

# Use of A Game in Teaching Early Childhood Learners in Zimbabwe

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*Abstract-* The effect and use of games in learning has been demonstrated overall by different researchers. Games are critical to early childhood learning as they develop a child to recall taught concepts and improve their learning. However, the effects brought by games may as well be negative to students learning. The study looks at an integrated game for early childhood learners that was developed and applied to primary students in Zimbabwe. The game aided in identifying the towns and associate them with minerals found around the towns in Zimbabwe and as well determine the distances between the towns. The population consisted of two primary level students doing grade six. Students from one school learnt using the game as an aid while the other used the conventional learning that does not involve the game. The teachers assisted the students in the learning for a week and students wrote a test to measure the competency. Results of the study indicated that the integrated played a crucial role in assisting students gain knowledge about the town and minerals found in those towns. The results also showed how integrating games with their background skill and pedagogic is crucial in learning. Repeating the game a number of times become boring and students tend to

forget the purpose as students would have achieved and scored high hence lacking competition. Finally, the role of a teacher in games tends to be important in guiding the learning.

*Keywords:* e-learning, game based learning, early child hood learning

## I. INTRODUCTION

According to [1] the reason most kids don't like school is not that the work is too hard, but that it is utterly boring. So if languages are taken as a subject or module or course for kids, there is definitely indirect resistance to the learning part as they consider schooling as boring. However, we can ask ourselves how can we motivate our children to learn languages, make their learning funnier and encourage competition and teamwork among themselves? Which way is quick and gives specific feedback that enable students to figure out the right way to success? The answer is inevitably the design, implementation and consistent use of language centered games that immerse them in the material which is essential for scoring and winning so that they can learn more

quickly and efficiently [2]. Since the game players routinely spend dozens, if not hundreds or thousands of hours trying to master complex skills in the digital worlds that are time consuming, challenging and difficult to master, then it is inevitable for the same effort to be rendered in learning crucial matters if the matters are embedded as critical keys for winning the game [3].

Triumphant competition of each game level means an incidental return to the student's board of knowledge in that particular subject. Triumphant completion of a game level also means a reward to the player in form of scores or points. Rewards are motivating by their very nature. The rewards are necessarily for doing well in school. The rewards increase understanding and new abilities which are represented in terms of marks and grades and sometimes more detailed feedback engages the student/player [4][5]. In our zeal to teach our children we studiously look for educational toys, games with built-in lessons and books with a message. Usually these educational tools are less attention-grabbing and stimulating than the child's natural curiosity and playfulness. Play is by its very nature educational. And it should be gratifying and exciting. When the actual excitement and gratification goes out of play, most often so does the actual learning [6]. Play is also an influential sway on learning that is fundamental to the development of children [7], promoting engagement and mastery of developmental tasks [8]. [9], admitted that games are an essential part of the evolving human being maturity and the way in which we learn, providing the opportunity to practice and explore in a safe and sound atmosphere.

The purpose of this research is to look how games play an effect to early childhood learners in Zimbabwe. Through permanent repetition in game playing more in-depth learning is hoped to be achieved, hence an integrated game that consists towns in Zimbabwe and distances between them was developed to assist children in their learning. The research also determines how an integrated game influences pupils' learning as compared to the conventional learning the majority of learners are exposed to. It also tries to determine the impact the game have on students in identifying the towns and the distances between them. The rest of the paper is organized as follows: section 2 gives the problem definition and research questions, section 4 gives a brief literature about games based learning followed by the methodology and research design. The results and analysis follows proceeded by the discussions, conclusions and recommendations.

## II. PROBLEM STATEMENT

The advent of games in learning of late has been met with mixed reception. The game may be interesting and attention seeking when playing but the role it plays in learning may be different. The ability to score and win in

GBL is critical but the environment should be conducive to the learning so that games become an inspiration to others. A game should address different aspects so that learners can recall a concept from the game. The possible solution to this scenario is inevitably the design, implementation and consistent exploitation of an integrated GBL that immerses them in the concepts and material (usually embedded in the game as key tasks for scoring and winning) which is efficient and critical for effective learning. The research determines the role of an integrated game designed for early childhood learners and the effect, impact and influence it has to the learners in trying to master the concepts embedded as compared to the traditional teaching and learning students are exposed.

## III. RESEARCH QUESTIONS

This article seeks to answer the following questions:

- Does an integrated game based learning have effect to the learning of early childhood learners?
- Is there a difference in students' performance from those using an integrated game based learning and conventional learning and between sexes?

## IV. HPOTHESIS/ ASSUMPTION

We hypothesise that an integrated game based learning plays a major effect to the learning of early childhood learners. We further hypothesise that there is a difference in learning and understanding from students who use an integrated game learning and the conventional ones.

## V. LITERATURE REVIEW

### A. Games

The history of games emanated a long time ago. Some researchers claim to have been used way back as 1920s [7]. The role games play in various cultural and social backgrounds vary with criticism although not outweighing success. The combination of games and learning is not a new phenomenon [7]. Instructors and trainers now try by all means to include games in one way or another. This is a dream list for anyone involved in education and training as they are the traditional weak points of most traditional classroom setup.

Researcher [10] defined a game as necessarily an activity, which contains rules and overt competition, either between other players or against the game system. Furthermore, [11] and [6] defined that the thought of encircling contest or challenge into a game portrays games as

activities regarding dexterity, facts and opportunity, in which you pursue predetermined regulations and try to win against an opponent to solve a the problem or puzzle. In addition, [12] reiterated that the fundamentals that characterize a game are representation, control, complexity, achievable and clear goals, hidden secrets, adaptation, debriefing, interaction, conflict or challenge, and provision of a safe environment; that is an atmosphere where costs do not hold in reality. [13], says that games necessity rules and boundaries, feedback, an interface to the game world, context sensitivity, goals, quests and challenges, a game environment and balance. [9], provides a much less formal definition, saying that games are puzzles to solve, they are exercises for our brains and that it is the act of solving these puzzles that makes games fun.

Reference [11] , also uses a wider definition including competition or challenge and describes a game as an activity or sport involving skill, knowledge or chance, in which you follow fixed rules and try to win against an opponent to solve a puzzle. [4], describes six structural elements of games; namely rules, goals, outcomes and feedback, competition or challenge, interaction and representation or story. All these game features can be summarised as follows:

TABLE 1: GAME FEATURES [4]

Game Features	Description
Competition	Player(s) must achieve goals better than other players
Difficult	Game must contain difficult tasks that require effort to achieve
Exploration	The game must contain context sensitive virtual worlds
Fantasy	A make believe environment or story
Goals	These are explicit aims and objectives , with a clear purpose
Interaction	Feedback from actions and changing state of play
Outcomes	Successful accomplishment of tasks must yield points of scores
Rules	There must be boundaries of play , limitations and constraints
Safety	The game must not have consequences to real world.
People	Any game must have a player or players

However, all these features above can be jointly combined to make a good educational game that can yield favorable outcomes. The more of these features an activity exhibits the more game like it is considered to be.

### B. Educational games

The inauguration of educational gaming dates back to early 1950s with the incorporation of war-gaming, computer science and operations research. The foremost computer games were designed in the late 1960s and it was not long before computer games were also being developed and used for educational aids [14]. Educational games and gaming simulations have been used for numerous years in the fields of business, training staff in fiscal and economic skills, and in the military for combat training and war-gaming. The medical sector has been effectively and efficiently employing gaming visualisation techniques for several years, for instance through the use of virtual patients, and aircraft pilots regularly use aircraft simulations in the early phases of training [15].

Recent research attempts signify that game designers also have extensive endeavors rendered to Higher Education to explore the use of games to support learning and practice (game based learning) [16], a competitive game to teach programming [17], and virtual reality games used with geography students [18]. However, the evaluation of the regularly used games in game-based learning research signify that existing commercial games are used in teaching perspective, for instance using the Civilization III game to guiding an historical civilization’s evolution from 4000 B.C. to the contemporary era [19] [20] , while others involve the creation of a bespoke game, such as the action and adventure games developed to teach basic literacy skills [21].

[22] , emphasized that games by their very nature are more motivating and educationally effective. In addition, [23] reiterated that, games are more enjoyable medium. Therefore we have to adopt them to our children’s classrooms as tools for learning. [24], added that games strengthen students' knowledge skills and attitudes towards the topics or subjects taught. On the other hand, [25]and [26], reiterate the need of games to be considered within GBL other than motivating or learning. Therefore there is need to embed relevant pedagogies kills in games to make them educational and thus creating strategic GBL platforms that are learner centered such that the real GBL benefits can be realized.

Gamers experience emotions that may impact positively on the learning practice consequently mitigating that games are superlative for learning. These kinds of games can be tamed educational. In addition for some player to be considered emotional at one viewpoint we can conclude that players entirely engaged in that particular activity and hence there is a total obstruction to learning monotony.

In spite of being good for learning, [27] argues that games should be used as adjuncts, not as standalone applications, and must be combined with relevant pedagogies. This means that there is need to test whether it is a noble idea or not to have games blended with the conventional learning practices such that the total benefits can be realized from both

conversional teacher-based if blended with game based learning practice.

Various successful GBL researches have been conducted globally and some have evidence to prove that GBL can be better than traditional teaching methods alone to improve learning and motivation for a wide range of topics which includes. The success in these researches triggered the need to explore more into GBL to discover its relevance in teaching. Integrating educational concepts such as mineral game (MG) where students learnt about cities/towns in Zimbabwe and the minerals found in those cities/towns as well as the distance between them is essential in environment and social studies at primary level. Hence, the research looks into how an integrated educational game, The Mineral Game (MG) can be used as a teaching and learning tool to early childhood learners in Zimbabwe to try to ascertain the essentiality of educational games compared to conventional learning where the majority of students are used to.

## VI. METHODOLOGY

The research uses a case study of 60 primary students in grade 6 from 2 primary schools in Harare, Zimbabwe. The students at this level had learnt some basics about computer usage and computer games at earlier grades. Three aspects from social studies, environmental science and mathematics were used in the design of the game namely minerals and towns in Zimbabwe and their association as well as the concepts of distance between towns, an aspect of mathematics.

### A. Materials and procedure

The Mineral Game (MG) was designed and implemented, to aid primary level students in understanding where certain minerals are found in relation to towns and the distance between them. The game consisted of 30 towns and 12 minerals where a student has to associate mineral to the towns where they are mined. Students are also supposed to determine the distance between the towns using the game. The game has 3 sections: The Learn section, where students learnt about the cities and minerals found in Zimbabwe, The Associate section, where they associate towns and minerals and the Calculate section where they calculate distance between the towns. The game starts with the Learn followed by the Associate then Calculate and scores shown upon completion.

To use and practice the game students were to be assisted by their teachers in one class whilst another class did not use computers for learning but used the traditional conventional classroom learning style for both grade 6 students. The experiment was conducted using the pre and post evaluation statistics were students were tested at first on towns

in Zimbabwe and the minerals found and the distance calculation. The students were then exposed to the game. The results were compared to determine the effect and impact of game based learning as well as the performance with a test written at the end.

### B. Research participants

Two schools located in Harare participated in the study where 60 grade 6 students from 2 schools were taken as the sample. Thirty students from grade 6 class from each school were divided into 2 groups at random, the GBL class and the conventional as shown by table 2 below. The teachers assisted in the learning and a test was applied after a week to determine the students' performance.

TABLE 2: PARTICIPANTS IN THE RESEARCH

School	Classes	Number of Students	Girls	Boys	Learning Platform
Mt Pleasant Junior	GBL	15	8	7	GBL + Teacher
	Conventional	15	10	5	Traditional/Conventional + Teacher
Eastville Junior	GBL	15	7	8	GBL + Teacher
	Conventional	15	6	9	Traditional/Conventional + Teacher
	<b>Total</b>	<b>60</b>	<b>31</b>	<b>29</b>	

## VII. RESULTS

In order to provide a rationale for the results on the similarities of the two environments, the students were tested with the aid of a pretest/posttest method. In this case, set of 30 towns and 12 minerals and the calculation of distances between the towns were used for the pre-test before the game was rendered to the students and a post test after a week of game use. The game was added to one of the two classes per grade. An independent samples t-test was used to determine the descriptive statistics on the scores obtained by all the students in the two tests they conducted after the week. A one way ANOVA analysis was used to determine the significance in the mean scores obtained by the students within the groups. The data collection and analysis techniques used to address these questions are summarised below.

TABLE 3: QUESTIONS, DATA COLLECTIONS AND ANALYSIS

Questions	Data collection	Data analysis
Is there a significant difference in performance and learning between students in GBL plus Teacher vs. Conventional +Teacher?	Pre-test Post-test	T-test Analysis One way ANOVA
Do students appreciate the role and use of GBL in their studies?	Pre-test Post-test	T-test Analysis One way ANOVA

The main objective was to determine the significant difference in learning between the students in each experimental condition. A Pre-test and post-test were used to determine this difference.

A. Study 1: Analysis of the performance of students

**Does an integrated GBL have an effect to students?**

In order to answer this research question, the researchers performed an independent samples t-test on the Learn, Associate and calculate scores obtained by the students who were exposed to GBL plus Teacher and those who have conventional teacher alone.

The independent t-test on the sample yielded the following descriptive group statistics for the all grade 6 students who participated in the research. The table below shows their' mean test score in the pre-test and post-test for the Teacher plus GBL and Teacher only learning platforms.

TABLE 4: ONE WAY ANOVA ON TEST SCORES

		Sum of Squares	Df	Mean Square	F	Sig.
Pre-Test	Between Groups	3.788	1	3.788	.027	.871
	Within Groups	2791.667	20	139.583		
	Total	2795.455	21			
Post-Test	Between Groups	1324.583	1	1324.583	6.364	.020
	Within Groups	4162.917	20	208.146		
	Total	5487.500	21			

The figure below is a chart that illustrates the summary of the mean test scores obtained by the students after conducting both the tests.

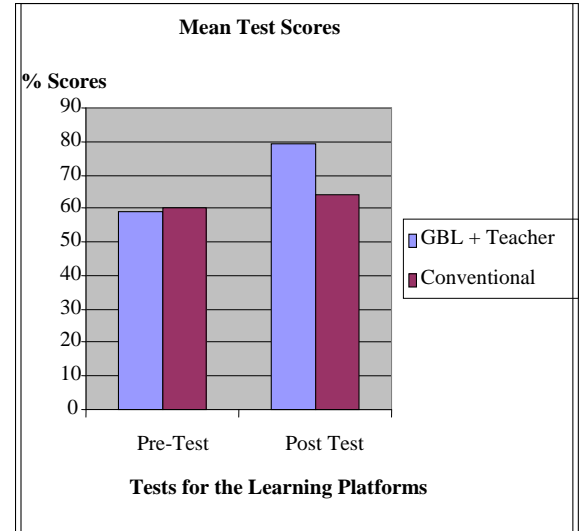


Figure 1: Mean test scores

A One Way ANOVA on both the tests taken by the students who participated in both learning platforms yields the following statistics at 95% level of significance.

TABLE 5: GROUP STATISTICS

	Learning Platform	N	Mean	Std. Deviation	Std. Error Mean
Pre-Test	GBL plus Teacher	30	59.1667	11.24790	3.24699
	Teacher	30	60.0000	12.47219	3.94405
Post Test	GBL plus Teacher	30	79.5833	15.87713	4.58333
	Teacher	30	64.0000	12.42757	3.92994

**Analysis of the independent variables between two Groups**

The results for the independent variables on the two groups were collected and analysed.

Although, age and gender are important factors, the study showed no difference. Even with gender, there were no disparities with the groups mainly because they shared the same characteristics and dimensions to learning although more females enrolled than males. An analysis on the mean scores between genders showed no significance difference with *p* value greater than 0.005 in all cases.

B. Study 2, Research Question 2

**Is there a significant difference in academic achievement between the two groups and sexes?**

In order to answer this research question a an independent-test was conducted on all the student classes that were exposed to GBL and the conventional learning practice to determine the significance in gender performance in as far as game based learning is concerned.

TABLE 6: MALE AND FEMALE GROUP STATISTICS

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Pre-Test	Female	31	63.0000	9.74679	4.35890
	Male	29	56.4286	12.14986	4.59221
Post-Test	Female	31	83.0000	12.04159	5.38516
	Male	29	77.1429	18.67644	7.05903

The figure below illustrates the summary of the mean test scores obtained by both male and female participants from in the research.

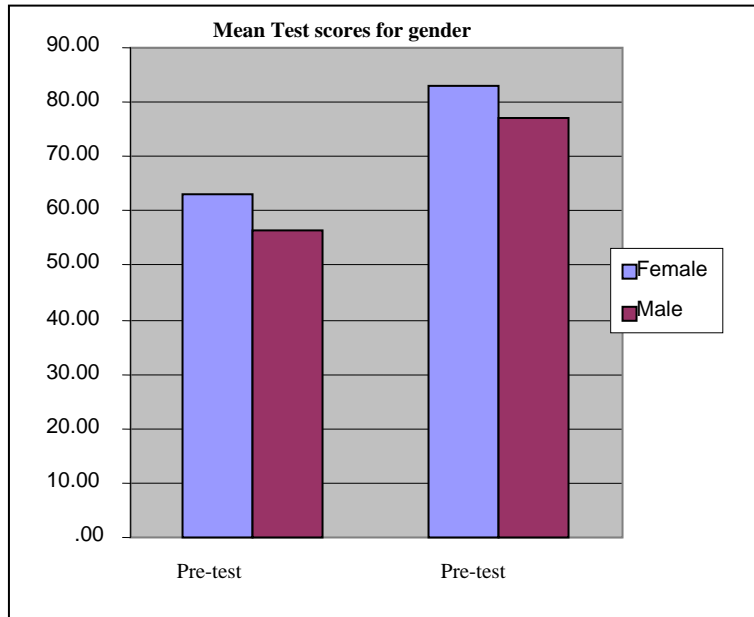


Figure 2: Mean test scores for male and female

A One Way ANOVA on both the tests conducted by the students who participated in both learning platforms yields the following statistics for the male and female groups.

TABLE 7: ONE WAY ANOVA FOR MALE AND FEMALE TEST SCORES

		Sum of Squares	df	Mean Square	F	Sig.
Pre-Test	Between Groups	125.952	1	125.952	.995	.342
	Within Groups	1265.714	10	126.571		
	Total	1391.667	11			
Post-Test	Between Groups	100.060	1	100.060	.374	.554
	Within Groups	2672.857	10	267.286		
	Total	2772.917	11			

VIII. FINDINGS AND DISCUSSIONS

Analysis of the results indicates that an integrated game based learning really work and leads to positive improvements in the children’s performance. This is illustrated by the results from study 1, which is an analysis of the mean test scores obtained by the students in the pre-test and post-test they conducted. Figure 1 illustrates the similarity of the means scores of the study when they sat for the pre-test. The figures shows that the students under GBL plus a teacher and those with the Conventional teacher only learning platform where equally the same in as far as their performance is concerned before introduction of the game. However the same figures show a difference in the mean scores of the group after a post-test was written. The students recorded a positive gain of 20.41% in their mean score for the GBL plus a teacher learning platform as compared to a positive gain of 4.0% in the mean scores for the teacher only learning platform. The results indicate that the students can also benefit from the use of games in their learning.

A one way ANOVA on the test scores obtained by the students, indicated sig. value of  $p= 0.871$  between the groups in pre-test and  $p=0.02$  between the groups at post-test at 95% level of significance. Since a  $p$  value of  $0.871$  is by far greater than  $0.05$  then we can conclude that the students were equally the same before the experiment. The  $p$  value of  $0.02$  obtained for the post-test scores is less than  $0.05$  which means that the initial hypothesis must be rejected which means that GBL has an effect on students’ performance if added to conventional learning. The effect is actually a positive effect supported by a 20.41% gain in the mean test scores for the students’ scores. If we assume that the teachers follow their syllabus normally, we could conclude a contribution of 16.41% gain in the mean score for students to be attributed to GBL.

Comparison of gender indicated that there was no difference in performance which can be attributed to gender

advantage or disadvantage. This may have been caused by the fact that play is part of children's development and thus boys and girls turn to exhibit comparable behaviour at early stages while difference accrue as girls mature faster than boys.

## IX. CONCLUSION AND RECOMMENDATIONS

The design and implementation of an integrated GBL platform (MG) was successful. It was noted that students' motivation determines, directs and sustains what they do to learn. In addition the positive gap between GBL students and conventional students indicated that the digital generation that makes up a large part of today's children is notoriously unmoved by traditional lessons and teacher-based training approaches. The students/ players tend to be highly motivated by in-game feedback such as scores and evaluations. In the process and sometimes without consciously realizing it, they learn how to operate within the game environment; experiment and learn how to safely accomplish their work; and practice their lessons learned to develop consistent and productive thought processes. However we can conclude that the best way to make our students enjoy learning, feel comfortable with learning, be motivated, actively think, experiment and learn how to safely accomplish their work, and practice their lessons learned to develop consistent and productive thought processes, is by using GBL.

By using such computer games, students become more effective learners and thinkers, allowing them to make connections across their curriculum. Concentration improved as students played for long hours trying to master the game. The computer game training provides a practical adjunct to traditional teacher learning platform.

The authors recommend the design and implementation of similar integrated GBL projects that covers various aspects of student learning and integrate with the student background. The GBL must be structured in how pupils learn and attention must be rendered to the pedagogical skills embedded in the GBL tool.

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