Gamification: A Collaborative Escape Environment Assessment Tool in Science

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ABSTRACT

This study seeks to find out the effectiveness of Gamification on the performance of grade 7 learners in Science. It aims to find out the significant difference on the prettest scores in Science of the learners when grouped to Gamification Paper and Pen Assessment Tool; find out the significant difference on the posttest scores in Science of the learners when exposed to Gamification: find out the significant difference on the pretest scores in Science of the learners when exposed to Gamification and Traditional Paper and Pen Assessment; and find out the significant difference on the posttest scores in Science of the learners when exposed to Gamification and traditional Paper and Pen Assessment Tool. Twenty-five (25) randomly selected grade 7 learners from section Goodness were exposed to Gamification and twenty-five (25) randomly selected grade 7 learners from section Gentlesness were exposed to Paper and Pen Assessment Tool. These learners were enrolled in Immanuel Mission International School S.Y 2022-2023. The study used a true experimental design, random assignment to form the experimental and control group, and the randomized pretest-posttest control group design. The study utilized pretest and posttest questionnaire. Data gathered were analyzed through percentage, mean, t-test and paired t-test. Most of the learners in both experimental group and control group got pretest scores that ranges from 0 to 17 which means did not meet the expectation. The mean posttest score for the experimental group is 20.23 while the control group obtained a mean posttest score of 12.97. T-test. This study concluded that Gamification can improve the learners' performance in Science and enhances learners' performance when it is used appropriately and correctly. Related study can be explored using Gamification: A Collaborative Escape Environment Assessment tool in other disciplines.

INTRODUCTION

Education and teaching in the modern days are moving toward a learner-centered approach and skill development, where a teacher guides students through the learning process, lets the learners move at their own pace and taking into account how each student learns.In order to improve the overall quality of learning that is accomplished, various games,digital technologies, and learning paradigms are frequently included into educational settings(Videnovik Multimed tools Appl, 2020) and transforms the way in which the evaluation process was developed, providing adaptation tools and access to information resources for students to demonstrate their learning, and to take ownership of immediate feedback. The gamification also organizes data about student learning, providing more

efficient, accurate and timely information for teachers, parents, administrators, and public policy makers in education (Darling-Hammond, 2010)

The term "gamification" refers to the use of gaming mechanics in serious settings, such as the classroom (Deterding and others 2011). The goal of gamification is to employ game mechanics to make ordinary lesson more fun and rewarding (Lister, 2015). Manzano-León and others' comprehensive review shows that students' motivation, performance, and commitment (engagement) may all be improved with the use of gamification. Popular gamification features in the classroom include leaderboards, avatars, and stories(Kapp, 2012). Students can benefit from pedagogical intervention when it is implemented through gamification since it is a fun, creative, and challenging way to learn. It encourages extrinsic motivation via incentives, with the goal of fostering intrinsic motivation via dedication to the job at hand and total absorption (Buckley,2016). There is evidence from a variety of studies and classroom experiences that gamification may be used to increase student engagement, productivity, and motivation by encouraging students to think critically and creatively. Furthermore, Harris-Reeves 2019 stated that a positive attitude towards learning, an interest in knowing their own training, the student's autonomy, a dedication to the educational act, a dedication to teaching by teachers and a dedication to learning by students, feelings of attraction, enjoyment, the absence of negative feelings, and satisfaction at facing the task.

There are several applications for gamification. Using Collaborative Escape Environment/Room Assessment tool is one of them (Lopez-Belmonte and others, 2020). In this context, given the goal of using educational games to support learning in school environments (and others), it is necessary to ensure that assessments are valid, reliable and also practically invisible (to keep the engagement intact). During the game, students naturally produce rich sequences of actions while performing complex tasks based on their own abilities or skills that we want to evaluate (for example, scientific research skills, problem-solving). Elements necessary to assess the skills is thus provided by the interaction of the players with the game itself (i.e. running processes), which may be contrasted with the product (s) of an activity–the standard in educational environments (Shute and Ke, 2012). In an Collaborative Escape Environment/Room Assessment, participants (learners) are trapped in a room and tasked with solving a series of puzzles and riddles in order to unlock the exit. Hence, the game's design lends credence to this strategy by requiring players to complete a series of test that require them to demonstrate their ability to independently manage and collaboratively disseminate their information. Students become more engaged as a result, helping to find solutions to the aforementioned difficulties (García ,2019). Many research on the efficacy of Collaborative Escape Environment/Room Assessment in the classroom provide us encouraging findings for their use in a variety of settings (Ouariachi , 2020). As a result, using it enhances all the gamification metrics that have been previously shown. Specifically, it increases students' involvement and participation in the teaching, learning and evaluation process, boosts their happiness with and attractiveness to learning, and presupposes stronger absorption and reinforcement of the knowledge (Hursen and others, 2019). None of this can help but improve the student's ability to retain information, which in turn boosts the student's academic performance and grade (Kinio and others, 2019) All of this is a result of the learning environment, and it has a profoundly positive effect on student mindsets, group work, and individual practice (Jambhekar, KPahls, and Deloney 2020). This also serves to provide teachers with formative and summative assessment to guide instruction (Kagan, 2020) Thus, this study aims to design, develop, implement and evaluate the

collaborative escape room or environment in learning Science of Immanuel Mission International School for the SY 2022-2023.

STATEMENT OF THE PROBLEM

This study aims to analyze the effectiveness of the use of educational Gamification in assessing students' performance in Science as compared to the traditional paper and pen assessment tool.
This study seeks to find out the following questions:

1. What is the pretest scores in Science of the students when grouped to:
a. Gamification: A Collaborative Escape Environment Assessment tool in Science
b. Paper and Pen Assessment

2. What is the posttest scores in Science of the students when group to:
a. Gamification: A Collaborative Escape Environment Assessment tool in Science
b. Paper and Pen Assessment tool

3. Is there a significant difference between the pretest scores in Science of the students when assessed to Gamification: Collaborative Escape Environment in learning Science and Traditional Paper and Pen Assessment tool?

4. Is there a significant difference between the posttest scores in Science of the students when assessed to Gamification: Collaborative Escape Environment in learning Science and Traditional Paper and Pen Assessment tool?

METHODOLOGY

Research design

The study used the true experimental research design, pretest-posttest control group design. Random assignment was used to form the experimental group and control group. Two sections were used, with one section as the experimental group which was assessed using Gamification: Collaborative Escape Environment and the other section as the control group which was assessed using Traditional Paper and Pen. The performance of the learners was measured through giving of pretest before the conduct of the study and posttest after the implementation of the study. A diagram of this design is shown below.

Gamification: Collaborative Escape Environment Assessment tool (experimental group)	R	O(1)	X	O(2)
Paper and Pen Assessment tool (control group)	R	O(3)		O(4)

where:

    R refers to the random assignment of the group
O(1) refers to the observation on the pretest scores of the experimental group
O(2) refers to the observation on the posttest scores of the experimental group

O(3) refers to the observation on the pretest scores of the control group
O(4) refers to the observation on the posttest scores of the control group
  X refers to the experimental group

SUBJECT OF THE STUDY

The subject of the study were the grade 7 learners of Immanuel Mission International School, Dagong Carmen Cagayan de Oro City enrolled during the S.Y. 2022-2023. The school has three (3) heterogenous grade 7 sections, where in two sections were randomly selected. These two (2) sections were also ramdomly assigned to experimental and control group. There were twenty-five (25) ramdomly selected learners in each sections. In this study, section Goodness was assessed using Gamification: Collaborative Escape Environment Assessment tool and section Gentleness to traditional Paper and Pen assessment. Immanuel Mission International School is located at Dagong Carmen, Cagayan de Oro City.

DATA GATHERING PROCEDURE

Permission to conduct the study was secured in advance by the researcher to the school principal. The researcher also asked permission from the Science teacher of sections Goodness and Gentleness to conduct the study and asked for the topics in the fourth grading period. Section Goodness was assessed using Gamification while section Gentleness was was assessed using Paper and Pen Test. The pretest was administered to both groups before the lecture phase. This was followed by the determination of the pretest scores. In the three-day implementation of the lecture phase, each topic was presented to the experimental and control group. The same administration was done in the experimental and control group during the second and third day.The topics presented in both groups were location of the Philippines on earth using the geographic coordinate system; interactions in the Atmosphere; and seasons in the Philippines.

After the implementation of the lesson, the conduct of the posttest using gamification was administered in the experimental group the entire class was separated into groups of 5 students. Until that day, the students are not informed that they would be assessed with gamification, and the escape environment gamification was a large surprise. These rooms were thematically decorated with books, posters, photographs, and materials related to the challenges of the escape environment. In each of the classrooms, the students of each team is "locked up" with all of the material necessary to carry out the activity, and was prevented from contacting the other team. Before the start of the assessment, the teacher explained the rules necessary to perform the gamification. On the same day the traditional paper and pen assessment tool was administered to the control group. Data were organized and analyzed through percentage, mean, t-test and paired t-test.

INSTRUMENT USED IN THE STUDY

The study used three (3) lesson plans for experimental group and three (3) lesson plans for the control group on the following topics:1. Location of the Philippines on Earth using the geographic coordinate system; 2. Interactions in the Atmosphere; and 3. Seasons in the Philippines.

A 30-item multiple choice pretest questionnaire was constructed and was administered before the conduct of the study to assess prior knowledge of the pupils. This study utilized a table of specification (TOS) for the pretest questionnaire to ensure validity of the test of the topics included in this study. Posttest questionnaire was constructed containing the same test items as the pretest but arranged differently to test the learners' performance after the presentation of the topics. Another table of specification (TOS) was constructed for the posttest questionnaire. Both questionnaires were taken from grade 7 Spiral Science teacher's guide, learner's material and textbooks.

The learners' performance was categorized into outstanding, very satisfactory, satisfactory, fairly satisfactory, and did not meet expectation. The minimum competency, which is considered as passing score in this study, is 60% based on the grading system designed by the Department of Education. This is best shown in the table below.

Table 1. Scoring assessment and its descriptor

Score	Descriptor
27 – 30	Outstanding
24 – 26	Very Satisfactory
21 – 23	Satisfactory
18 - 20	Fairly Satisfactory
0 - 17	Did Not Meet Expectation

Data analysis

The following statistical tools were used to analyze and interpret the data in the study.

1. **Percentage**

Percentage was used to present the performance of the learners in Science of the two groups.

$$\% = \frac{fi}{n} \times 100$$

where:

fi is the frequency of ith response

n is the total number of response

2. **Mean** gave the summary responses of the pupils.

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

where:

$\bar{x}$ is the mean

x_i is the different value in ith terms

n is the number of sample

3. **T-test**

T-test was used to find out the difference on the pretest scores and posttest scores of the two groups.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

where:

$\bar{x}_1$ is the mean of control group

$\bar{x}_2$ is the mean of experimental group

S_1 is the standard deviation of control group

S_2 is the standard deviation of experimental group

n_1 is the total number of control group

n_2 is the total number of experimental group

4. Paired t-test

Paired t-test was used to identify the difference of the pretest and posttest scores of the two groups.

$$t = \frac{\bar{d}}{\sqrt{s^2/n}}$$

where:

$\bar{d}$ is the mean difference

s^2 is the sample variance

n is the sample size

t is a student's t quantile with n-1 degree of freedom

RESULTS AND DISCUSSION

Pretest score in Science when grouped to Gamification: A Collaborative Escape Environment Assessment toolandPaper and Pen Assessment tool

Figure 1 shows the percentage distribution on the learners' pretest score in Science when grouped to Gamification and and Traditional Paper and Pen Assessment tool. The Experimental group resulted to One-hundred percent (100%) or 25 out of 25learners have scores that ranges from 0 to 17 which means did not meet the expectation. Same result with the control group, exposed to traditional Paper and Pen Assessment tool. One hundred percent (100%) or 25 out of 25learners have scores that ranges from 0 to 17 which means that did not meet the expectation.Based on the result, it means that all learners that have taken the pretest find it difficult for the reason that they have taken the pretest without any background knowledge of the topics included in the pretest. The pretest was given to the learners at the beginning of the research where the learners had poor level of proficiency (Honarmand, Rostampour and Abdorahimzadeh, 2015). This is consistent with the study of Lindsey Richland, 2009 entitled "The Pretest in Effect: Do Unsuccessful Retrieval Attempts Enhance Learning"

Figure 1. Percentage distribution on the learners' pretest score in Science when grouped to Gamification and Traditional Paper and Pen Assessment tool

Posttest score in Science when grouped to Gamification and Paper and Pen Assessment tool

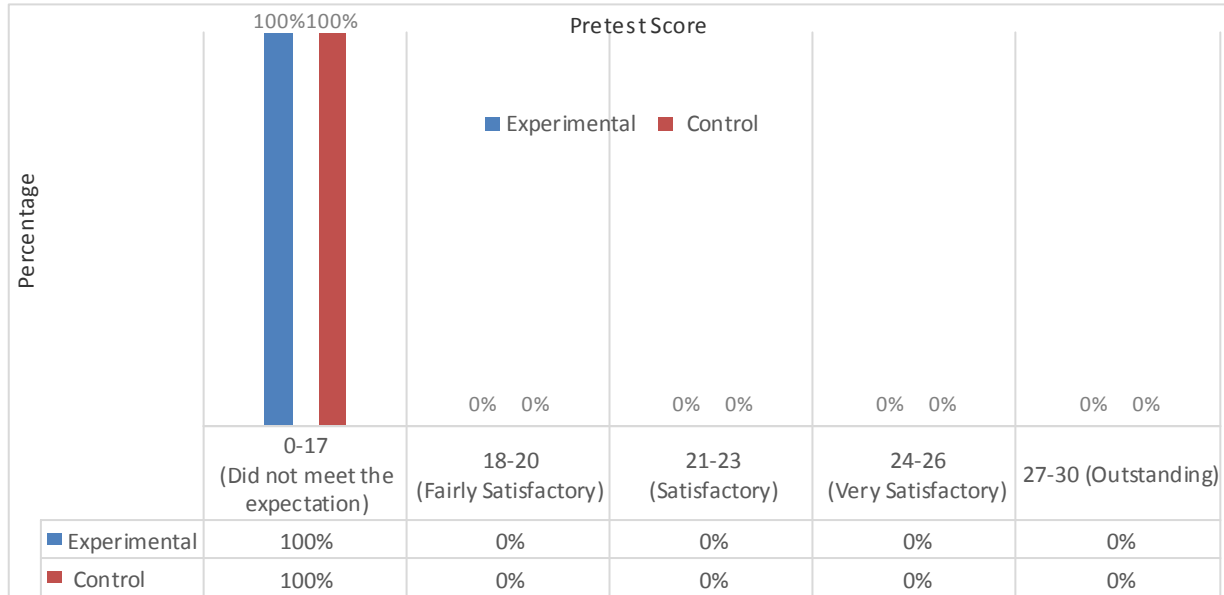|	0-17 (Did not meet the expectation)	18-20 (Fairly Satisfactory)	21-23 (Satisfactory)	24-26 (Very Satisfactory)	27-30 (Outstanding)
Experimental	100%	0%	0%	0%	0%
Control	100%	0%	0%	0%	0%

Figure 2 presents the percentage distribution on the learners' posttest score in Science when exposed to Gamification and Traditional Paper and Pen Assessment tool. Experimental group shows that twenty percent (20%) or 5 out of 25 learners have scores that ranges from 0 to 17 which means did not meet the expectation, forty percent (40%) or 10 out of 25learners have scores that ranges from 18 to 20 which means fairly satisfactory, thirteen percent (13%) or 4 out of 25 learners have scores that ranges from 21 to 23 which means satisfactory and twenty-seven percent (27%) or 7 out of 25learners have scores that ranges from 24 to 26 which means very satisfactory. On the other hand, the percentage distribution on the learners' posttest score in Science when exposed to Paper and Pen Assessment tool. Ninety percent (90%) or 23 out of 25learners have scores that ranges from 0 to 17 which means did not meet the expectation and ten percent (10%) or 3 out of 25 learners have scores that ranges from 18 to 20 which means fairly satisfactory. Forty percent (40%) or 10 out of 25 learnersexposed to Gamification: A Collaborative Escape Environment Assessment tool have posttest scores that ranges from 18 to 20 which means fairly satisfactory; thirteen percent (13%) or 4 out of 25learnershave scores that ranges from 21 to 23 which means satisfactory; and twenty-seven percent (27%) or 7 out of 25learnershave scores that ranges from 24 to 26 which means very satisfactory. This implies that assessing with gamification, the majority of the learners' performance in Science had improved. As a support for this result, study showed learners in gamification condition significantly outperformed learners in the traditional pen and paper assessment (Boon, Burke and Fore, 2006). Also, the results of study by Plass, J.L., B.D. Homer, and C.K. Kinzer 2015 indicated significant positive effects favouring gamification. Piaget believed that as children grow older, they look at the world through different experiences, and that children have completely different perspectives than adults (Robinson, 2004). Piaget (1980) stated that, when knowledge is constructed within oneself, it is examined against what is happening in the real world in much the same way that a scientific idea is tested. Gamification: A Collaborative Escape Environment Assessment tool gives the

learnersnew venues to express themselves, practice self-control, learn in different ways and master and retain the lesson they have learned (Kagan, 1994).

Bruner (1960) claims that Piaget research on cognitive development suggest that if cognitive development is most important for teaching basic concepts, children should helped to pass progressively from concrete thinking to the utilization of more conceptually adequate modes of thought.

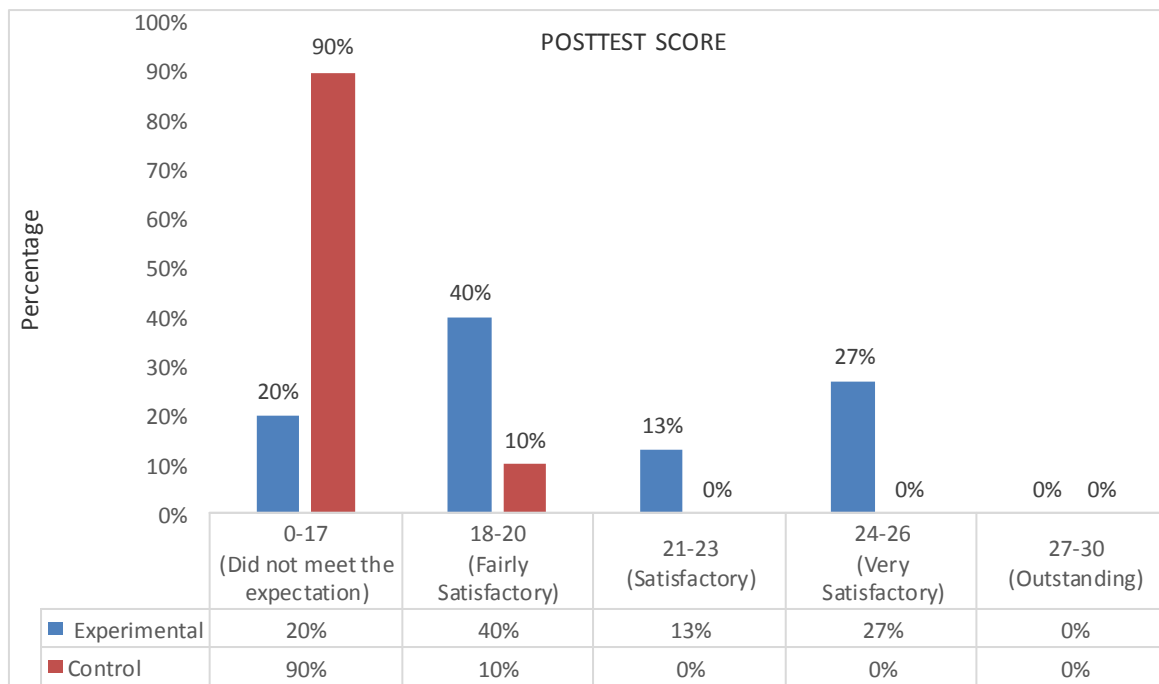|	0-17 (Did not meet the expectation)	18-20 (Fairly Satisfactory)	21-23 (Satisfactory)	24-26 (Very Satisfactory)	27-30 (Outstanding)
Experimental	20%	40%	13%	27%	0%
Control	90%	10%	0%	0%	0%

Figure 2. Percentage distribution on the learners' posttest score in Science when exposed to Gamification: A Collaborative Escape Environment Assessment tool

Difference on the learners' pretest scores in Science when grouped to Gamification: A Collaborative Escape Environment Assessment tool and Paper and Pen Assessment tool

Table 2 shows the t-test result showing the difference between the pretest scores in Science of the learners grouped to Gamification: Collaborative Escape Environment Assessment tool and the pretest scores of the learners grouped to Paper and Pen Assessment tool. It reveals no significant difference on the pretest scores in Science of the learners when grouped to Gamification: Collaborative Escape Environment Assessment tool and Paper and Pen Assessment tool with mean scores of 7.17 and 7.00 respectively. The mean difference of the pretest scores is 0.17 with t-value of 0.32 and p-value of 7.49E-01 which is greater than the p-value of 0.05 level of significance. This means that the prior knowledge of the learnersof both group are the same. Today's teacher knows that the ways in which learners learn vary greatly. Individual learners have particular strengths and weaknesses which can be built upon and enhanced through effective instruction. The main focus of educative process is to improve the performance or learning of the learners. The learning outcomes of the learners are measured with the help of their achievement or performance. Performance assessment is the process of measuring the terminal behaviors of the learners at the end of instruction. It is the job of the

teacher to measure whether the learnershave acquired the component concepts, as on achievement, before proceeding with the instruction which arranges these concepts in proper relationship for the learning of the principles. (Sharma and Neetu, 2011).

Table 2. T-test result showing the difference on the learners' pretest scores in Science of the two groups

Variable	Mean Score	Mean Diff.	t-value	p-value	Remarks
Pretest Gamification: Collaborative Escape Environment Assessment tool	7.17				
		0.17	0.32	7.49E-01	Not Significant
Paper and Pen Assessment tool	7.00				

p< 0.05* level of significance

Difference on the learners' posttest scores in Science when exposed to Gamification and Paper and Pen Assessment tool

Table 3 displays the t-test result showing the difference between the posttest scores in Science of the learners exposed to Gamification and the posttest scores of the learners exposed to Paper and Pen Assessment tool. The data shows a significant difference on the posttest scores in Science when exposed to Gamification and Paper and Pen Assessment tool with mean scores of 20.23 and 12.97 respectively. The mean difference of the pretest scores is 7.26 with t-value of 8.48 and p-value of 9.53E-12 which is lesser than the p-value of 0.05 level of significance. As a support to this result, learners who were assesed using gamification performed significantly better on the recall of science concept and text material as a transfer measure than learners who received the traditional paper and pen assessment (Griffin and Tulbert, 1995). Spiegel and Barufaldi (1994) suggested that self-regulated learning strategies with active involvement of the learners and collaborative work should be introduced instead of the passive ones. Learners need to actively work to fill in and complete the task for them to be effective. The theoretical perspective of this study was the constructivist theory of learning, Learners use what they already know to make connections to new material. When learners make these connections, they are learning new material and relating it to what they already know (Dewey, 1916).

Table 3. T-test result showing the difference on the learners' posttest scores in Science of the two groups

Variable	Mean Score	Mean Diff.	t-value	p-value	Remarks
Posttest					
Gamification: Collaborative Escape Environment Assessment tool	20.23				
		7.26	8.48	9.53E-12	Significant
Paper and Pen Assessment tool	12.97				

p< 0.05* level of significance

IMPLICATION

1. The result implies that Gamification: A Collaborative Escape Environment Assessment tool can improve learners' performance in Science when it is used appropriately and correctly.

2. The result also implies that assessingGamification: A Collaborative Escape Environment Assessment tool allowed more achievements of the learners to occur than Paper and Pen assessment tool.

3. A study can also be conducted using Gamification: A Collaborative Escape Environment Assessment toolby having other intervening variables like different grade levels and learners' condition or combination of teaching-learning tool,strategy and other form of gamification with scoring rubric.

4. For the researchers who intended to have similar to this study, it should be conducted with at least five topics in Science with more participants to get more reliable results. The mastery of the teacher is required so that learners can get used of this learning tool.

5. Related study can be explored using Gamification: A Collaborative Escape Environment Assessment toolin other subject areas like English, Mathematics, Araling Panlipunan and Filipino.

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