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Difficulties Encountered by Calaca Senior High School Learners in Science Subjects: An Input to Game Based Learning Strategy (GBLS)

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***Abstract*: The main purpose of the study was to identify the difficulties encountered by the learners and its effect on learners' attitude/behavior, interest, and comprehension. The study also assessed game-based learning as a form of teaching strategy. A total of 246 learners participated in this study, and a descriptive quantitative design was administered. The methods employed were pre-test and post-test using ten item two-tier multiple choice test; games such as mahjong chem, periodic table battleship, balancing chemical equation, periodic table bingo together with direct instruction of the subject matter; and a survey on the learners' assessment as to effectiveness of the strategy using Likert scale. Frequency, ranking, weighted mean, Pearson r and T-test were used for the analysis of the study using the Statistical Package for Social Sciences (SPSS). The result revealed that there was a statistical relationship at the level (0.05) between the difficulties and the effect of difficulties encountered by the learners. Consequently, the two-tier pre-test and post-test scores implied that there was significant difference on scores after utilizing game-based learning strategy. Limitations of the study were the respondents, sample size and location of the study. The overall results supported the potential of GBLS in enhancing learners' academic performance in Science.**

***Keywords*: Game-Based Learning Strategy, Science, Academic performance, Two-tier multiple-choice test.**

1. Introduction

The 21st century learners' demand in acquiring knowledge for its application in real life situation changes gradually for these digital age individuals and is becoming more active and aggressive. This is a challenge to the educational system. Teachers must stimulate their interests and critical thinking skills to learn new concepts. This is done through the application of relevant strategies which is becoming more intricate. (Bajado N. A. et al., 2016)

Games are part and parcel of students' daily activities. According to Pearson Innovation and Research Network, 97% of students who are 12-18 years old play digital games. These games serve students various purposes, like fun, entertainment, satisfaction, and acquisition of new strategy or technique to learn new things, to master things, and even to defeat opponents as most gamers would claim. In the research conducted by Richard Van Eck (2006) about Digital Game-Based Learning, he emphasized that both non-digital and digital games have consistently promoted learning and /or reduced instructional. Game-based learning is built upon a constructivist type of learning. Constructivism posits the need to provide students with the necessary tools so they can build their own procedures in order to solve a problem. This implies a participatory process by students, who interact with their environment to solve the situation that is being set out to them (Gamelearn, 2015).

Old and current research shows correlation with the present situation encountered by the researcher. The researcher of this study is a classroom teacher, teaching core and specialized science-related subjects. He personally observed the difficulties encountered by the students during the teaching and learning process. Learners found difficulties in learning both in core and specialized science subjects regardless of their tracts and strands. Considering the given situation, the researcher deemed it wise to study the difficulties encountered by the learners in their science subjects and their assessment on game-based science learning as a teaching strategy.

A. Objectives

This action research assesses the difficulties encountered by learners on their science related subjects and learners' assessment on the Game-Base Learning Strategy.

Specifically, it sought to answer the following questions.

1. What are the factors affecting the difficulties encountered by the respondents in terms of:
   - 1.1. Teacher Factor,
   - 1.2. Student factor,
   - 1.3. Instructional Materials; and
2. What are the effects of the difficulties encountered by the respondents in terms of:
   - 2.1. Attitude and Behavior,
   - 2.2. Interest; and
   - 2.3. Comprehension?
3. Is there significant difference in the two-tier pre-test and post test scores of the respondents?
4. Is there significant relationship between the factors affecting difficulties encountered by the students and the effect of difficulties encountered by the learners?

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5. What is the learner's assessment on the game based learning strategy?
6. What program may be proposed to enhance learners' academic performance?

B. Scope, Delimitation, and Limitation of the Study

This research study aimed to identify the difficulties encountered by learners in science, it also aims to assess the effectiveness of game-based learning strategy to select grade 12 learners. The study covers factors and effects of difficulties experienced by select senior high school learners of Calaca senior high school. Limitations of the study were the respondents, sample size and location of the study.

2. Review of Literature

The Department of Education reports a serious lack of science laboratories in both elementary and high schools all over the country. According to DepEd data, in Regions III, IV-A, X, XI, and XII, only one school has a science laboratory out of every 10 public elementary schools. In the National Capital Region, this ratio is 3 laboratories for every 10 elementary schools. The public elementary schools in the other regions do not have any science laboratory to facilitate science learning. Preliminary results from a survey done by Raymond Pingol from the VISSER project show that only around 20% of high schools have laboratories with non-traditional "modern" equipment. Unfortunately, these "modern" equipment are typically no more than the combination of a computer and an LCD projector. The lack of science education facilities is reflected on the poor quality of basic science and math education seen by the low achievement scores of Filipino students in various tests. The passing rate for the National Achievement Test (NAT) for the Grade 6 is only 69.21%. This was already a 24% improvement compared to the 2005-2006 passing rate but is still below the passing rate of 75%.

On the other hand, the NAT passing rate for high school is 46.38% in SY 2009-2010, which is a slight decrease from 47.40% in SY 2008-2009.The last time the Philippines participated in international surveys like in the 2003 Trends in International Mathematics and Science Study (TIMSS), the country ranked 34th out of 38 countries in HS II Math and 43rd out of 46 countries in HS II Science; for the Grade 4, the Philippines ranked 23rd out of 25 participating countries in both math and science. In 2008, even with only the science high schools participating in the Advanced Mathematics category, the Philippines ranked lowest among 10 countries.

The implementation of the K to 12 basic education programs does not bode well for science education. Science education will start only at Grade 3, which is not comforting for the improvement in basic science and math education. There is a need to develop critical thinking skills of Filipino students at an early age. The time allotment for laboratories and non-lecture activities is also limited.

The government's plan for improving science and math education remains limited to scholarships and a few projects. This must be improved and expanded to address not only the supply side of science experts but also to build industries that will utilize them. We need radical solutions to reverse the current backward science and technology situation of the country (Jalmasco, 2014).

Numerous classical reports also suggested that students find difficulties on learning science on the following factors but not limited to curriculum, learning materials, teachers and student performance. This was supported by the compilation report made by Bella Marinas, UNESCO statistical yearbook of 1988, which she mentioned problems encountered n teaching science and technology.

1. On the curriculum teachers often complain that the curriculum is overcrowded and that they are not able to finish the content in certain year levels and there are not enough teaching learning materials. Some teachers complain some topics are too difficult to teach (Nebres & Vistro-Yu, 1998). Concern also has been expressed about the placement of science subjects in the curriculum. Earth science, for example, is offered in the first year, although it requires knowledge about concepts in chemistry and physics that are taken up in higher year levels. Another example is chemistry (third year) and physics (fourth year). There are increasing suggestions that the courses be reversed because of the perception that chemistry is more difficult than physics (Mendoza, 1998).

2. Learning materials such as books and science equipment are either unavailable or inadequate in many schools. Also, very few schools have science laboratories. Concern also has been expressed that teachers' manuals, intended to help teachers teach more effectively, are inadequate.

3. On teachers in science, because of the shortage of science teachers in general, and majors in certain science disciplines in particular, a science teacher may be hired to teach a science subject that is not his major. Thus, a teacher must be multiskilled to teach all science disciplines. But that is not the reality (Mendoza, 1998). Even teachers in science high schools find difficulty in teaching the integrated way (Reyes, 1998). Future science teachers graduate from pre-service programs, yet few are competent enough to teach their subjects (Nebres & Vistro-Yu, 1998).

4. On student performance in various assessments and surveys report downward trends in students' performance in science. The results are consistent, but a major concern is whether such results are used as a starting point when new programs and activities in science and mathematics education are organized.

3. Research Method and Procedure

A. Participants and/or other source of data and information

This study involved 246 select students of Calaca Senior High School enrolled in S.Y. 2017-2018. The number of respondents is result from using Slovin's Formula sampling technique. The 246 respondents were based on an equal distribution among Academic and TECHVOC tracks, which were subdivided by STEM, ABM, HUMSS, CSS, SMAW, Organic-Agriculture, and FBS strands. This ensured that each track had representatives. The participants were randomly and purposively selected because they had core subjects (Earth and

Life Science and Physical sciences). The study also included all 46 students from the Grade 12 STEM students because they had more science-related subjects (earth science, general biology, general chemistry and general physics) compared to other tracks.

B. Data gathering method

The researcher used descriptive, both qualitative and quantitative research design since it tried to dwell on particular situation about present condition. The main objective of the study was to describe the nature of situation as it exists at the time of the study and explore the causes of particular phenomena. As stated by Krathwoll (1993), descriptive research has three main purposes: to describe, explain and validate findings. Basically, the data were gathered from Calaca Senior High School selected students wherein the researcher himself has been working as a classroom teacher and acting as STEM subject group head. Modified-adapted questionnaire was distributed to the selected learners. The propose action research was first introduce to the researcher's immediate supervisor and immediately after his approval, the action research proposal was submitted to the District Research Committee for approval.

C. Data analysis plan

1. Frequency Distribution – It is defined as the arrangement of data which shows the frequency of different values or group of values of variables.
2. Ranking – It means the position of an observation score or individual in relation to its order in the group according to some characteristics such as magnitude usually indicate numbers. The higher quality may be given as the rank one, the second as the rank two, so on and so forth.
3. Weighted Mean – The Likert Method of Scaling Techniques assigns a scale to each of the five options. The weighted mean points for each item was obtained by multiplying the scale value of responses by the total number of responses indicating it. The total weighted point for each value weighted means of each item was obtained by dividing the total weighted point by the total number of respondents. This is synonymous to average. It is summing of the responses divided by the total number of respondents.
4. Likert Scale- This was used to interpret and analyze the student responses.
5. Pearson r. This was used to determine the relationship the factors affecting the difficulties and the effect difficulties encountered by the respondents.
6. T-test. This was used to measure the probability difference between pre-test and post-test.

4. Presentation, Analysis, and Interpretation of Data

This section deals with the presentation, analysis, and interpretation of data. It contains the textual and tabular presentation of data, quantitative analysis of data, and interpretation of data in the light of relevant literature.

Table 1

Comparison between pre-test and post-test scores

Test	Mean	SD	t-value	p-value	Interpretation
Pre-test	3.45	2.01	2.16	0.0024	Significant
Post-test	7.03	17.35			

Based on the Table 1, the mean scores in the pretest and posttest of the learners were 3.45 and 7.03, while the SD were 2.01 and 17.35 respectively. From the above the p-value 0.0024 showed that there is a significant difference between the pre-test and post-test after using game-based learning strategy. The p-values where judge to be significant because it is less than 0.05 level of significance. This simply implies that the use of game-based learning strategy (GBLS) strategy has significantly affected the academic achievement of learners in certain concept.

Table 2

Factors Affecting Difficulties In Terms of Teacher Factor

Teacher Factor	Mean	Interpretation	Rank
1.Sets lesson objectives within the experience and capabilities of the learners.	3.25	Always	4
2. Uses/utilizes varied techniques and strategies in teaching.	3.31	Always	3
3. Has mastery of the lessons and subject matter.	3.35	Always	2
4. Provides activities that are engaging and suitable for learners.	3.24	Often	5
5. Encourages learners to ask questions or clarifications about the lesson.	3.48	Always	1
Composite Mean	3.33	Always	

Table 2 shows the mean scores of teacher factor that might affect learner difficulties. The descriptors 1, 2, 3 and 5 have weighted mean ranging from 3.25-4.00, which means that they "always" observed those descriptors to STEM teachers. However, item 4 got 3.24 which was interpreted as "often"; this implies that not most of the time teachers activities were not engaging and suitable. Overall, the mean score of 3.33 highly suggested that teachers were not considered as a factor to the difficulties experienced by the learners. This also implies that pedagogy was evident on teachers.

Table 3

Factors Affecting Difficulties in Terms of Student Factor

Student Factor	Mean	Interpretation	Rank
1. I am lazy to study my lessons.	2.68	Seldom	3
2. I have difficulty managing my time.	2.88	Seldom	1
3. I have lack of resources such as laptop and access to internet.	2.83	Often	2
4. I have lack of interest on the subject matter.	2.30	Seldom	5
5. I cannot focus on my study because there are lot of household chores.	2.48	Seldom	4
Composite Mean	2.63	Seldom	

It can be gleaned from the Table 3 that majority of the respondents agreed that their personal life was not a factor that might contribute to the development of difficulties. However, respondents agreed that they had lack of learning resources such as laptop/computer and even access to the Internet. Majority of the learners enrolled in Calaca SHS were from middle family

and some of them are 4 P's beneficiaries.

Table 4

Factors Affecting Difficulties in Terms of Instructional Material Factor

Instructional Material Factor	Mean	Interpretation	Rank
1. Utilizes various instructional materials like Manila paper and PowerPoint presentation.	3.11	Often	1
2. Utilizes laboratory equipment and apparatuses.	1.75	Seldom	5
3. Uses indigenous materials such as improvised instructional tools.	2.00	Seldom	4
4. Uses appropriate and simple instructional materials.	2.02	Seldom	3
5. Assures that instructional materials are readily available.	2.24	Seldom	2
Composite Mean	2.22	Seldom	

Table 4 reveals that majority of the teachers used various appropriate and simple instructional materials. However, apparatuses and laboratory equipment's were not available. But this did not stop teachers to provide quality education as they utilized indigenous materials as improved tools with a mean score of 2.00. Overall, the mean score of 2.22 suggests that instructional material was not a factor that contributed to learners' difficulties.

Table 5

Effects of the difficulties encountered by the respondents in terms Attitude and Behavior

Attitude and Behavior	Mean	Interpretation	Rank
1. I don't attend my Science class.	1.29	Not at All	5
2. I no longer participate in cleaning our rooms.	1.43	Not at All	2.5
3. I don't have good relationship with my teacher and classmates.	1.56	Not at All	1
4. I don't impose proper discipline and right conduct.	1.43	Not at All	2.5
5. I don't have any sense of humor.	1.25	Not at All	5
Composite Mean	1.39	Not at All	

It can be gleaned on the Table 5 that majority of the respondents perceived that the difficulties that they encountered had "not at all" affected them in terms of attitude and behavior. It further implied that learners had a proper attitude and behavior inside the classroom.

Table 6

Effects of the difficulties encountered by the respondents in terms Learners Interest

Learners Interest	Mean	Interpretation	Rank
1. I don't want to listen to the lecture.	1.60	Not at All	5
2. I can't get good grades on quizzes, assignments and projects.	2.04	Very Little	1
3 I don't like reading books.	1.75	Very Little	3
4. I am happy when my teacher is late or absent.	1.71	Not at All	2
5. I am happy if my teacher forgets to check and collect our assignments and projects.	1.71	Not at All	4
Composite Mean	1.76	Very little	

The overall computed mean was 1.76, which was described to be very little. This result implied that learners had very little problems regarding their interest in studying science. It further implied also that the learners were eager and motivated study.

Table 7 shows that the overall computed mean of 2.02 simply suggest that learners had very little problems regarding their comprehension. It further suggests that teachers gave learners problem sets and exercises that enrich learners comprehension skills.

Table 7

Effects of the difficulties encountered by the respondents in terms Comprehension

Comprehension	Mean	Interpretation	Rank
1. I can't easily understand the lesson.	2.35	Very little	1
2. I can't give my own insight/opinion about the lesson.	2.08	Very little	2
3. I don't share my knowledge to my classmates.	1.83	Very little	5
4. I don't gather factual information.	1.95	Very little	3
5. I can't apply new knowledge to my studies.	1.91	Very little	4
Composite Mean	2.02	Very little	

Table 8

Learners Assessment on GBLS

	Mean	Interpretation	Rank
1. GBLS is engaging.	3.56	Always	2
2. GBLs is helpful in answering questions.	3.59	Always	1
3. GBLS is effective in understanding lesson.	3.54	Always	3
4. GBLS is an innovative way of teaching lessons.	3.50	Always	4
5. GBLS is consumes so much time.	2.83	Often	5
Composite Mean	3.40	Always	

As of learner's assessment on game-based learning strategy, the Table 8 shows the weighted mean scores and majority of the descriptors had positive response on the said strategy with the overall weighted men of 3.40. This implies that GBLS was effective and is an engaging way of teaching; however, it consumes so much time on the teacher's part. This further reinforces the role of teacher in facilitating activities and managing classroom.

Table 9

Relationship between the factors affecting difficulties encountered by the students and the effect of difficulties encountered by the Learners

Variable X	Variable Y	R	Direction and Strength	p-value	Decision	Interpretation
Teacher Factor	Attitude and Behavior	-0.538	Moderate Negative	0.000	Reject Ho	Significant
	Learners Interest	-0.511	Moderate Negative	0.000	Reject Ho	Significant
	Comprehension	-0.374	Weak Negative	0.001	Reject Ho	Significant
Student Factor	Attitude and Behavior	0.238	Weak Positive	0.033	Reject Ho	Significant
	Learners Interest	0.355	Weak Positive	0.002	Reject Ho	Significant
	Comprehension	0.312	Weak Positive	0.005	Reject Ho	Significant
Instructional Material Factor	Attitude and Behavior	-0.538	Moderate Negative	0.000	Reject Ho	Significant
	Learners Interest	-0.511	Moderate Negative	0.000	Reject Ho	Significant
	Comprehension	-0.374	Weak Negative	0.001	Reject Ho	Significant

Table 9 shows the significant relationship between the factors (teacher, student, and instructional material) and effect of difficulties (attitude and behavior, learners' interest, and comprehension). As what can be gleaned from the table above, all computed p-values are less than the critical values at 0.05 level of significance. Therefore, the null hypothesis was rejected. With this, there was significant relationship between the factors affecting difficulties and the effect of difficulties experienced by the learners.

This data simply shows that teachers play vital roles in the lives of the learners. A teacher's role involves more than simply standing in front of a classroom and lecturing. In fact, teacher spends most of the day in the classroom and even extend their duties at home to provide quality education. An effective teacher understands that learners are unique in another and diverse in many ways. Teacher should always think and utilized different ways to catch the learner's attention, such as utilizing innovative instructional materials and different methods and teaching strategies. Learning should be fun and engaging to both learners and student as they will have professional relationship.

5. Conclusions and Recommendations

A. Conclusion

1. There are lot of factors that may affect students' engagement and motivation to learn.
2. Game-based learning as a form of strategy is engaging and effective.
3. Teachers play huge part in the teaching-learning process of the learners.

B. Recommendation

1. Conduct of related study to a larger sample to revalidate the result.
2. Utilization of the same study with additional factors and effects of difficulties experienced by the learners.
3. Improve and develop digital and non-digital games that can be used as a learning strategy for different STEM subjects.

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