experimentally test theories of the physical universe. According to Mendel (2018), Physics is the aspect of science that deals with the structure of matter and the interactions between the fundamental constituents of the observable universe. 'In the broadest sense, physics (from the Greek physikos) is concerned with all aspects of nature on both the macroscopic and submicroscopic levels. Its scope of study encompasses not only the behaviour of objects under the action of given forces but also the nature and origin of gravitational, electromagnetic, and nuclear force fields' (Okonkwo, 2011). In Nigeria, physics is studied as a subject at the senior secondary school level (SSS1 to SSS3).

The educational system in Nigeria is grouped into Kindergarten, Primary education, Secondary education, and Tertiary education, which are all managed by the Government. The Federal government has been bedeviled with instability since declaring independence from Britain, and as a result, a unified set of educational policies are yet to be successfully implemented (Ajibade, 2019).The Nigeria system of education is comprised of six years of elementary school, followed by six years of secondary school. Senior Secondary school consists of the SSSI, SSS2, and SSS3 which is equivalent to the 10th, 11th and 12th Grade (Mendel, 2018). The Senior Secondary School Certificate Examination (SSCE) is taken at the end of the SS3.

Marczewski (2019) opined that 'Gamification is adding game mechanics into nongame environments, like a website, online community, learning management system , business' intranet or schools to increase participation'. He is of the view that, the goal of gamification is to engage with consumers, employees, partners and students to inspire collaborate, share, interact and learn. Gamification can be seen as a strategic attempt to enhance systems, services, organisations, and activities in order to create similar experiences to that experienced when playing games so as to motivate and keep the students busy (Marczewski, 2019). This is usually achieved through the application of game-design elements and game principles (dynamics and mechanics) in non-game environment. Hamari, Shernoff, Rowe, Coller, Asbell-Clarke, and Edwards, (2014) defined gamification to be a set of activities and processes to solve problems by using or applying the characteristics of game components. According to Hamari, & Koivisto, (2014), 'Gamification is part of persuasive system design, and it commonly employs game design elements to improve user engagement, organizational productivity, flow, learning, crowdsourcing, knowledge retention, employee recruitment and evaluation, ease of use, usefulness of systems, physical exercise, traffic violations, voter apathy, public attitudes about alternative energy, and more'. Literature shows that majority of studies on gamification concludes that, it has positive effect on individuals, not leaving out the fact that individual and contextual differences exist.

Gameful thinking, as it relates to education, is often expressed in 4 categories of cosmetic/visual enhancement, accessory, integrated, and through making the learning process a game. As adults, games still have the power to transform tedious tasks into engaging, pleasurable activities (Umar, 2015). Umar (2015) also posited that gamification is very effective in learning (for children and adults) because the learner forgets they are "working" and instead feels they are "playing" while working. Egwu (2017) stated that research have shown that students who learn with everyday games content experience increased long-term retention.

An assessment of the effect of edutainment in advanced countries found that it increased engagement time with online programs and that it also positively impacts engagement and downstream attitude (e.g wellbeing and academic performance), especially in the interim. According to Hamari (2019), there are clear indication that gamification is among the effective ways of increasing learner engagement, retention, and recall by reducing barriers to learning. This is to say that gamification have been shown in the western world to be effective.

The aim is to generate levels of involvement equal to what games can usually produce (Fardo 2014). The objectives of edutainment are to; enhance certain abilities, introduce objectives that give learning a purpose, engage students, optimize learning, support behavior change, and socialize the learner with the content to be learnt (Knutas et al. 2014; Krause et al. 2015; Dichev and Dicheva 2017; Borges et al. 2013). Teachers use gamification to simulate the environment to motivate the student's interest for better learning. Fardo (2014) posit that the level of gamification in secondary schools in Nigeria is quite poor probably because of the general assumption that it's meant for Childrens' play class.

Research Questions

The following questions were raised to guide the study

1. What is the level of awareness of teachers to the use of Gamification in the teaching of physics in Buruku Local Government Area?
2. Do Physics teachers use Gamification in the teaching of physics in the Local Government Area?
3. What is the effectiveness of the use of Gamification among secondary school teachers in the Local Government Area?
4. Are there difference between gender in the use of gamification in the Local Government Area?

Research Hypothesis

Ho: There is no significant difference in the use of gamification in teaching of physics in the Local Government Area.

2. MATERIALS AND METHODS

Research design

The study adapted quasi-experimental design. A quasi-experiment is an empirical interventional study used to estimate the causal impact of an intervention on target population without random assignment. As such, this design gave room for experiment where an experimental group would be taught using gamification and a control group which shall taught through conventional classroom method.

Area of study

Buruku is a Local Government Area in Benue State, Nigeria. Its headquarter is in the town of Buruku. It has an area of 1,246 km^2 and a population of 203,721 at the 2006 census. Over 80% of adults in this rural population is engaged in food crop production but each household also holds some livestock and citrus farm. The area is characterized by agricultural and educational activities. Buruku is a riverine local government area with large areas of Katsina-Ala River Basin where sugar cane is planted in commercial quantity. Rice is also produced in commercial quantities along the River Katsina-Ala basin and its streams/tributaries. Popular local markets in Buruku LGA are Ityowanye, Adi, Abwa, Buruku, Adogo, Kur, Usen, Agwabi, Ortese-Mbashian, Gbanyam, Ugah, Jingir, and Dogo/Wuna. Buruku has a large citrus and soya beans market at Ityowanye.

Population

A population could be infinitely large or finite. The totality of the student teachers' population in the given institution. According to Benue State board cited in Uzo (2017), there are about 110 senior secondary schools in the area under study which comprised of 550 teachers and 22514 students. Hence, the population is all the 110 secondary schools (23,064 student and teacher population) in the LGA.

Sample and Sampling techniques

Purposive sampling was implored to select ten schools from the population. However, simple random sampling was also used in determining six students from Senior Secondary two (SS2) in the schools selected. The choice of purposive sampling was due to undocumented figures on the total number of schools in the LGA. Hence, the sample size is 60 respondent students were selected for the study

Instrument for data collection

A test-retest was conducted (quasi experiment). The students (respondents) were grouped into two (group A and group B). Group A was the experimental group where they were exposed to gamification in physics topic (Motion) while group B was taught the topic of motion in physics using the convention classroom teaching method. Same test instruments called 'effectiveness of gamification" (EG) was administered to the groups before and after each lesson and data was collected and was used for analysis

Validity of the instrument

The content and face validity of the instrument was determined by the supervisor and his suggestions and modification formed the final draft of the questionnaire. As an authority, he scrutinized the items to make sure that items that are not clear are eliminated. Only suitable items were captured in the questionnaire

Reliability of Instrument

The trial testing exercise was conducted to gather information on the appropriation of the test instrument for the intended level of teachers that will participate . Trial testing was carried out using gamification to teach students outside the sample. The objective of trial testing is to find out the internal consistency of the items. The data collected was analyzed using Kuder-Richardson 21 formula ($K\text{-}R_{21}$). The ($K\text{-}R_{21}$) reliability was used because the items are scored dichotomously. The Cronbach Alpha Coefficient method was used to calculate the reliability coefficients. Any coeffiecient below 0.5 shows that the instrument is not relaible, if the coefficent is 0.5 or above then the instrument is said to be reliable.

Method of data collection

Students' scores gotten from the test retest was used for data analysis. A test was conducted on the respondents at the beginning and at the end of each lesson (Physics corner and jigsaw game). This was repeated for both groups.

Method of data analysis

The tool for data analysis used was descriptive tools like frequency, percentages and mean was used to analyse the research questions while the product moment correlation was used to analyse the research hypothesis.

3. RESULT AND DISCUSSION

3.1 Results

The results of the data analyses and interpretations are presented according to the research questions asked.

Research Question 1: What is the level of awareness of teachers in utilizing gamification in the teaching of physics in Buruku Local Government area of Benue State?

Information gathered as presented in Table 1 showed that the level of awareness of the utilization of gamification in the local government area is very low , only (8.3%) claim to aware of gamification. About 70% of the teachers do play game of varied difficulty level however; they do play games for fun. This is to say, there is no targeted educational objective while playing the game. 21% were not aware of gamification at their own level. This imply that gamification is not quite in use in the LGA.

Table 1: Awareness of the Use of Gamification

	Frequency	Percent
group play games but just for fun	42	70.0
Group use gamification	5	8.3
Group Not Aware on the use of Gamification in Education	13	21.7
Total	60	100.0

Research Question two: Do Physics teachers use Gamification in the teaching of physics in Buruku Local Government Area?
The data gathered and presented in Table 2 shows that physics teachers use Gamification (3.3%) while the rest physics teachers don not use Gamification (96.7%). This is to say that gamification is a rare concept of teaching in Buruku local government area. Majority could possibly be using the conventional methods of teaching physics.

Table 2: Physics teachers use Gamification in the teaching of physics in Buruku Local Government Area

	Frequency	Percent
Physics Teachers use Gamification	3	3.3
Physics Teachers do not use Gamification	57	96.7
Total	60	100.0

Research Question 3: What is the effectiveness of the use of Gamification among secondary school teachers in Buruku Local Government Area?

The result of the pretest and post test of the experimental and control group presented in Table 3 shows that the experimental group (pretest) have mean score of (16.35), the experimental group (post test) have mean score of (20.93), the control group (pretest) have mean score of (13.78) while the control group post test have mean score of (19.37).

Table 3: Effectiveness of Gamification in the teaching of Physics

		Mean	Standard deviation
Pair 1	experimental (pretest)	16.3500	5.66830
	experimental post test	20.9333	5.69230
Pair 2	control_pretest	13.7833	5.29820
	control_post_test	19.3667	6.61013

Research Question 4: Are there difference between gender in the use of gamification in Buruku Local Government Area?

Table 4 presents the mean score of male and female in the use of gamification in Buruku local government area of Benue state. The male experimental group (pretest) shows a mean of 12.50, male experimental group (post test) showed mean of 17.33. The female experimental pretest showed a mean of 10.33 while the post test is 14.67. Their respective mean difference is 4.83 and 4.34 for male and female pretest and post-test.

Table 4: Difference between gender in the use of gamification in Buruku Local Government Area

3.2 Test of Hypothesis

		Mean	Mean Difference	Standard deviation
Male	experimental (pretest)	12.50	4.83	2.830
	experimental post test	17.33		1.230
Female	experimental _pretest	10.33	4.34	1.820
	experimental _post_test	14.67		2.013

Ho: There is no significant difference in the use of gamification in teaching of physics in Buruku Local Government Area.
H_1: There is significant difference in the use of gamification in teaching of physics in Buruku Local Government Area
Table 5 showed that the experimental group had a negative correlation of -0.069 between the pretest and posttest group while the control group had positive correlation (0.132) between the pretest and posttest group. The group showed a p-value of 0.00 as shown in appendix which is below the 5% (0.005) level of significance. It therefore stand that we reject the null hypothesis and accept the alternate hypothesis that there is significant difference in the use of gamification in teaching of physics in Buruku Local Government Area.

Table 5: Paired sample correlations

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	experimental (pretest) & experimental post test	60	-.069	.602
Pair 2	control_pretest & control_post_test	60	.132	.316

4. Discussion of findings

Based on the result of this research presented from table 1 to table 6, it has been shown that Gamification is not well known as a tool for teaching and learning of physics in Buruku Local Government Area of Benue State. Physics teachers have not been using gamification in the area which makes the concepts new to the students and teachers of physics in the area. This finding is related to that of Soman (2013 who say that gamification is a relative new idea to the third world countries like Nigeria. he further posit that most Nigerian teachers are not well aware of gamification and the principles guiding it. To most teachers, gamification simply involves the provision of technology-enabled games for students to play with, without aligning it with learning objectives. Such teachers and policy makers therefore advocate for the provision of technology gadgets. This poor understanding is a challenge against the integration of gamification in Nigeria school.

Considering the effectiveness of the use of gamification, it has be shown across gamified groups and gender. Gamification as shown in table 3 to improve student performance in physics the experiment group (posted group) had higher scores compared to the control (post test) group. This is evidence that the gamification in which the experimental group were exposed to have influence in their performance. This trend was also exemplified when the groups were considered based on gender. The groups exposed to gamification had higher performances which invariably imply that gamification would improve students performance in physics when used for teaching and learning. Being that it is a new concept, it can be relayed to the student to build their curiosity in the cocept. In agreement to the work of Ajibade,(2019), Gamification have the ability to increase the performances of students not just in Physics but also in all subject applicable. In addition, Edward (2014) also advocate for proper use of gamification claiming that it can be counter productive if not well used. The students may soon make fun of it and forget about the objective of the gaming element. Therefore experts (professionals) should be involved in the implementation of gamification in education at all levels across subjects of interest.

The gender difference as shown in table table 4 shows that there is difference between and within the groups. Gamified group had higher score compared to the non gamified group both within male and female. Comparing female and male group performance, the male gamified group had the highes score followed by the female gamified group. In a similar trend, the male control group also performed better than the female control group. This is to say that male perform higher in physics and their performance can be improved by using gamification in both gender. This finding also agrees with Abel (2014) was state that male perform higher in rational subjects (science) like physics and mathematics .

The correlational studies of the hypothesis testing showed that the experimental group were negatively correlated while the control group were positively correlated. This implies that post test and pretest of the experimental group are not directly proportional. It means that if the score of the post test increases, it have tendency of decrease with pretest of same group, verse versa. On the other hand, the control group having a positive correlation means that both post test and pre test scores increases and decreases concurrently. Hence there is a significant change between and within the gamified and control group.

5. Conclusion

Based on the finding of the study, the study concluded that;

1. There is no awareness among physics teachers in the use of Gamification in the teaching of physics in Buruku Local Government area of Benue State.
2. Gamification is not in use among secondary school physics teachers in Buruku LGA
3. The use of Gamification among secondary school Physics teachers can be very effective in Buruku LGA
4. There is gender differences in the use of gamification in Physics in Buruku local government Area.

6. Recommendation

i) Awareness should be created in Buruku local government area of Benue State on the Use of Gamification in the teaching of Physics

ii) Gamification should be use in the teaching of Physics in secondary schools in Buruku local government Area of Benue State.

iii) Professionals should be employed in the use of gamification to boost student performance in Buruku Local Government Area of Benue State.

iv) Gender factor should be considered in physics especially when teaching and learning to enhance the performance of both gender in Buruku local government area.

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