

## GAME BASED LEARNING APPROACH TO IMPROVING STUDENTS LEARNING ACHIEVEMENTS IN A NUTRITION COURSE

By

**ALABI T.O. & ANIAH .TONY**  
Science Education Department  
Federal University of Technology,  
School of Science and Science Education  
P.M.B. 65, Minna  
E-mail: thomasalabi2011@yahoo.com

AND

**BOLARINWA R. Ph. D**  
Department of Educational Foundation and Management,  
Faculty of Education,  
Ekiti State University

### ABSTRACT

*The aim of this study was to explore the influence of applying a game based learning approach to nutrition education. The quasi-experimental non equipment-control group design was adopted in a four-week learning activity. The participant included sixty-six students in two classes of an elementary school. One of the classes was assigned to be the experimental group and the other was the control group. The experimental group learned with computer games while the control group learned with the traditional teaching approach. The result showed that the learning achievement of the students in the experimental group was significantly better than that of the student in the control group. Similar results were obtained in terms of the learning interest of the students. Moreover, most of the students revealed quite positive attitudes toward the use of the game-based learning approach in terms of nutrition knowledge and learning attitudes.*

### INTRODUCTION

With the fast development of information technology and rapid social change in the twenty first century, the growing economy, higher education level and progress of medicine is gradually turning people's attention to health concept and problems. Shaping health habits has become very important. Under Bakke, McBride and Spencer (2006) held in the view that healthy habits should be formed as early as possible. Therefore, to shape learners to have correct food and drink habits and establish a balanced diet, nutrition education needs be carried out in the early stage of school. The objective of health education is behavioral implementation, during which health concepts are acquired to form personal value. It is paramount in teaching to shape students values that can influence attitudes and behaviours. Nutrition education has been recognized as a crucial factor in promoting good health. Researchers have indicated that healthy eating habits not only influence the normal growth of students, but also advance chronic disease Hang et. Al. (2009). Other researchers stated that nutrition education should be a kind of experience learning through which eating habits and nutrition knowledge can be changed. School students spend a lot of time in school so the school environment can have a certain degree of influence on them. Nutrition knowledge and

attitudes of the students who take related courses are better than those of students who do not take the course. Kinner and Woodburn (2010) found that there is a positive correlation between the teaching of teachers nutrition courses aid change in the nutrition knowledge, attitudes and behaviours of students. Several research have also shown that the implementation of nutrition education is helpful in improving their eating habits, in the meantime, scholars have also indicated the difficulty of conducting effective nutrition learning activities since most students show low interest in nutrition and health courses. Therefore, it becomes an important and challenging issue to educate children to foster good eating habits in school.

Computer games developer have provided students interest in studying health-related courses, this studies attempt to investigate the influence of the game-based approach on nutrition education, improving nutrition attitudes and building the food and drinking habits of students via a computer games provided.

In this research, the following issues are studied.

- The influence of the game-based learning approach on the students' leaning achievements in the nutrition course.
- The influence of the game-based learning on students' learning attitudes toward the nutrition course.
- The influence of the game-based learning approach on the food and drink habits of students.
- The influence of the game-based learning approach on students
- Students' feedback regarding the game-based learning approach for nutrition education.

## LITERATURE REVIEW

Alabi (2010) Games have been recognized as being a good tool to promote learners to actively participate in learning activities. It is the best way to trigger students' learning motivation. In addition it has been reported that game-based learning approach might provide a good chance to stimulate children's abstract thinking during the process of cognitive development and further foster their higher order thinking abilities. Carbonaro et al. (2010) stated that computer games are able to boost motivation owing to some characteristics, such as adventure, challenges and freshness. Therefore, if teachers are able to apply computer games to teaching, students can not only have better learning achievement but also learn happily via these games. Several previous studies have demonstrated the ease of use and usefulness features of computer games by applying the game-based learning approach to a variety of learning activities. Bonigonjon et al (2010). Using computer game for learning in elementary school can increase their internal motivations and learning achievements of students. Yi Jiang and Li (2010) indicated education in primary and secondary schools, the learning motivation and learning achievements of the students can be increased and their competence and knowledge can be promoted. Another researcher also sees computer games, children's learning interest are effectively promoted and they are guided to actively improve their food and drink habits. There are several theories that are recognized as being relevant to the game-based learning approach, such as cognitive theory and situated theory. Cognitive theory emphasizes that learners should master basic skills to further acquire higher-level abilities while learning new things. It also emphasizes that learning processes are progressive and more from simplicity to complexity; moreover, games that are adopted need to stimulate students learning motivation and make learning more fun. Situated learning theory states that learners should enter learning scenarios of acquire knowledge. The knowledge that is actively explored in the

scenario should not only be useful, but should also be analogical. Therefore establishing a rich learning scenario enables learners to gain practical problem-solving abilities via observation and behavioural exploration, and a well designed game is able to provide such a learning scenario Cunca Lopex & Martin Caceres (2010). Some researches believed that evens the best teaching materials and techniques are not as good as having children learn happily via games. Compared with other media games are closer to the children's world and are easily accepted by them, game can help children develop problem-solving skills.

**RESEARCH DESIGN**

This study adopted a quasi-experimental none equivalent-control group design. The independent variable was the different teaching media. The experimental group recommend nutrition education with computer game-based teaching, while the control group was taught the nutrition with a multi media power point. The dependent variable nutrition education was included in the nutrition education knowledge tests, the questionnaire nutrition attitudes and the questionnaire of food- and-drink habit.

To evaluate the learning achievement of the students, the nutrition knowledge test developed by Lo (2006) was adopted. The test consisted of twenty items, each of which was awarded one point of the students gave the correct answer. Kuder-Richardson reliability of the test was 0.71, the item discrimination value were higher than 0.25 and the item difficulty values ranged from 0.4 to 0.8.

To measure the students learning attitudes toward the nutrition course, the questionnaire developed by Ln (2004) was adopted. It consisted of twenty items on a five-point Likert scale. The Cronbach's & Values of the questionnaire was 0.85 showing good reliability in internal consistency. In the meantime, another questionnaire developed by Her (2004) was adopted to evaluate the food-and-drink habits of the students. It consisted of twenty items on a five-point Likert Scale. The Cronbach's & Value of this questionnaire was 0.85 showing good reliability in internal consistency.

The teaching activities were designed based on nutrition education to have four topics, including 'knowledge of eating function', 'Our eating', 'Healthy eating habits' and 'Tracking eating habits' each was taught for forty minutes. The experimental lasted in nutrition education for the two groups was the same, but the experimental group was taught via computer game-based instruction while the control group was instructed with multi-media power point.

Table 1. The four units for teaching activities on nutrition education.

Class order	Topic	Purpose	Game title
First	Knowledge of eating functions	1. To experience the importance of food for psychological and physical needs. 2. To list reasons that influences personal food choices 3. To classify the six types of food correctly	1. Litter Dietician 2. Gifts from Heavens.
Second	Our eating	1. To experience how experimental factors influence eating habits. 2. To speak of factors that	Saving Health Kingdom

		influence eating habits	Health Super Maris Delicacy Island
Third	Healthy eating habits	<ol style="list-style-type: none"> <li>To understand the advantages of eating fast food often and be willing to reduce the amount of fast food.</li> <li>To choose nutritional meals for keeping fit.</li> </ol>	
Fourth	Tracking eating habits	<ol style="list-style-type: none"> <li>To compare personal eating habits with standard healthy rules</li> <li>To practice good eating habit</li> </ol>	Nutrition Supplement Battle

There were five games used in this study, the first two games mainly taught students to correctly classify the six types of food for a balanced diet. The third game Saving Health Kingdom enabled the learners to understand that snacks, fast food and beverages are not essential elements of a diet and their amount should be reduced. The fourth game Health Super Mails Delicacy Island, instructed the students to combine different food for a balanced diet via observation of a one-day diet while the least game, Nutrition Supplement Battle, made understandable that a lack of nutrients might lead to diseases by providing questions, hints and answers when needed.

## RESULTS

**Learning Achievements** - This study adopted the pretest scores of the nutrition. Knowledge test as the covariate for analysis of covariance (ANCOVA) to avoid the influence of the pretest on nutrition Knowledge Learning. One assumption of ANCOVA is that the regression coefficient of each regression line needs to be homogeneous. The interaction effect between the independent variable and the covariate of the nutrition knowledge test was not significant ( $F = 1.93$   $P > .05$ ) suggesting that the relationship between the covariate (the pre test scores) and the dependent variable (the post-test scores) was not different by the levels of the independent variable. Therefore, further ANCOVA analysis was appropriate.

Table 2. ANCOVA for the post-test results of the nutrition knowledge test.

Variable	Group	N	Mean	S.D.	Adjusted Mean	Std Error	F
Post Test	Experimental group	33	16.94	2.38	17.39	.43	20.01**
	Control group	33	15.09	3.39	14.64	.43	

\*\*\* $P > .001$

Table 2 shows the descriptive data and ANCOVA for the results of the nutrition knowledge post test. The influence of the pretest scores on the nutrition knowledge test was excluded and the learning achievements between the two groups were significantly different ( $F = 20.01$ ,  $P < .001$ ). The adjusted mean of the experimental group was 17.39 while that of the control group was 14.64, implying that the learning achievement of the experimental group was significantly higher than that of the control group, showing that computer game based instruction can effectively promote students nutrition knowledge.

The pretest scores of the questionnaire of nutrition attitudes were used as the covariate for ANCOVA. The interaction effect between the independent variable and the covariate of the questionnaire was not significant ( $F = 1.37$ ,  $P = .25$ ,  $P > .05$ ) suggesting that the relationship

between the covariate (the pre-test scores) and the dependent variable (the post-test scores) was not different by the levels of the independent variables, therefore the ANCOVA could be further conducted.

Table 3. ANCOVA result on the range of the attitudes toward the Nutrition courses

Variable	Group	N	Mean	S.D.	Adjusted Mean	Std Error	F
Post Test	Experimental group	33	88.82	7.28	88.98	1.00	.19
	Control group	33	88.52	9.01	88.36	1.00	

The learning achievement between the two groups were not significantly different ( $F = 19, P = .66, P > .05$ ) after the influence of the nutrition knowledge pretest scores were excluded. The adjusted mean for the experimental group was 88.98 whereas the adjusted mean for the control group 88.36. The score of the experimental group was higher than that of the control group, but there was no significance between the two. Computer game-based instruction was not shown to enhance the nutrition attitude of the students any more than multimedia power point instruction.

Table 4. ANCOVA result on the rating for the food and drink habit questionnaire

Variable	Group	N	Mean	S.D.	Adjusted Mean	Std Error	F
Post Test	Experimental group	33	88.46	10.36	89.28	1.12	4.17*
	Control group	33	88.88	8.25	88.05	1.12	

\* $P < .05$

Table 4 shows the descriptive data and ANCOVA for the posttest results of the food and drink habit questionnaire. The influence of the pretest scores of the food and drink habit questionnaire was excluded and learning achievement between two groups were significantly different ( $F = 4.17, P = 0.05, P < 0.05$ ). The achievement of the experimental group was better than that of the control group, showing that computer game-based instruction can effectively enhance student food and drinking habits.

An analysis was made to further compare the nutrition knowledge attitude toward the nutrition course and food and drink habits between gender after participating in this learning activity.

Table 5 shows the ANCOVA results on the post test scores of the nutrition attitudes and food and drink habits between the two genders by excluding the influence of corresponding pretest scores and pre-questionnaire rating. It was found that there is no significant difference between genders in terms of the three aspects applying that the game-based learning approach is helpful to both genders to improving their learning achievement and learning attitudes.

Table 5. ANCOVA results on the post test result of different genders.

Variable	Group	N	Mean	S.D.	Adjusted Mean	Std Error	F
Nutrition Knowledge Test	Male	17	17.47	2.00	17.29	.50	1.00
	Female	16	16.38	2.68	16.57	.51	
Nutrition Attitude Questionnaire	Male	17	89.65	6.62	88.81	1.44	.80
	Female	16	87.94	8.05	88.83	1.49	
Food and Drink Habit Questionnaire	Male	17	87.29	11.97	87.97	1.89	.14
	Female	16	89.69	8.56	88.97	1.90	

## CONCLUSION

The study aims at investigating the achievements of the student in nutrition education via computer game-based learning and multimedia power point instruction. The experimental results reveal that computer game-based learning can improve the learning achievements and learning attitudes of students. More over it was found that the game-based learning approach is equally helpful to both male and female students in terms of nutrition knowledge learning attitude and food and drink habits. This finding is quiet different from other research a difference between genders in using computers and networks. Longer experiments with larger samples to further investigate the effectiveness of the game-based learning approach for nutrition education. It is expected that the innovation approach not only improves the students' nutrition knowledge, but also fosters their food and drink habits in their daily lives. This approach can be applied to other courses in the future. Moreover, as mobile and wireless communication technologies are becoming more popular, it has become an interesting and challenging issue to use mobile devices for conducting game-based learning activities in real-world learning environment so that the students can be situated in real-world scenarios with support or hints from the learning system.

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