MULTIPLE INNOVATIVE EXPERIENTIAL GAMING LITERACY: AN APPROACH IN ACADEMIC PERFORMANCE IN PHYSICS OF SCIENCE 7

MARIA EVA E. DIONGCO, ED. D.
SANTA ISABEL MERCADO
MARIE ANN S. GONZALES

Laguna State Polytechnic University
Sta. Cruz Campus, Sta. Cruz, Laguna, Philippines

Abstract: The purpose of this study was to determine the effect of multiple innovative games – based learning with the use of different games to 150 grade 7 students in physics using quasi – experimental method of San Francisco Integrated National High School. A checklist – questionnaire method and mastery test for pre-test and post-test were utilized in order to reveal the effectiveness of the treatments. The three sections of grade 7used different innovative games such as Dice and Side game, Bingo card game, and Wheel of Knows game. All groups were taught at the same time by the same teacher except for the use of the innovative game tool. The academic performance was measured in terms of mean percentage score (MPS). The MPS of the students in both pretest and posttest is below 75%. Although, the MPS is lower than 75% in both tests, each group obtained a positive differential between the posttest and pretest. Further, students who have an *"Excellent"* level of literacy in Bingo have the highest mean differential between their pretest and posttest (mean differential = 26.3). Based on the results of the study it was found that there is significant difference in the level of performance in physics in terms of pre-test and post –test. The hypothesis stating that there is significant difference between scores of the pre-test and post-test in the performance of the students when using the Innovative Experiential Gaming Literacy of Grade 7 in Physics is accepted. The following recommendations are given; teachers must use the multi-player gaming environment to provide virtual collaboration opportunities in their problem-solving abilities. Due to its positive effect in students learning, the principals, parents, and supervisors are encouraged to provide help and support on the use of the approach for the improvement of student's academic performance.

Keywords: gaming literacy, Dice and Side, Wheel of Knows and Bingo

Introduction

Education is of great value as it is the main ingredient to achieve social and economic success. Educators have been increasingly incorporating various games into their teaching curriculum in an effort to create fun and engaging learning environment for students. One of the teaching methods that can help the learners become active during discussion is gaming literacy, an approach based on game design. Although this can be very challenging and time consuming; competitive games tend to motivate and encourage student participation in the learning process. There are many more options that incorporate the use of technology and interactivity. Pannesse & Carlesi, (2007) and Gros (2007) stated that students need to be more engaged and be put at the center of the learning experience to change from 'passive vessel' to 'active participant'. Gaming literacy is the ability to understand and create specific kinds of meanings. It is based on three concepts: systems, play, and design. All three are closely tied to game design, and each represents kinds of literacy that are currently not being addressed through traditional education.

Review of Related Literature

Games provide real-world experiences in which players are immersed in a complex problem – solving tasks allowing proactive players on the real-world situation thus making learners become independent. Game –based learning approach coincides with active learning pedagogy and a variety of teaching methods. Using educational games as a classroom activity has been found to be a positive interactive method of teaching information. It promotes authentic learning wherein students are allowed to discover process and finally apply the new information gained Wu et. al. (2012). Gaming literacy is certainly one promising approach, making use of a cultural form that is wildly varied and popular which is strikingly contemporary but intrinsically playful (Zimmerman 2013).

The use of gamification have a significant effect on the achievement of students in Physics but more rigorous studies should be done before further investigate the benefits as well as risks of the use of gamification in learning Physics (Tolentino and Roleda (2017). It was supported by Liu et.al. (2014) that game based learning environment has a greater impact on content learning gains that adhere to a particular sequence of problem – solving steps; that if the teacher has the capacity to implement it inside the classroom it can be an effective tool in teaching science most specifically in Physics.

Another study by Tabago (2014) proved the effectiveness of game-based learning approach; that

there is a significant difference between the pre and post achievement scores of the students and a positive feedback towards physics also drawn from them. The Pinoy –game based activities affirmed the worth and advantage as instructional material in teaching concepts of work, power, energy and enhancing students' achievement and interest towards physics.

A collateral study by Ely, (2015) pointed out that baseline knowledge has a strong influence on the pre-test performance of learners thus it can be contributed on the mean score result of the test and can also be cited to support the pre-test score of the students. It provides preliminary data on Experiential Gaming Literacy and the performance of the students. It also gives insight on how the students perform during the games.

BINGO has been applied to chemistry education for matching element names to symbols and compound names to formulas. Nomenclature BINGO can allow a bit of fun while providing instruction and practice. The game also provides a nonthreatening opportunity for feedback to the instructor on the students' weaker areas.

"Jawi Snakes and Ladders game" is an educational game developed specially for primary students in Malaysia. It became a teaching tool for the teachers and can be used as individual learning tool to learn. The game captures the student's interest to learn Jawi and students can use this application as one of their computer game. This game could be played individually or in pair Hairul et. al. (2010).

Board games are excellent tools for teaching fundamental and core educational skills. It is very useful in the manner of delivering the message of the lesson done by the teacher (Hinebaugh, 2009). In addition, there are many positive outcomes that can be seen after several activities have been carried out in the classrooms Tengku et. al. (2012), Fulton (2007).

Palaoag et. al. (2016) attempted to determine the wheel-spinning behavior among students using an educational game for physics. 30 to 40 % of students failed to successfully complete a level when attempting it 8 times or more, or when working on it for more than 160 s.

Generally, literature in the game-based context reflects similar understanding of the phenomenon that the challenge in games may drive a players' sense of flow and engagement (Wang & Chen, 2010; Hwang, Wu, & Chen, 2012).

The use of gamification has a significant effect on the achievement of students in Physics but more rigorous studies should be done before further investigate the benefits as well as risks of the use of gamification in learning Physics as supported by (Tolentino and Roleda (2017), Yien et. al. (2011) and Lin et. al. (2013). In addition, game based learning environment has a greater impact on content learning gains that adhere to a particular sequence of problem – solving steps; that if the teacher has the capacity to implement it inside the classroom it can be an effective tool in teaching science most specifically in Physics.

Another study by Tabago (2014) proved the effectiveness of game-based learning approach; that there is a significant difference between the pre and post achievement scores of the students and a positive feedback towards physics also drawn from them. The Pinoy –game based activities affirmed the worth and advantage as instructional material in teaching concepts of work, power, energy and enhancing students' achievement and interest towards physics.

Teaching science to diverse learners require a variety of techniques to cater their needs. With this in mind, effective teaching strategies must be enhanced to offer students with all ideas, activities thought provoking question, experiments and demonstration about the lesson in a more efficient and effective way. Teaching methods represents combination of certain specific procedures or operation such as carefully developed question sequences, grouped and ordered in definite sequence as stated by McGuinness (2005) and Orlik (2012).

The game environment becomes exceedingly motivating as described by Goldstein (2015). Players normally begin playing as a result of a personal choice thus; they do not need any type of exterior power that would entice them to initiate this activity. In the study conducted by Huizenga et. al.(2009), engagement, motivation and learning in a mobile city game pupils who played the game were found to be engaged and to gain significantly more knowledge about the subject matter than those pupils who received regular project-based instruction.

Methodology:

The study utilized quasi – experimental method design. A total of 150 respondents were used in this study consisting of 3 sections grade 7 physics students. A validated self-made pre A test/post A test question was used tested using Cronbach alpha. A five-point Likert scale with the following verbal interpretations as follows: 5(highly accepted), 4(accepted), 3(moderately accepted), 2(slightly accepted), and 1(not accepted). Statistical tools such as mean, standard deviation,
MPS (mean percentage score) were applied to present the data and T-test, F-test and Bayes factor were used to answer the inferential questions.

Results and Discussion

Table 1. Level of Multiple Innovative Experiential Gaming Literacy in terms of familiarization in Dice and Side.

Legend:

Scale	Range	Remarks	Verbal Interpretation
5	4.21 - 5.00	Strongly Agree (SA)	Very High
4	3.41 - 4.20	Moderately Agree (MA)	High
3	2.61 - 3.40	Accepted (A)	Moderately High
2	1.81 - 2.60	Slightly Accepted (SA)	Low
1	1.00 - 1.80	Not Accepted (NA)	Very Low

The students were very pleased with the game, they responded high or moderately agree in all statement of a survey which are reinforce understanding of subject- specific terminology with a focus on students internalizing key concepts, concepts and pictures are appropriate to the level of the students, emphasizes student's engagement and higher level thinking skills, increase student's problem solving and sets mood of the class wherein fun and focus is harmonious. It shows that the students enjoyed the Dice and Side game after the lesson as a form of assessment. The level of Multiple Innovative Experiential Gaming Literacy in terms of familiarization in Dice and Side of the students has an interpretation of High which implied that the teachers find dice and side to increase students' cooperation and problem solving skills.

Table 2. Level of Multiple Innovative Experiential Gaming Literacy in terms of familiarization in Bingo.

Indicative Statement	Students			Teachers		
	Mean	SD	Remarks	Mean	SD	Remarks
1. Reinforce understanding of subject-specific terminology with a focus on students internalizing key concepts.	4.60	0.68	SA	4.20	0.79	MA
2. Concepts and pictures are appropriate to the level of the students.	4.59	0.79	SA	4.20	0.63	MA
3. Emphasizes student's engagement and higher level thinking skills.	4.39	0.79	SA	4.10	0.74	MA
4. Increase students' cooperation and problem solving skills.	4.06	0.92	MA	4.40	0.70	SA
5. Sets the mood of the class wherein fun and focus is harmonious.	4.39	1.00	SA	4.20	0.92	MA
Grand Mean	4.41	0.86	SA	4.22	0.74	SA
Verbal Interpretation	Very High			Very High		

Indicative Statement	Students			Teachers		
	Mean	SD	Remarks	Mean	SD	Remarks
5. Sets the mood of the class wherein fun and focus is harmonious.	3.71	0.94	MA	4.70	0.48	SA
Grand Mean	3.55	0.99	MA	4.30 4.58	0.26	SA
2. Concepts and pictures are appropriate to the level of the students.	3.55	0.91	MA	4.57	0.41	SA
Verbal Interpretation	Very High			Very High		
3. Emphasizes student's engagement and higher level thinking skills.	3.84	1.07	MA	4.70	0.48	SA
4. Increase students' cooperation and problem solving skills.	3.71	1.00	MA	4.70	0.67	SA

Legend:

Scale	Range	Remarks	Verbal Interpretation
5	4.21 - 5.00	Strongly Agree (SA)	Very High
4	3.41 - 4.20	Moderately Agree (MA)	High
3	2.61 - 3.40	Accepted (A)	Moderately High
2	1.81 - 2.60	Slightly Accepted (SA)	Low
1	1.00 - 1.80	Not Accepted (NA)	Very Low

It shows that the students really like Bingo game. They find it interesting to play Bingo based on their responses, the concepts and pictures utilized are appropriate to the level of the students.

The bingo card game to assess one's knowledge in physics not only increased the learning motivation of students but also assisted them in the formation of higher conceptual abstractions. The use of such a card game for assessment purposes could help to reduce test anxiety and promote better learning effectiveness as stated by Haupt, (2006).

Table 3. Level of Multiple Innovative Experiential Gaming Literacy in terms of familiarization in Wheel of Knows

The status of Multiple Innovative Experiential Gaming Literacy in terms of familiarization in Wheel of Knows is Moderately High. There is a need to set the mood of the class to make them attentive and increase cooperation and problem solving skills. The traits of the learners and their prior knowledge to be able to establish clear teaching with the game content are vital. The primary goal is teaching and that the game is a supplementary tool; take advantage of game characteristics to enable students to enjoy learning while they take control of learning; and periodically assess learning effectiveness and improve teaching.

Table 4. Composite table on the level of Multiple Innovative Experiential Gaming Literacy

Indicator	Students Response			Teachers Response		
	Mean	SD	Remarks	Mean	SD	Remarks
Bingo	3.68	0.99	MA	4.58	0.64	SA
Dice and Side	4.44	0.86	SA	4.22	0.74	SA
Wheel of Knows	3.26	1.06	A	4.04	0.78	MA
Grand Mean	3.79	0.97	MA	4.28	0.72	SA
Verbal Interpretation	Moderately Agree			Strongly Agree		

Legend:

Test	Bayes Factor	F-value	p – value	Analysis
Pretest	0.517	4.512	0.013	Significant
Posttest	2.93+32	147.58	0.000	Significant

Scale	Range	Remarks	Verbal Interpretation
5	4.21 - 5.00	Strongly Agree (SA)	Very High
4	3.41 - 4.20	Moderately Agree (MA)	High
3	2.61 - 3.40	Accepted (A)	Moderately High
2	1.81 - 2.60	Slightly Accepted (SA)	Low
1	1.00 - 1.80	Not Accepted (NA)	Very Low

The results on the level of Multiple Innovative Experiential Gaming Literacy suggest that games are more effective than other instructional methods because they simultaneously engage trainees' affective and cognitive processes. That is why, learning occurs through the manipulation of simulations as well as the physical act of playing. It shows that Multiple Innovative Experiential Gaming Literacy in terms of familiarizations in Bingo, Dice and Side and Wheel of Knows can reinforce understanding of subject – specific terminology with a focus on students internalizing key concepts.

Indicative Statement	Students			Teachers		
	Mean	SD	Remarks	Mean	SD	Remarks
1. Reinforce understanding of subject-specific terminology with a focus on students internalizing key concepts.	3.45	1.04	MA	4.10	0.74	MA
2. Concepts and pictures are appropriate to the level of the students.	3.29	1.08	A	3.90	0.57	MA
3. Emphasizes student's engagement and higher level thinking skills.	3.27	1.04	A	4.10	0.88	MA
4. Increase students' cooperation and problem solving skills.	3.29	1.08	A	4.10	0.99	MA
5. Sets the mood of the class wherein fun and focus is harmonious.	3.00	1.04	A	4.00	0.82	MA
Grand Mean	3.26	1.06	A	4.04	0.78	MA
Verbal Interpretation	Moderately High			High		

Table 5. Performance of the Students in the Pretest and Posttest

The pre-test / post-test can be a valuable diagnostic tool for more effective teaching and to measure how much students have improved in one semester, students are not expected to know the answers to all of the questions; however, they are expected to utilize previous knowledge to predict rational answers. The students' performance based in their post-test, after the use of different games.

The results show that there is a significant difference in the pre-test and post-test performance of Grade 7 students in Physics (p- values < 0.05). Based on the data, the significant difference in the pretest performance of the students is anecdotal or unreliable (Bayes Factor = 0.517). Although, there is also a significant difference in posttest performance of the groups, there is extreme evidence which supports the hypothesis that there is no significant difference in the level of performance of the students in the posttest (Bayes Factor = 2.93+32). The performance of the groups: Group 1 (Dice and Side), Group 2 (Bingo) and Group 3 (Wheel of Knows) in the posttest is significantly the same. The pretest and posttest results demonstrate that the card game significantly increased the student's scientific knowledge related to energy and means of transport. These results correspond to the use of digital games in game-based learning in previous studies (Lin et al., 2013; Huizenga, et. al. 2009; Gros, 2007; Yien et al., 2011). The use of the card game to promote game-based learning also enhanced learning motivation and learning effectiveness. Similar to the study of Stabler (2014), the mean gain post-test result is significantly different. It concluded that the active use of

metacognitive strategy assisted the learner to learn the physics lesson effectively.

Summary, Conclusions and Recommendations:

The findings of the study presented that there is a significant difference in the level of multiple innovative experiential gaming literacy in terms of Dice and Side, Bingo, and Wheel of Knows and the level of performance in Physics in terms of pre-test and post –test. The results of this study have practical implications for teacher educators, because it increases the understanding on how game-based learning could be introduced in teacher training programs, especially in early adoption phases for enhancing academic performance in all subjects.

School heads may conduct SLAC sessions on how to use multiple innovative game-based learning approaches that will affect the performance of the students especially in academic.

In view of the findings and conclusions it was recommended that game-based learning should be encouraged in the classroom. High school teachers are suggested to make better use of multi-player gaming environment to provide virtual collaboration opportunities and to promote collaborative problem-solving abilities of students.

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