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ABOUT THE JOURNAL

Romblon State University Research Journal is a refereed multi-disciplinary research journal that aims to provide a source of information in the areas of agriculture, natural resources and environment; social science, ethics, humanities and the arts; physical and biological sciences; business and management; engineering, information and communication technology; education; health and medical education; alternative medicine; institutional system and process assessment; and community baseline or impact studies. The objective of the journal is to help educators and decision-makers disseminate information and learn from each other's work.

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Forecasting Enrollment: A Substitute to Career Guidance Campaign

Joefel T. Libo-on[1,2], and Al M. Gadon[1,3]

ABSTRACT

The use of forecasting models is essential for advanced decision-making and planning. The conduct of the career guidance campaign of guidance counselors and teachers has been a challenging task in a time of community and border restriction. This study was conducted to determine factors that can predict and forecast the number of Junior High School enrollees based on the eleven-year historical records. The data were gathered from the school registrar, guidance counselor of Tanagan National High School, and Philippine Statistics Authority (PSA). The unemployment rate, sex, parents' educational attainment, honors, the distance of the school from home, parent's income, employment of parents, and government beneficiaries are found to be significant predictors of enrollment. There were two forecasting models found and by confirmatory factor analysis (CFA) by structural equation modeling (SEM), the most appropriate model is $\hat{Y} = -1.714 + .335x_4$; where Y refers to the number of enrollment and x_4 to parents' educational attainment. Experimental results yield an average of 1.26% difference in the forecasted and actual numbers of enrollment. The forecasted enrollment using the most appropriate model underwent validation, and the model forecast was accepted.

Keywords: *AMOS, CFA, Enrollment, forecasting, SEM*

INTRODUCTION

The state of national emergency drives the Philippines to undergo community restriction to counter the spread of the virus, COVID-19. In such an event, the President of the Republic declares the whole Luzon archipelago under enhanced community quarantine on March 16, 2020 (Merez, 2020). The declaration of community restriction impacts every sector and affects the economy. This is the time where the education sector is on the culminating part of the school year for most of the basic education and mostly in the middle of the term for the tertiary and graduate education level.

The surge of COVID-19 cases also impacts the programs and activities of schools and universities. Among these is the conduct of career guidance. Expecting an enrollment based on the conduct of career guidance to the school within the catchment area is done when the school year is about to end. Thus, the challenge now is to determine a method to deliver career guidance that will consider the implemented safety guidelines of the national government to avoid face-to-face contact with students and the slow internet connection.

Enrollment is an event that happens every year in schools. Secondary schools are conducting an early enrollment campaign for incoming Junior High School students. This is to estimate the number of incoming students which may serve as a basis for the planning and preparation of schools. If the enrollment can be estimated as early as possible it will also help teachers to prepare an estimated number of copies of modules to be reproduced during the state of national emergency. Unfortunately, after enrollment, data are being kept aside purposelessly. However, the said data can be used to predict the number of enrollees for the near future using forecasting, which is a process of predicting something to happen using the variables of a certain event (Rakhimov & Kankarej, 2015).

Moreover, if the school can predict the number of enrollees by forecasting, it can lead to better plans and preparations (Lavilles & Arcilla, 2012). The school could prepare if there is a need to add classrooms, teachers, and other resources. Furthermore, if the school is well-prepared because of the foreseen possible number of enrollees, it can offer quality education which may produce equally competitive graduates.

For several years, Tanagan National High School has been interviewing enrollees and collecting other requirements of the incoming junior high school

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students. After this, data are just kept until the admission process resulting in a large amount of data in databases and student files in the registries. However, these are not just simply data; this could serve as a source of information that could help for the improvement and preparation of the school, especially during this time of community restrictions.

To make these data worthy, the researcher decided to utilize the gathered valuable information. By forecasting these data and processing those variables, the researcher could get some information like predicting the number of enrollees for the next school year and determining what factors contribute to students' decision to enroll in this school. Daniel and colleagues (2014), define forecasting as the process of making a statement on unobserved events and sometimes kept for estimates of values at a certain future period. Meanwhile, Lazar and Lazar (2015) stated that forecasting students' enrolled every year represents an important activity for an academic institution. This has been the basis of identifying the income and the basis of the foundation for operational plans and strategies. Not only does forecasting the data could help the school by predicting the number of enrollees but also be the basis of all plans and preparations.

Tanagan National High School experiences a lack of classrooms due to the sudden increase in the population of students every year. Way back year 2012 and below, the school only needed eight classrooms but at present, the school needs 13. However, the school has only 11 classrooms that is why the computer laboratory room and Technology and Livelihood Education (TLE) building were used as classrooms for the meantime just to accommodate the students. To add, the performance of the students, as well as the quality of education, is highly at stake because of the absence of conducive and enough classrooms.

This study seeks to provide a forecasting model of the possible number of enrollees for the succeeding years so that the school will have an idea about how many classrooms are still needed to be constructed for the next school years. Also, it aims to determine the factors that can predict the school enrollment rate. Moreover, if the school can already predict the possible number of students, the school management may have better plans and preparations especially in the reproduction of the number of modules. This involves proper planning of the resources which could not be possible if there will be no well-founded estimation of the students who are admitted annually (Lazar & Lazar, 2015).

METHODOLOGY

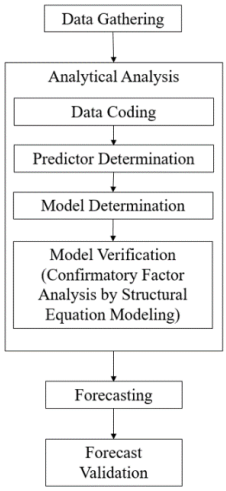

Figure 1. Paradigm of the study.

This study utilizes analytical method research. It is characterized by a phenomenon that answers the questions of how many. Description plays a critical role in educational research. The purpose of this analysis is to identify and explain patterns and differences in populations, establish new measures of key phenomena or describe samples in studies aimed at detecting causal effects (Loeb, et al., 2017).

This study was conducted at Tanagan National High School in Tanagan, San Andres, Romblon. The historical data of enrollment of Tanagan National High School from 2009 to 2019 were used in this study. These data were gathered from the school registrar, guidance counselor, and PSA with permission from the school principal. The paradigm for this study is presented in Figure 1. The data were gathered from the school registrar, guidance counselor, and PSA and were analyzed analytically. In an analytical analysis, the gathered data were analyzed, (Table 1) and the predictors and covariance were determined using correlation. Those independent variables that are significantly correlated are considered as predictors. Those that are not predictors will be dropped in the next step. In model determination, the determined predictors will be subjected to multiple regression to generate the available forecasting model given the determined predictors. After determining the forecasting models, it will be subjected to confirmatory factor analysis by structural equation modeling using analysis of moment structures to verify its model fitting.

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Table 1. Correlation between variables.

		Number of Enrollees	Sex	Parents Educational Attainment	Honors	The distance of School from Home	Parents Income	Employment	Government Beneficiaries	Unemployment Rate	Inflation Rate	Attrition Rate	Catchment Area
Number of Enrollees	*r*	1											
	p												
Sex	*r*	**0.963	1										
	p	0.000											
Parents Educational Attainment	*r*	**0.994	**0.970	1									
	p	0.000	0.000										
Honors	*r*	**0.975	**0.953	**0.973	1								
	p	0.000	0.000	0.000									
The distance of School from Home	*r*	**0.919	**0.884	**0.888	**0.895	1							
	p	0.000	0.000	0.000	0.000								
Parents Income	*r*	**0.969	**0.950	**0.972	**0.959	**0.831	1						
	p	0.000	0.000	0.000	0.000	0.002							
Employment	*r*	**0.907	**0.834	**0.904	**0.872	**0.817	**0.874	1					
	p	0.000	0.001	0.000	0.000	0.002	0.000						
Government Beneficiaries	*r*	**0.945	**0.936	**0.948	**0.912	**0.851	**0.926	**0.768	1				
	p	0.000	0.000	0.000	0.000	0.001	0.000	0.006					
Unemployment Rate	*r*	*-0.620*	-0.519	-0.600	*-0.623	*-0.626	-0.584	-0.519	*-0.722	1			
	p	0.042	0.102	0.051	0.041	0.040	0.059	0.102	0.012				
Inflation Rate	*r*	-0.183	-0.118	-0.168	-0.046	-0.277	-0.167	-0.286	-0.180	0.233	1		
	p	0.590	0.729	0.622	0.894	0.410	0.623	0.395	0.597	0.491			
Attrition Rate	*r*	-0.290	-0.263	-0.253	-0.252	-0.445	-0.312	-0.068	-0.376	0.448	0.523	1	
	p	0.387	0.434	0.454	0.454	0.170	0.350	0.843	0.255	0.167	0.099		
Catchment Area	*r*	0.584	0.518	0.525	0.552	0.546	*0.613	0.408	*0.612	-0.530	0.070	-0.436	1
	p	0.059	0.103	0.097	0.079	0.082	0.045	0.212	0.046	0.094	0.837	0.180	

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 2. ANOVA Table of Regression Model

	Model	Sum of Squares	df	Mean Square	F	Sig.	Interpretation	Decision
1	Regression	2759.184	1	2759.184	744.347	0.000[b]	Significant	Accept the Generated Model
	Residual	33.362	9	3.707				
	Total	2792.545	10					
2	Regression	2776.378	2	1388.189	686.884	0.000[c]	Significant	Accept the Generated Model
	Residual	16.168	8	2.021				
	Total	2792.545	10					

[a]*Dependent Variable: Number of Enrollees*
[b]*Predictors: (Constant), Parents Educational Attainment*
[c]*Predictors: (Constant), Parents Educational Attainment, Distance of School from Home*

The forecasting model with the best fit will be considered as the best forecasting model of the number of enrollments for Junior High School. Also, the best forecasting model will be utilized in predicting the estimated number of enrollees for the succeeding year. Lastly, the forecasted data generated by the best model will be validated. The statistical forecasting technique was utilized in forecasting junior high school enrollment. The technique made use of the data gathered for past periods to forecast future values. *Stepwise Regression Analysis (SRA)* was then utilized to pick out the potential explanatory factors that significantly contribute to the explanation of the criteria measure ($\hat{Y}$) – the number of enrollments. The process for SRA

included the computation of the coefficient of determination (R^2). *Adjusted R – Square (RA^2)* was computed to know if the independent variables included in the equation significantly contributed to the variation of the variable. Root Mean Square Residual (RMR) is the square root of the average squared amount by which the sample variances and covariances differ from their estimates obtained under the assumption that the model is correct. The smaller the RMR is, the better. An RMR of zero indicates a perfect fit. Comparative Fit Index (CFI) refers to the degrees of freedom and the non-centrality parameter estimate for the baseline model. The CFI is truncated to fall in the range from 0 to 1. CFI values close to 1 indicate a very good fit. The Root Mean Square Error of Approximation (RMSEA) model fit was used to give an overall idea if the structured model fitted.

Table 3. Regression Model

Dependent Variable	Predictors	Regression Equation	Adjusted R^2
Junior High School Enrollment	Parent's Educational Attainment	$\hat{Y} = -1.714 + 0.335x_4$	0.987
	Parent's Educational Attainment and Distance of School from Home	$\hat{Y} = 1.013 + 0.284x_4 + 0.064x_6$	0.996

RESULTS AND DISCUSSION

Predictors of Enrollment

The factors with a significant relationship or with predictive relationship to the number of enrollments is shown in Table 2. Furthermore, the significant covariance of each significant variance was considered during the Confirmatory Factor Analysis (CFA).

Model Identification

The stepwise regression was utilized to pick out from the independent variables the possible predictors or factors that could significantly affect the dependent variable. To determine the predictors of enrollment as a coded data, regression analysis was done with the aid of SPSS.

Model 1 is an acceptable model, F (1,9) = 744.347, p=0.000 (Table 2). By regression analysis, the parent's educational attainment predicted enrollment with the coefficient of determination of .994 (Table 2), calculating the proportion of variance of the enrollment over its mean (Table 4), which was explained by the parent's highest educational attainment, R^2 = .987. It implied that the parent's highest educational attainment provides 98.7% explanatory power to the number of enrollees. In addition, the majority of students' parents were only high school achievers therefore most of them have low income so, to send their children to school they will choose the nearest school. The mathematical model in predicting the number of enrollments was determined by:

$$\text{Model 1: } \hat{Y} = -1.714 + .335x_4$$

Model 2 is also another acceptable model, F(2,8)= 686.884, p=0.000 (Table 3). By regression analysis, the parent's highest educational attainment and distance of the school from home were identified as predictors of enrollment, R^2 = .996 or its adjusted coefficient of determination (Table 4) indicates that the number of students enrolled can be explained by the parent's highest educational attainment and distance of the school from home by 99.6% of its variation.

Table 4. CFA Statistics of $\hat{Y} = -1.714 + .335x_4$

Statistics	
AIC= 6.000	RMSEA= 0.630
CFI= 1.000	RMR= 0.000; PCLOSE=0.028

One of the factors was the distance of the school from home, which implies that the majority of the parents will send their children to the nearest school for low expenses. Although some came from isolated areas far from school, still they have no choice because the nearest school to them was Tanagan National High School. This is also an additional input to the result of the study of Li and Qiu (2018) that establishes parenting and the desire of parents to compete for better education quality. The mathematical model in predicting the number of enrollment was determined by:

$$\text{Model 2: } \hat{Y} = 1.013 + .284x_4 + .064x_6$$

Model Verification

Application of Analysis of Moment Structures (AMOS), the Structural Equation Modeling (SEM) for Confirmatory Factor Analysis (CFA) was advanced.

$$\textit{CFA for Model 1: } \hat{Y} = -1.714 + .335x_4$$

The explanatory powers of model structure of $\hat{Y} = -1.714 + .335x_4$ was affirmed by CFA as 0.987

(Figure 2); in the proportion of its variation, the number of enrollees over its mean was explained by parents' highest educational attainment.

Figure 2. Output-structured model for regression.

Statistics of the first structure model in Table 4 transpires using the independent variable described in model 1 shows estimates appear to be equivalent in both AIC (Akaike Information Criterion) = 6.000 The CFI (Comparative Fit Index) of 1 appears that the model is acceptable (Schrieber et. al, 2006). The root means square residual (RMR) of 0.000 indicates a highly acceptable model (Bian, 2011). Lastly, the RMSEA (Root Mean Square Error of Approximation) of 0.630 with *p*=0.028 indicates that the model is on its best fit.

CFA for Model 2: $\hat{Y} = 1.013 + .284x_4 + .064x_6$

Table 6. CFA Statistics of the Generated Model

Category	Model 1	Model 2
AIC (Akaike Information Criterion)	6.000	12.000
CFI (Comparative Fit Index)	1.000	1.000
RMR (Root Mean Square Residual)	0.000	0.000
RMSEA (Root *Mean* Square Error of Approximation) [PCLOSE]	0.630[.028]	0.407[.117]

The CFA affirms that the explanatory powers of model 2 was 0.996 (Figure 3); it implies that the enrollees was explained by parents' highest educational attainment and distance of the school from home. Model structure 2 (Table 6) estimates appear to be equivalent in both AIC = 12. The CFI of 1 appears that the model is acceptable (Schrieber et. al, 2006). The *RMR* = 0.000 indicates a highly acceptable model (Bian, 2011). Lastly, the *RMSEA*=0.407, *p*=0.117 indicates that the model is on its best fit.

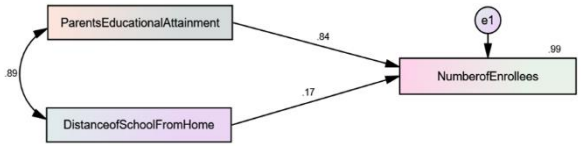

Figure 3. Output-structured model for regression.

Table 5. CFA Statistics of the $\hat{Y} = 1.013 + .284x_4 + .064x_6$

Statistics	
AIC= 12.00	RMSEA= 0.318
CFI= 1.000	RMR= 0.000; PCLOSE=0.117

Confirmatory Factor Analysis Comparative Summary Report

This section presents the best model in predicting the enrollment of Tanagan National High School. Since the models were all none nested models, the AIC appears that Model 1 appears the smallest estimates weights of 6.000 (Table 7) and considered as best fit among the other models (Schreiber et.al, 2006), *RMSEA*=0.630 (Figure 4).

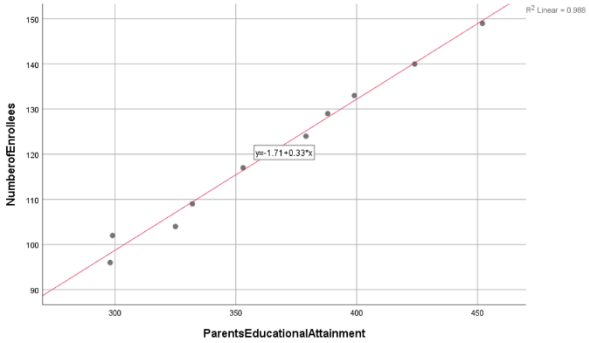

Figure 4. Graph of $\hat{Y} = -1.714 + .335x_4$

Forecasting Enrollment

Using Model 1 as the best fit model (Figure 5), the actual enrollment of the Junior High School was compared to the forecasted enrollment, and it shows an average of 98.74% accuracy or an average of 1.26% difference to the actual enrollment data.

Table 7. Acceptability of the Forecasted Data

Category	N	Mean	t	df	Sig. (2-tailed)	Interpretation	Decision
Actual	11	120.36	0.019	21	0.985	Not Significant	Accept the Forecasted Data

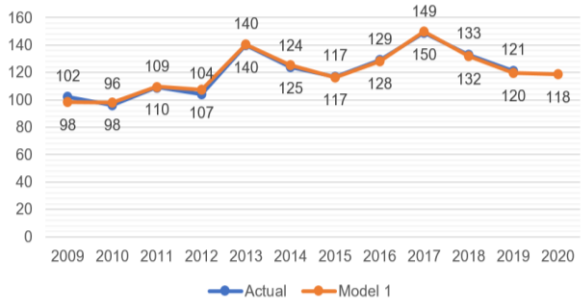

Figure 5. Comparison of the actual and forecasted enrollment.

Forecast Validation

Comparing the actual and the forecasted data generated by experimentation of model 1 shows that the forecasted data are somewhat the same, $t_{(21)} = 0.019$, p=0.985; hence, the forecasted data of the number of enrollments is acceptable.

CONCLUSION

The investigators concluded, based on the result, that the predictors of junior high school enrollment were unemployment rate, sex, parents' educational attainment, honors, the distance of the school from home, parent's income, employment of parents, and government beneficiaries. This added to the findings of previous studies where it was found that color and those with economic advantage are the predictors of student enrollment. Two equation models have been developed which shows that parent's highest educational attainment and distance of the school from home are significant predictors of enrollment. This indicates that the number of students to enroll can be predicted using forecasting models.

Parent's highest educational attainment was the predictor of the best model. This only shows that those students with parents of students having educational attainment affect the enrollment of Junior High School. The forecasted enrollment for the year 2020 was 118. The forecasted number of enrollments differs from the actual number of enrollments by 1.26%. This provides the school heads to opt that instead of conducting face-to-face career guidance in different schools, forecasting may be considered also avoiding a health-related risk during the pandemic. Generally, it is safe to conclude that majority of the parents of the upcoming enrollees of Tanagan National High School were educated.

AUTHORS' CONTRIBUTION

J.T.L.: Conceptualization, methodology, validation, formal analysis, writing original draft, supervision, revision. A.M.G.: Conceptualization, formal analysis, investigation, writing original draft, and revision.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Integrated Project Eureka Intervention: Effect on the Discourse Skills in English Among Grade 11 Students

Alma Gay B. Llorca[1], Garry Vanz V. Blancia[2,3], and Emelyn R. Villanueva[4,5]

ABSTRACT

This quasi-experimental study was conducted to determine the effect of Integrated Project Eureka Intervention (IPEI) on the Discourse Skills (DS) in English of Grade-11 Humanities and Social Sciences (HUMSS) students at Odiongan National High School. Two intact HUMSS classes were selected and assigned each to control and experimental groups, respectively. In determining the DS, a 20-item standardized assessment for communicative/discourse test was adapted from University of Louisville. T-test for independent samples was used to compare the mean pre-test scores in DS of the experimental and control classes. Analysis of Covariance was used to compare the post-test mean scores in DST between the two classes, using DST mean pre-test scores as covariates. Results of the investigation revealed that the IPEI was effective *($\eta_p^2 = 0.4$)* in improving the discourse skills of HUMSS students. A longer period of experimentation to fully ascertain the dosage of the intervention and to test the intervention to different strands in the senior high school program are recommended.

Keywords: *Integrated Project Eureka Intervention, discourse skills, Humanities and Social Sciences, Grade 11*

INTRODUCTION

Communication plays a vital role in the development of students across subject areas. The current era is marked by an exponential increase in knowledge. English has been significant in academics, personal and professional growth as the language of information. To succeed in their academic studies and to perform effectively as the expert they dream of becoming, students must be able to possess proficient English-speaking performance. In the Philippines, the pressure on the Filipino students to be a proficient speaker of this language for personal and, eventually, national growth, has increased dramatically (Domantay, & Ramos, 2018).

Language learning is considered to be the foundation of human existence, according to some. Understanding the language may aid in the expression of ideas, hopes, and even dreams (Tavil, 2009). Furthermore, foreign language instructors have long sought explanations for why some pupils have a tough time learning a foreign language like English while others have a much easier time (Ganschow et al., 1994). Students who have difficulty with English language learning are often described as underachievers, or sometimes, lacking in motivation.

Many students do not understand what their teacher is saying and therefore they cannot follow the lesson. The very reason for this is that the language in school is one they can hardly speak or understand (Bunch et al., 2020).

Senior High School students are expected to be knowledgeable in discourse and research by the time they go to college (Lustry Ro Manna, 2017). This notion is imperative among Humanities and Social Sciences (HUMSS) students since that this strand focuses on law, governance, public administration, and other fields which need discourse or communicative skills (De Vera & De Vera, 2018). More so, most of the subjects are taught using English and, in that case, students who could not understand the language will not also express their ideas in a way that they will also be understood. However, it is observed by the researchers that majority of the students do not have the necessary skills related to discourse, one of the fields in English which is necessary in higher education studies and graduate school. Students must be able to have skills related to

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communication to be able to survive the grueling high school life anchored on such skills.

In Odiongan National High School, an innovative way of determining communicative skills known as Project Eureka is implemented. however, there was no study conducted yet on how effective the intervention is. That is one of the reasons why the researcher wanted to know the effectiveness of Project Eureka intervention. As language teachers, it is important to know how the students will be helped in developing their discourse skills through this intervention since in the process, they will be doing it in a performance-based task oral participation.

This study would be beneficial among students, teachers, and curriculum implementers. Since learners are the heart of the educative process, they would be the main beneficiary of this study. This intervention would be a great help among teachers who find it hard to improve communicative skills and achievement of students in English. More so, curriculum implementers may adopt the intervention in the curriculum guide to reach a wider scope of study.

This study aims to determine the effect of Integrated Project Eureka Intervention (IPEI) on the Discourse Skills in English of Grade 11 students.

METHODOLOGY

Research Design and Participants

Table 1. Research Design

Group	Pre-Test	Treatment	Post-Test
1	O1	IPEI	O2
2	O1	CTM	O2

Where:

1 = Experimental Group (IPEI)
2 = Control Group (CTM)
O1 = Pre-Test of Discourse Skills
O2 = Post-Test of Discourse Skills

Shown in Table 1 is the research design of the study and the data that were collected from the experimental and control groups throughout the duration of the experiment. The non-equivalent pretest- posttest control group quasi-experimental design was employed because the participants were from two intact classes in a natural school setting where the random assignment is not possible, and the distraction of class structure is avoided to the minimum. This design was suggested to the best option for school-based research where classes were formed at the start of the year and it is not practical nor feasible to assign the students randomly to treatments, as discussed in the work of Fetalvero (2016).

Eighty (80) students from Blocks 2 and 3 of Humanities and Social Sciences (HUMSS) strand, Senior High School Department of the Odiongan National High School were involved in this study. The control and experimental groups were chosen using fishbowl method. Although both classes were heterogeneously mixed during their sectioning in the first day of class, the pre-test in achievement in English was the basis in determining if both sections were comparable. Pre-test scores in achievement test in English of both classes (*M=7.30, SD=6.98; M=6.98, SD=2.86*) revealed that they do not have any significant difference (*p=0.076*) in mean scores, therefore, both classes are comparable. Also, if the pre-test scores in Discourse Skills Test was used, comparable Discourse Skills ability were seen (*M=3.52; M=3.53*).

Discourse Skills Test

In getting the results for discourse skills of students, the researcher used a standardized self-assessment test for communicative/discourse test. This test is a 20-item test statements adapted from the University of Louisville where the respondents answered based from the five-point (5) Likert's Scale. It was administered in a 20-minute period which evaluated the students' discourse skills.

The Intervention

The intervention that was used in the study was termed Integrated Project Eureka Intervention (IPEI). This intervention is a concept of Archimedes' term "EUREKA" which means "I knew it". In Odiongan National High School, the intervention which is project eureka intervention or oral recitation was institutionalized. This intervention was conducted after discussion and before the scheduled assessment. The researcher prepared questions enough for the number of students/sample in a class. To supplement the teaching-learning process, questions were flashed on the screen first, before a student's name was drawn so as to provide a wait-time for them to think about the question and explain why it was the answer. In explaining the answer, student explained his answer subjectively to the given question. In addition, a documenter was requested to capture video while class had been conducted by the teacher. The intervention was done in a period of one (1) month. Below (Table 2) is a sample of the comparative Daily Lesson Log that the teacher implemented in the experimental and control group. Notice that in all parts of the lesson, the groups differ in item G.

All lesson logs and materials used by the teacher were first subjected to content and construct validity of three (3) master teachers in Odiongan National High School. This ensures that all materials are anchored on the curriculum guide set by the Department of Education.

Table 2. Sample of Daily Lesson Log for the IPEI group and CTM group.

DLL SECTION	IPEE	CTM
I. Objectives		
Content Standard	The learners realize that information in written text may be selected and organized to achieve a particular purpose.	
Performance standard	None	
Learning Competencies	Recognize the do's and don'ts of resume making	
II. Content	Resume Making and College Application Making	
III. Learning References	DepEd Teachers' guide/ Internet/ Web	
IV. Procedures		
a.) Review or Introduction Reviewing previous lesson or presenting the new lesson	The review will be integrated with a game- based approach. A canister with jumbled letters written in pieces of paper shall be passed to each of the student. Once the music stops, the student holding the canister shall get a paper and answer the question written on it.	
b.) Daily Objective/s Establishing a purpose for the lesson	Understand the concept of resume making	
c) Pre-activity Examples/ instances of the new lesson	The students will answer the question "How do you see yourself 3-5 years from now?" Their answers will lead to the idea of them going to colleges/universities and the future	
d) Activity Discussing new concepts and practicing new skills	A thorough discussion through Socratic dialogue will be established. Recitation per individual shall also be encouraged.	
e). Application Finding practical applications of concepts and skills in daily living	Students will make a draft of their resume following the format and guidelines given.	
f). Generalization/ Abstraction Making generalization and abstraction about the lesson	Question and Answer technique shall be done to generalize the whole topic.	
g). Assessment Evaluating Learning	Before the assessment, IPEI will be applied. Questions will be flashed on the screen. After this, 20-item pen and paper test shall be done.	20- item pen and paper test shall be done
h). Assignment/ Remediation Additional Activities for application on remediation		
i). Remarks		

Data Analysis

Descriptive analysis was employed to determine the mean and standard deviation of the study variables. Findings from the descriptive analysis was used to calculate the effects of Project Eureka to the Discourse skills of the students. Statistical Package for Social Sciences was used to conduct the analysis of the data. T-test for independent samples was used to compare the mean pre-test scores in Discourse Skills of the classes exposed to IPEI and CTM. Analysis of Covariance was used to compare the mean post test scores in Discourse Skills between the IPEI and CTM classes, using discourse skills (DS) mean pre-test scores as covariates.

RESULTS AND DISCUSSION

This section presents the results of the analysis on the variable Discourse Skills. This is organized by first comparing the pre-test and post-test mean scores in Discourse Skills Test between the control and experimental groups.

Table 3. The Descriptive Analysis of Pre-Test and Post-Test of Control and Experimental Groups in Discourse Skills

Test	Group	Mean	SD	N
Pre-Test	Control	3.52	2.73	40
	Experimental	3.53	2.68	40
	Total	3.53	2.71	80
Post-Test	Control	3.75	0.39	40
	Experimental	4.01	0.51	40
	Total	3.88	0.45	80

Legend:

1.0 – 2.5	Very poor Communication
2.6 – 3.8	Average Communication
3.9 – 5.0	Effective Communication

Table 3 shows the descriptive statistics of the pre-test and post-test mean scores in discourse skills of the samples in control and experimental groups. Both groups have the same number of students (40) with the total sample of 80. The Pre-test mean scores of the control and experimental groups are 3.52 (*SD*=2.73) & 3.53 (*SD*=2.68) respectively with a mean of 3.53 (*SD*=2.71) (average skills in effective communication). On the other hand, based on the post-test mean scores, the experimental group had a higher mean score of 4.01(Very Effective in Communication) (*SD*=0.51) compared to the control group with mean score of 3.75 (Average Skill in Effective Communication) (*SD*=0.39) having an average mean of 3.88 (*SD*=0.45).

The above data implies that the intervention applied had been very effective as reflected in the mean scores of both groups. It was made through the questionnaire that was given to the samples before and after the intervention. In addition, students were eager to increase their skills through oral participation by showing their interests through classroom discussion where they were able to freely express themselves in the topics and questions given to them. Moreover, the use of multi-media added interests to the students (Aljazzaf, 2020). It was found out that students were more motivated if they were given enough time to participate in class discussion. Project Eureka Intervention was successful in shifting teachers' conduct toward more constructive classroom conversation. The finding was particularly noteworthy because a comparison with the CTM revealed that, in the absence of such intervention, teachers tended to narrow their discourse practices (in the form of closed questions and simple feedback) towards more teacher-centered forms of discourse throughout the school year. The results of this study further showed positive changes in students' experiences of autonomy, competence, and social relatedness as well as intrinsic learning motivation, when their teacher used the Project Eureka intervention as being discussed also in the work of Goss and Sonnemann (2017) that students learn better when they participate. The results demonstrated the importance of productive classroom discourse in promoting positive learning outcomes for students' motivational orientations and its role in fostering student interest in English subject. This affirms the study of Murphy et al. (2018) that the development of discourse skills promotes high level of classroom comprehension and learning. Aside from the mean score, which showed that the intervention was effective, overall achievement of students was improved, both oral and written through the process of discourse where they were given enough time to answer subjectively, and in written form which was made through the given examination, where they had to choose the best and correct answer from the given choices.

The results of this undertaking were supported by the research findings of August et.al (2010). Their project was called "QUEST," and they used the same tactics. As a result, regardless of whether students were English Language Learners or native English speakers, the QUEST intervention improved their performance. Furthermore, the QUEST intervention had a beneficial impact on students' Science and Vocabulary outcomes, as evidenced by curriculum-based assessments. Furthermore, the QUEST intervention had beneficial benefits on students' Science and Vocabulary results, as evidenced by curriculum-based assessments that mirrored the material taught in both the treatment and control portions.

Indeed, with the corroboration of other research studies in introducing intervention project and with its positive impact, the intervention is commendable.

Table 4. ANCOVA Tests of Between-Subjects Effects of Discourse Skills Test (Dependent Variable: Post-Test).

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2.005[a]	2	1.002	4.950	.009	.114
Intercept	8.920	1	8.920	44.052	.000	.364
PRETEST	.653	1	.653	3.224	.076	.040
GROUP	1.325	1	1.325	6.541	.013	.078
Error	15.592	77	.202			
Total	1222.725	80				
Corrected Total	17.597	79				

R^2 = 0.114 (Adjusted R^2 = 0.091)
Legend:

0.01 - 0.05	small effect
0.06 - 0.13	medium effect
0.14 and above	large effect

Table 4 shows the ANCOVA results of test between-subject effects in the post-test mean scores of the control and experimental group in Discourse skills test. The results have shown a significance value of 0.013 (*F=6.541*) which is lower than the significance value of 0.005. This only explains that the post-test mean score of the experimental group is significantly higher than the control group. Thus, it implies that the use of the Project Eureka intervention is effective in honing Discourse skills among learners. The result affirms the study of O'Connor et. al. (2013) that classroom discourse interventions showed greater gains from pre- to post-tests than those who received direct instruction without a focus on classroom discourse. Similarly, Reeve et al. (2019) confirmed on the issue that students' engagement was greatly observed aside from a positive result of this study.

CONCLUSION

Even with the various pedagogical approaches in education, it is undeniable that the quest for best teaching methodology is unending. Nonetheless, not all English classrooms experience almost the same problem, therefore, varied approaches or interventions should be implemented to address each specific challenge.

The Integrated Project Eureka Intervention (IPEI) as being studied in this investigation showed a positive result in improving students' discourse skills. This communicative skill is considered as a very important competency in Humanities and Social Sciences (HUMSS) which centers in law, governance, public administration, and other related programs (De Vera & De Vera, 2018).

Since that experimentation was only done in one month for a specific competency, it is recommended that this will be extended into a longer timeframe to fully determine the dosage of the intervention.

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AUTHORS' CONTRIBUTION

A.G.B.L. is the main researcher and the classroom implementer, G.V.V.B planned the research design and served as the Statistician of the study and conducted the data analysis, and E.R.V. served as the consultant and the language expert.

CONFLICT OF INTEREST

This investigation holds no conflict of interest across and between the samples of the investigation, institution where it was conducted, and other affiliations.

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Perceptions and Predictors of Science Motivation Under the Realm of Self-Determination Theory Among Grade 10 Public School Students

Andrew M. Famero[1,2]

ABSTRACT

This research was aimed at finding out the perceptions and predictors that motivate students to study science under the realm of Self-Determination Theory (SDT). Results revealed that students have average perception of satisfaction in terms of personal-related factors such as autonomy, competence and relatedness and high level of intrinsic motivation in terms of science motivation. Multiple linear regression analysis showed that teacher's competence, parental support, teacher's classroom management and autonomy have been found to significantly predict science motivation. Intrinsic motivation emerged as best predictor of student's intention to take Science, Technology, Engineering and Mathematics (STEM) course.

Keywords: *science motivation, intrinsic motivation, self-determination theory, autonomy, competence, relatedness*

INTRODUCTION

One of the most potent factors that educators can consider in improving student's learning is motivation. Understanding the determinants that affect student's motivation to study science is crucial for reforming school program, improving learning, and boosting career choice. Factors such as autonomy, competence, and relatedness which according to some psychologists, are all personal-related universal necessities needed by an individual to be motivated and eventually succeed in life (Deci et al., 2001). The widely researched Theory of Self-Determination proposed by Deci and Ryan supports this notion. Glynn et al., (2009) also points that intrinsic motivation, self-efficacy, self-determination, grade motivation and career motivation are all theoretical constructs that relate to student's science motivation. Social-related factors such as teacher's influence (Furrer et al., 2014), attitude, and classroom management can be strong motivators. School's facilities like library (Gbemi-Ogunleye, 2016) and laboratory (Akande, 2017), parents' involvement and support (Katz, 2011) and internet, gadgets (Silius, 2010; Boyer, 2009) and student's exposure to science inventions can be potent social-related motivators.

This study was conducted to find out the perceptions of the respondents towards personal-related factors of science motivation in terms of autonomy, competence, and relatedness and determine the level of science motivation in terms of intrinsic motivation, self-efficacy, self-determination, grade motivation, and career motivation. It also aimed to discover whether the social-related factors such as the teacher, school, parent, media, and the personal-related factors such as autonomy, competence, and relatedness significantly predict science motivation. This study also sought to shed light which among the components of students' science motivation significantly predict students' intention to take STEM.

METHODOLOGY

Locale, Population and Time of Study

This study was conducted in Tablas Island, Province of Romblon. The respondents were grade 10 students randomly selected from 9 municipalities where the 23 public secondary schools were located namely Odiongan, San Andres, Calatrava, San Agustin, Sta. Maria, Alcantara, Santa Fe, Looc, and Ferrol from October 2017 to December 2017 (Table 1).

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Instruments Used

Basic Psychological Need Satisfaction Scale (PNS). It is a 21-item instrument developed by (Deci & Ryan, 2000). It was used to assess the autonomy, perceived competence and relatedness of student. The questionnaire addresses need satisfaction. It is calculated by computing three subscale scores, one for the degree to which person experiences satisfaction of each of the three needs. This is done first by reversing scores of all items that are worded in a negative way (i.e., the items below with (R) following the items number). To reverse score an item was simply subtracted from 8. Thus, for example, a 2 would be converted to a 6. Once the scored items have been reversed, simply average the items on the relevant subscale were averaged. They are:

Autonomy: 1, 4(R), 8, 11(R), 14, 17, 20(R)
Perceived Competence: 3(R), 5, 10, 13, 15(R), 19(R)
Relatedness: 2, 6, 7(R), 9, 12, 16(R), 18(R), 21
The scale is:

1	2	3	4	5	6	7
Not at all true		Somewhat true			Very True	

Table 1. Population and Respondents of the study by school.

Name of School	Population	Number of Respondents
Alcantara National High School	208	26
Buenavista National High School	65	8
Cabolutan National High School	44	6
Calatrava National High School	160	20
Carmen National High School	51	6
Eduardo Moreno National High School	56	7
Esteban Madrona National High School	99	13
Ferrol National High School	85	11
Guinbirayan National High School	99	13
Libertad National High School	130	16
Looc National High School	425	54
Mayha National High School	71	9
Melodias Imperial National High School	30	4
Odiongan National High School	303	38
Pascual Catajay National High School	37	5
San Agustin National High School	96	12
San Andres National High School	201	26
Sta Maria National High School	101	13
Sta Fe National High School	232	29
Sto Niño National High School	46	6
Tanagan National High School	101	13
Tranquilino Cawaling National High School	49	6
Tugdan National High School	60	8
Total	**2,749**	**349**

Science Motivation Questionnaire (SMQ). It is a 25-item instrument developed by Glynn (2011), which will better understand about what and how students feel about science courses or subjects. It contains statements or items about intrinsic motivation, self-efficacy, self-determination, grade motivation and career motivation. The scales were 4-Always; 3-Often; 2-Sometimes; 1-Rarely; and 0-Never.

Social Factor Questionnaire. It is a self-made instrument used to measure the perceptions of students towards the social factors of science motivation. The indicators were taken from other materials relevant to the study. The rating scales are 4-Strongly Agree, 3-Agree, 2-Disagree, and 1-Strongly Disagree. The questionnaire was subjected to validation by experts and reliability test using Cronbach's Coefficient Alpha.

Data Analysis

The descriptive quantitative method of research was used. Mean was used to determine the perceptions of the respondents towards personal-related factors and their level of science motivation. Since the two main constructs include perceptions-BPNSS tool and predictions, multiple linear regression analysis (MLRA) and logistic regression were used. The MLRA was used to determine which social and personal-related determinants such as teacher, school, parent, media, autonomy, competence, and relatedness best predicts the science motivation of students while logistic regression was used to assess which among components of science motivation significantly predict student's intention to take Science, Technology, Engineering, and Mathematics (STEM) course/track.

RESULTS AND DISCUSSION

Perceived Satisfaction of the Respondents in Terms of Autonomy, Competence and Relatedness

In general, grade 10 students were satisfied with the personal-related factors such as autonomy, competence, and relatedness (M = 4.35, SD = 1.69). Most of the students are generally open in expressing their ideas and opinion while some felt the need of following what others have told them to do. In addition, students feel satisfied with their competence in learning science through developing interesting new skills. However, it should also be noted that there are some students who felt that they were not able to showcase their full capabilities. Lastly, most of the students believed that people in their lives are concerned about their well-being while there are some who expressed negative relatedness towards other people.

Table 2. Level of satisfaction of the respondents on basic psychological needs in terms of autonomy, competence, and relatedness.

Personal-Related Factors		Mean	DI	SD
A. Autonomy				
1.	I feel like I am free to decide for myself how to live my life.	3.83	S	1.82
2.	I feel pressured in my life	4.41	S	1.80
3.	I generally feel free to express my ideas and opinions.	4.60	S	1.80
*4.	In my daily life, I frequently have to do what I am told.	3.76	S	1.62
5.	People I interact with on a daily basis tend to take my feelings into consideration.	4.28	S	1.47
6.	I feel like I can pretty much be myself in my daily situations.	4.17	S	1.72
*7.	There is not much opportunity for me to decide for myself how to do things in my daily life.	3.91	S	1.80
	Overall	**4.14**	S	1.72
B. Competence				
*1.	Often, I do not feel very competent.	4.61	S	1.49
2.	People I know tell me I am good at what I do.	4.19	S	1.72
3.	I have been able to learn interesting new skills recently.	5.18	MS	1.67
4.	Most days I feel a sense of accomplishment from what I do.	4.43	S	1.54
*5.	In my life I do not get much of a chance to show how capable I am.	4.13	S	1.62
*6.	I often do not feel very capable.	4.52	S	1.49
	Overall	**4.51**	S	1.59
C. Relatedness				
1.	I really like the people I interact with.	4.33	S	1.80
2.	I get along with people I come into contact with.	3.91	S	1.69
*3.	I pretty much keep to myself and don't have a lot of social contact.	4.37	S	1.80
4.	I consider the people I regularly interact with to be my friends.	5.04	S	1.72
5.	People in my life care about me.	5.26	MS	1.86
*6.	There are not many people that I am close to.	4.25	S	1.88
*7.	The people I interact with regularly do not seem to like me much.	4.45	S	1.56
8.	People are generally pretty friendly towards me.	4.86	S	1.76
	Overall	**4.56**	S	1.76
	General Overall Level of Satisfaction	**4.35**	S	1.69

Negative statement. Scored in reverse.

Legend:

Mean	Descriptive Interpretation (DI)
5.81 – 7.00	Very Satisfied (VS)
4.61 – 5.80	More Than Satisfied (MS)
3.41 – 4.60	Satisfied (S)
2.21 – 3.40	Partially Satisfied (PS)
1.00 – 2.20	Not At All Satisfied (NS)

Table 3. Level of science motivation of the respondents in terms of intrinsic motivation, self-efficacy, self-determination, grade motivation and career motivation.

Level of science motivation of respondents.		Mean	DI	SD
A. Intrinsic motivation				
1.	The science I learn is relevant to my life.	2.61	A	.92
2.	Learning science is interesting.	2.92	H	1.00
3.	Learning science makes my life more meaningful.	2.66	A	.96
4.	I am curious about discoveries in science.	2.84	H	1.03
5.	I enjoy learning science.	2.89	H	.98
	Over all	**2.78**	**H**	**.98**
B. Self-efficacy				
1.	I am confident I will do well on science tests.	2.58	A	1.02
2.	I am confident I will do well on science labs and projects.	2.51	A	.99
3.	I believe I can master science knowledge and skills.	2.28	A	.94
4.	I believe I can earn a grade of "100" in science.	2.15	A	1.08
5.	I am sure I can understand science.	2.62	A	.95
	Overall	**2.43**	**A**	**1.00**
C. Self-determination				
1.	I put enough effort into learning science.	2.63	A	.99
2.	I use strategies to learn science well.	2.50	A	1.00
3.	I spend a lot of time learning science.	2.35	A	.91
4.	I prepare well for science tests and labs.	2.36	A	.99
5.	I study hard to learn science.	2.72	H	.91
	Overall	**2.51**	**A**	**.97**
D. Grade Motivation				
1.	I like to do better than other students on science tests.	2.30	A	.96
2.	Getting a good science grade is important to me.	3.32	H	.94
3.	It is important that I get "100" in science.	2.54	A	1.22
4.	I think about the grade I will get in science.	2.85	H	1.00
5.	Scoring high on science tests and labs matters to me.	2.54	A	.98
	Overall	**2.71**	**H**	**1.02**
E. Career Motivation				
1.	Learning science will help me get a good job.	2.80	H	1.07
2.	Knowing science will give me a career advantage.	2.71	H	1.03
3.	Understanding science will benefit me in my career.	2.68	H	1.03
4.	My career will involve science.	2.38	A	1.10
5.	I will use science problem-solving skills in my career.	2.37	A	1.00
	Overall	**2.59**	**A**	**1.05**
	General Overall Level of Motivation	**2.60**	**A**	**1.00**

Legend:
Mean Descriptive Interpretation (DI):

2.68 – 4.00	High (H)
1.34 – 2.67	Average (A)
0.00 – 1.33	Low (L)

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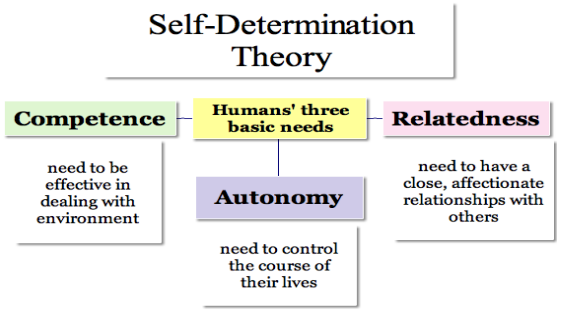

Figure 1. Deci and Ryan's Model of Self-Determination Theory (Deci & Ryan, 2000).

Overall, the results above implied that the grade 10 students are satisfied with what they feel about autonomy (*M* = 4.14, *SD* = 1.72), competence (*M* = 4.51, *SD* = 1.59) and relatedness (*M* = 4.56, *SD* = 1.76). This supports the Deci and Ryan's Self-Determination Theory (SDT), which explains that people have three basic innate psychological needs that are considered universal: autonomy, competence, and relatedness (Niemic & Ryan, 2009). Without satisfying these basic needs of students as what Abraham Maslow has also theorized in his Hierarchy of Needs, success in life cannot be possibly achieved. In Figure 1, the theory specifies that motivation can be achieved when autonomy, competence and relatedness are satisfied. (Lavigne, 2007). It is thru satisfying student's needs that will trigger self-determined behavior (Deci & Ryan, 2000).

Level of science motivation of the respondents in terms of intrinsic motivation, self-efficacy, self-determination, grade motivation and career motivation

Results in Table 3 indicate that the level of science motivation of grade 10 students is high in public secondary schools (*M* = 2.60, *SD* = 1.00). Based on the results, all the intrinsic factors given (Table 3) contributed to the motivation of students in learning science. Learners are more motivated especially if they find the subject interesting (*M* = 2.92, *SD* = 1.00) and relevant in their lives (*M* = 2.61, *SD* = 0.92). Moreover, self-determination (*M* = 2.51, *SD* = 0.97) helped a lot in increasing the motivation of learners. By giving more time in studying and learning science, it increased the confidence and competitiveness of students (*M* = 2.43, *SD* = 1.00). They tend to be more conscious with their grades as well as the grades of their classmates (*M* = 2.71, *SD* = 1.02). Lastly, the students believe that their knowledge in science will helped them in securing a job and advancing in their careers (*M* = 2.59, *SD* = 1.05).

It is interesting to note that intrinsic motivation (*M* = 2.78, *SD* = 0.98) was found to be the highest motivational variable. It is also the best predictor in grade 10 student's intention to take STEM course after graduation in high school which can be gleaned in Table 7. Highly controversial intrinsic motivation studies supported this finding. The study of Deci et al., (2001) emphasized that extrinsic rewards such as gold stars, best-student awards, honor roles, pizzas for reading, and other reward-focused incentive systems that have long been part of the currency of schools have demonstrated negative effects on students' intrinsic motivation to learn. Some studies have suggested that, rather than always being positive motivators, rewards can at tines undermine rather than enhance self-motivation. The studies of intrinsic motivation under SDT, strongly suggests that intrinsic motivation is a factor to develop self-determined behavior (Lavigne, 2007). Trenshaw (2016) pointed out that being intrinsically motivated means that a student has a sense of own free will to act out of own values (Deci & Ryan, 2000; Niemic & Ryan, 2009).

Multiple Linear Regression Analysis of the Social-Related Factors and the Personal-Related Factors

Table 4. Regression analysis of the social-related factors and the personal-related factors.

Model	Coefficients				
	B	Std. Error	Beta	t	Sig.
Constant	-.738	.246		-2.99	.003
Teacher's Competence	.434	.070	.342	6.236	.000
Parental Support	.270	.058	.216	4.647	.000
Teacher's Classroom Management	.251	.069	.199	3.643	.000
Autonomy	.090	.043	.089	2.099	.037

Legend:
Dependent Variable: Motivation, R = 0.642, R^2 = 0.413

To find out which factors significantly predict science motivation of grade 10 students, all the personal-related and social-related factors were regressed using the multiple linear regression analysis (MLRA). In Table 4, regression model shows that among the predictors of student's science motivation, only four factors significantly entered the regression equation. These are teacher's competence, teacher's classroom management, parental support, and autonomy. Teacher's competence, B = 0.434, *t* = 6.236, *p* = < *0.05*, parental support, B = 0.270, *t* = 4.647, *p* = < 0.05, teacher's classroom management, B = 0.251, *t*=3.643; *p* = < 0.05 and autonomy, B = 0.090, *t* = 2.099, *p* = 0.037<0.05.

The direction of relationship is positive thus, the predicted science motivation can be estimated using the following regression equation:

$$Predicted\ ScienceMotivation\ Score = -0.738 + 0.434 + 0.270 + 0.251 + 0.90.$$

Table 5. Analysis of Variance (ANOVA)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	55.118	4	13.780	60.393	0.000[d]
Residual	78.489	344	0.228		
Total	133.607	348			

Results showed that for every unit increase in teacher's competence, parental support, teacher's classroom management and autonomy there is a corresponding increase of 0.434, 0.270, 0.250, and 0.090 in their science motivation score, respectively. Other social and personal factors which were reported to be also playing significant roles were not found to be significant predictors. The Analysis of variance (Table 5) and multiple regression analysis (Table 6) showed that the equation is highly significant, and that science motivation may be predicted or regressed from the four variables that entered the equation (R^2 = 0.413, F = 60.393, $p < 0.01$). This means that 41.3% of the variability in science motivation could be explained by the variables included in the above equation.

Several studies supported these findings. Brophy (2004) revealed that teacher's competence are significant predictors of science motivation. The core of professional science education is competence. In science education, teacher's competence is a key component of teacher's professionalism and competence, which lead to highly motivated students. The study of Zahedani et al., (2016) also supported that parental support is one factor that influence children's motivation to study. Students whose parents are interested in science perform better than students whose parents do not show interest (Tubingen, 2017). Teacher's classroom management has greater influences on student's science achievement (Cockman, 2002). Students are eager to learn, willing to undertake activities and attend classroom punctually and regularly if teacher's management style is effective.

Table 6. Multiple Linear Regression Model Summary

Model	R	R^2	Adjusted R^2	Std Error of the Estimate
1	0.572	0.327	0.325	0.50904
2	0.619	0.383	0.379	0.48828
3	0.636	0.405	0.400	0.48002
4	0.642	0.413	0.406	0.47767

Table 7. Logistic Regression predicting intention of students to take STEM course/track in Senior High School.

	B	**S.E.**	**Wald**	***df***	***p***	**Odds Ratio**	**95.0% C.I for Odds Ratio**	
							Lower	**Upper**
Intrinsic Motivation	.629	.269	5.458	1	.019	1.876	1.107	3.180
Self-Efficacy	.093	.293	.101	1	.750	1.098	.618	1.949
Self-Determination	.282	.325	.757	1	.384	1.326	.702	2.505
Grade Motivation	.072	.289	.063	1	.802	1.075	.610	1.894
Career Motivation	.529	.286	3.420	1	.064	1.698	.969	2.976
Constant	-4.972	.662	56.362	1	.000	.007	-	-

Effective teacher should plan adequate science activities to maintain the zeal or motivation of the class. It is recommended that teacher should endeavor to introduce motivation ideas related to science concepts like frequent debates and quiz competitions. In autonomy, the more teachers support students to participate in science activities, the more autonomously motivated they will be (Reeve, 2009). Several researchers concluded that autonomously motivated students has higher academic achievement (Black, 2000). Interestingly, students who has higher sense of autonomy were more likely to have higher motivation to learn science.

Predicting Intention of Students to Take STEM Course/Track in Senior High School (SHS)

Direct logistic regression assessed the impact of number of factors on the likelihood about student's intention to take STEM in Senior High School (SHS). The model contained five independent variables (intrinsic motivation, self-efficacy, self-determination, grade motivation and career motivation). The full model containing all predictors was statistically significant, X^2 (5, 349) = 64.971, $p < 0.001$, indicating that the model was able to distinguish between

respondents who intended and did not intend to take STEM in SHS.

It can be gleaned in Table 7 that only one of the independent variables made a unique statistically significant contribution to the model (intrinsic motivation), which reported and odds ratio of 1.876. This indicated that respondents' high intrinsic motivation were over 1.876 times more likely to take STEM course/track. In Tables 8, 9, and 10 the model explained between 17% (Cox and Snell R^2) and 23.3% (Nagelkerke R^2) of the variance in intention to take STEM, and correctly classified 72.2% of cases.

Table 8. Omnibus Tests of Model Coefficients

		Chi-Square	df	Sig.
Step 1	Step	64.971	5	0.000
	Block	64.971	5	0.000
	Model	64.971	5	0.000

Table 9. Model Summary

	-2 Log likelihood	Cox & Snell R^2	Nagelkerke R^2
Step 1	390.373[a]	0.170	0.233

Table 10. Classification Table

	Observed		Predicted		
			Intention to take STEM		Percentage Correct
			No	Yes	
Step 1	Intention to take STEM	No	193	31	86.2
		Yes	66	59	47.2
		Overall Percentage			72.2

Discussing further, these findings may be brought about by grade 10 student's exposure in numerous computer-related and advanced science activities which are interesting, enjoyable, and challenging in public secondary schools in Tablas Island. Intrinsic motivation has something to do with individual's satisfaction and enjoyment in doing an activity (Deci et al., 2001). Most grade 10 students are enjoying and highly engaged in science–related computer technologies today (Hassan, 2012). Intrinsically motivated people intend to take science-related courses out of interest and innate satisfaction. In fact, tangible rewards like grades and money do indeed have a substantial undermining effect (Deci et al., 2001). Intention of students to take STEM course is significantly related to intrinsic motivation as described by Deci and Ryan where autonomy, competence and relatedness are considered as fuel for action to satisfy one's innate needs (Deci & Ryan, 2000).

Niemic and Ryan (2009) and Deci et al., (2001) described intrinsic motivation as the desire of every man to enjoy while working. Glynn (2011) explained that intrinsic motivation is student's inherent satisfaction to learn science by his own. In other words, individual or student's intention to take STEM course as in the case of grade 10 students to enter the Senior High School in Tablas Island are decisions or forces not externally dictated by others but by their own choice.

Finally, Hassan (2012) and Pascual (2014) concluded that students with high levels of interest in science thru teacher's support will most likely pursue their study on science and mathematics careers. Students who have high motivation in learning science will most likely pursue science career or intend to take STEM course/track.

CONCLUSION

Based on the results of the study, grade 10 students in Tablas Island have an average perception of satisfaction in terms of their personal-related factors such as autonomy, competence, and relatedness. The level of science motivation is high in intrinsic motivation and grade motivation. Teacher's competence, parental support, teacher's classroom management and autonomy have been found to significantly predict science motivation of students.

Among the components of students' science motivation, intrinsic motivation best predicts students' intention to take STEM-related courses in college. To improve students' intrinsic motivation, concerned authorities and professionals in the field of education should conduct forum and seminars on Self-Determination Theory which will empower students how to satisfy basic psychological needs such as autonomy, competence, and relatedness. On the other hand, intrinsic motivation, and grade motivation, should be maintained. Regarding the findings that teacher's competence, parental support, teacher's classroom management, and autonomy significantly predict science motivation, school officials should recruit competent teachers to handle and manage STEM courses/strands thereby improving science motivation of students.

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CONFLICT OF INTEREST

The Author declare that there is no conflict of interest.

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Effects of Four Teaching Strategies on the Academic Performance of Senior High School Students

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ABSTRACT

Determining the effects of four teaching strategies on the academic performance of senior high school students was the main objective of this study. The quasi-experimental design, specifically the equivalent pretest-posttest design was used. A grade-11 class was divided into four sections, the three sections served as the experimental classes subjected to game-based, outcome-based, and technology-based teaching strategies, and one section served as the control group who undertook the traditional teaching method. Results showed that all groups were at a "*satisfactory*" level of performance before the treatment. Although the means of the experimental groups increased a little than that of the control group after the treatment, still all groups were at a "*satisfactory*" level. Before treatment, all groups were comparable, but difference was observed after the treatment. Improvement from pretest to posttest performance of the experimental groups and control group was found for outcome-based and traditional teaching methods. However, no significant statistical differences were found between the pretest-posttest for the other pairings. The utilization of outcome-based teaching strategies is an effective way of enhancing the level of performance of students in Mathematics compared to other teaching strategies. In the mean gain scores, statistical significance existed in the mathematics performance of the experimental groups and control group. Students exposed to outcome-based strategy performed better than those students who are exposed to other teaching strategies; while game-based, outcome-based, technology-based, and traditional teaching methods also improved the mathematics performance of students.

Keywords: *game-based, outcome-based, technology-based, traditional teaching method, mathematics performance*

INTRODUCTION

In the Philippines, the K to 12 Senior High School (SHS) curriculum started its implementation only in 2016. It is composed of four tracks: 1) Academic; 2) Technical-Vocational-Livelihood; 3) Arts and Design, and 4) Sports. Two of the core subjects required to be taken by all senior high school (SHS) students in any track and strands are mathematics subjects namely, General Mathematics and Statistics and Probability. It is expected that several problems in teaching and learning mathematics will arise since both the teachers and students are still in the adjustment period.

Jaudinez (2019) emphasized that teaching SHS Mathematics must embark on a learner-centered, contextualized, and relevant curriculum. In targeting the goals of the Department of Education (DepEd), teachers must be flexible enough and should learn to adapt to the new curriculum despite the several problems encountered during its implementation. She also revealed that there was a lack of recommended teaching strategies for difficult topics in mathematics. Also, she recommended that teachers should bestow tirelessly all their efforts in employing teaching and assessment strategies, and suitable instructional resources in SHS mathematics to fit lessons in the functional skills and college readiness standards, foundational skills articulated by DepEd, and Commission on Higher Education (CHED), respectively.

Since most of the teachers in senior high school came from junior high school, they should be fully aware that their students are matured enough compared to junior high school students. So, it is a challenge to them on how to match the teaching and learning approach to the level of maturity and intelligence of the learners. Thus, the DepEd conducted several pieces of training and seminars in mathematics to equip the teachers with the necessary knowledge and skills to prepare them for this new educational transition. Educational institutions are trying to devise effective

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teaching strategies that would best fit the abilities, skills, and interests of the learners.

It is noticeable that most of the grade 11 students have a negative attitude towards the subjects. Also, the student's poor performance had been attributed to their lack of mastery and basic skills. When the researcher asked the students why they act like that, their responses would be: 1) they believe that mathematics is a difficult subject; 2) they think that mathematics is a boring subject; 3) they cannot relate to the new lessons because they say that some of the lessons from junior high school mathematics were not yet tackled, and 4) they feel that they are not good enough in this subject. Besides, the mean percentage score of grade 11 students in mathematics for almost four years of senior high school operation is below 50%. This is an alarming situation. Although there might be several factors that affect the interest of the students in learning mathematics, it is indeed a challenge to the teachers on how they are going to achieve the target learning competencies in mathematics.

Teaching and learning strategies involve whole class, group, and individual activities that could develop and create different abilities, skills, learning rates, and styles that would help students to participate actively and to attain success. Since most of the schools are already provided with the needed tools and equipment like LED monitors, LCD projectors, and computers, these can be used to deliver quality education to the learners. The use of technology in the teaching and learning process can be employed. Another, with a higher maturity level, discovery approach through outcome-based education, perhaps, would be appropriate for them. Of course, learning while having fun through game-based learning would also be a great strategy for learners to interact actively. Literature and studies also revealed a positive effect of games on the academic performance of the students.

Further, there are only a limited number of studies regarding effective teaching strategies for senior high school students in the Philippines. Hence, the researchers would like to investigate several teaching strategies to determine which of these are most helpful and most appropriate to senior high school students.

The teacher is an important factor in the success of students (Baptiste, 2019; Meyers et al., 2019; Anderson, et al, 2020; Kawuryan, et al., 2021). It is relevant to further improve the quality of teachers to enhance the quality of the teaching and learning process. One of the subjects taught in school is mathematics. It plays an important role in the development of an educational system. However, problems in teaching this subject arise. Thus, the teacher devises several teaching strategies to ensure that the students can cope with the lessons. Since there are different types of learners, it is their task to motivate and encourage learners to actively engage in the teaching and learning process. One of the teaching strategies that could change the negative impression of the students in mathematics is game-based. Most of the studies revealed that games had an impact on the interest of the students. It was recommended to be part of the DepEd curriculum and that teachers should be equipped with the necessary skills and knowledge on how to conduct this classroom intervention. Also, research studies stated that games provide students with opportunities to develop their skills and talents, develop workmanship and sportsmanship, and could bring fun and enjoyment. Another teaching strategy that could help the students to become independent is outcome-based. Some studies stated that outcome-based is useful in terms of academics, attitude, and instruction. It is an individualized instruction since it focuses on the outcomes of the students. However, there were problems encountered especially in the submission of requirements of the students to the teachers. Nowadays, with the provision of Information and Communication Technologies (ICT) tools and equipment, technology-based would also be an appropriate teaching strategy. Most of the studies revealed that technology-based is more effective compared to the traditional teaching method. Moreover, in this digital age, the students are more interested in the use of technology since they are aware of the latest trends in ICT integration. Many teaching strategies could probably help the students to achieve their full potential. The challenge is how teachers are going to match these strategies to the learning styles of the students.

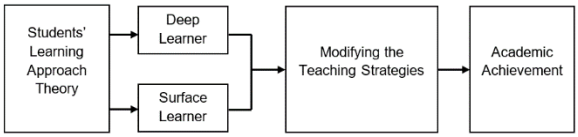

Figure 1. The student learning approach theory by Marton and Saljo (Macloone & Oluwadun, 2014).

Figure 1 explicates that learner can be classified based on the learners' approach to ascertain the student's depth of understanding (Mcloone & Oluwadun, 2014). This study used the student approaches to learning as a theory to examine differences in learning processes among students. The student's responses about their learning process were compared to their level of understanding. The original work on the learning approach was a phenomenography approach that involves obtaining descriptions of people's experiences and performing qualitative analysis to categorize and examine the relationship among them. The first group that was associated with a deep level of understanding and consequently a good learning

outcome was identified as deep learners. Whereas the second group that was associated with a low level of understanding and poor learning outcomes was identified as surface learners (Mcloone & Oluwadun, 2014).

Maslow's hierarchy of needs theory was used also in this study. Needs lower down in the hierarchy must be satisfied before individuals can attend to needs higher up. From the bottom of the hierarchy upwards, the needs are physiological, safety, love and belonging, esteem, and self-actualization (McLeod, 2020). Furthermore, it has made a major contribution to teaching and classroom management in schools. This theory served as a basis in this study since it used teaching strategies to help achieve student's full potential.

Another theory that is crucial to this study is Bloom's Taxonomy. This study used teaching strategies that will help identify the student's cognitive learning abilities based on the six domains of learning. Besides, it was used to assess the level of abilities and skills of the students depending upon the strategies that will be employed.

Chandio and colleagues (2016) recommended that Bloom's Taxonomy should be incorporated in both the teaching and learning process and assessment practices. Also, Forehand (2011) stated that Bloom's Taxonomy provided the measurement with the dramatic changes in society over the last five decades, the Revised Bloom's Taxonomy provides an even more powerful tool to fit today's teachers' needs.

Nowadays, with the implementation of the new curriculum and the new ICT trends, it is a challenge for teachers how to adapt to this fast-changing environment. New teaching strategies may arise however, the most appropriate strategy that is suitable to the interest and learning abilities of the learners must be identified. Maslow's Hierarchy of Needs and the Revised Bloom's Taxonomy are truly great tools in helping the teachers and students clarify what should be done and what will be the goals and objectives to be achieved at the end of learning sessions.

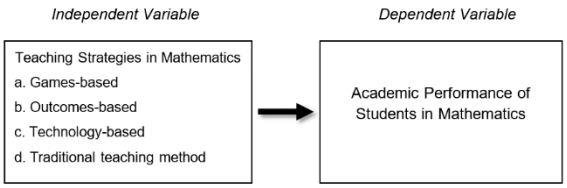

Figure 2. The paradigm of the study.

The integration of four teaching strategies which are the game-based, outcome-based, technology-based, and traditional teaching methods in teaching mathematics (Figure 2) may help encourage students to sustain their interest and work on a specific subject in a formal education setting. The integration of these four teaching strategies into schools could help reform the educational system. However, Fatta, et al., (2009) believed that new strategies cannot be blindly brought into our classrooms without carefully reviewing the process and the data that support its effectiveness. Thus, teachers should guarantee that the integration of the teaching strategies is properly and religiously implemented based on the types of learners.

The researchers wanted to investigate the effect of four teaching strategies on student's academic performance. In general, information that supports the question: What teaching strategy is the most appropriate in the learning process of senior high school students? Is being sought for. The initiative is to improve instructional competence and supervision as well as strengthening it.

METHODOLOGY

Table 1. The Pre-Test – Post-Test Control Group Design

Group		Pretest	Treatment	Post test
Experimental	Group 1	O_1	X_1	O_2
	Group 2	O_3	X_2	O_4
	Group 3	O_5	X_3	O_6
Control	Group 4	O_7		O_8

where:
O_1 – first experimental group pretest (game-based)
X_1 – first treatment/intervention (game-based)
O_2 – first experimental group posttest (game-based)
O_3 – second experimental group pretest (outcome-based)
X_2 – second treatment/intervention (outcome-based)
O_4–second experimental group posttest (outcome-based)
O_5 – third experimental group pretest (technology-based)
X_3 – third treatment/intervention (technology-based)
O_6 – third experimental group posttest (technology-based)
O_7 – control group pretest (traditional teaching method)
O_8 – control group posttest (traditional teaching method)

The quasi-experimental design specifically the equivalent pretest-posttest design was used to determine the treatment effect in the mathematics achievement of the students due to the exposure to four teaching conditions. The randomization process in selecting and assigning samples to the experimental and control groups, was not possible, hence the quasi-experimental research was employed in this study. The randomization provides an equal chance to all the comparable groups to be part of the experimentation (Sevilla et al., 2001). The model for the design is shown in Table 1.

The 80 grade 11 students at Carmen National High School were the participants of this study. The actual sectioning of grade 11 composed of block 1, block 2, block 3, and block 4 was used for the four groups. To determine which group will be assigned as an experimental and control group, simple random sampling was applied. The section name was written on a piece of paper and placed in a box. The first section that was picked was group 1, the second group 2, the

third group 3, and the fourth group 4. The number of participants in the four groups was determined by grade matching. The grade matching identified the actual participants of the study. The average of the four groups should be the same. Three to five students with an average of 90 above, ten to fifteen students with an average of 80-89, and two to three students with an average of 75-79 in General Mathematics were chosen. The researchers ensure that each student in one group has a match grade with other students in other groups. There were 20 students identified using grade matching in each group (Table 2).

Table 2. Distribution of Subjects.

Category	n	%
Experimental Group 1(Game-Based)	20	25
Experimental Group 2 (Outcome-Based)	20	25
Experimental Group 3 (Technology-Based)	20	25
Control Group (Traditional Teaching Method)	20	25
TOTAL	**80**	**100**

The researcher-made multiple-choice test was used for pretest and posttest. The initial draft was submitted for face and content validation to the panel of jurors, meticulously selected by expertise in their major field. The panels for validation were the division supervisor in Mathematics and four (4) senior high school teachers from nearby secondary schools with specialization in Mathematics. In addition, almost all of them had experience in teaching Statistics and Probability.

The full experiment procedure comprised of three stages: pre-experimental stage, experimental –with 3 sub-stages- stage, and post-experimental stage as presented in matrix form in Table 3.

The effect size was used when significant difference was found between variables which indicates the significant difference between groups. Significance of the results expresses the practical importance of a study finding as big effect size signifies that the conclusion has practical value, while a small effect size indicates limited practical implications.

RESULTS AND DISCUSSION

Level of Mathematics Performance

Before the treatment, the experimental groups which are a) game-based was in "satisfactory" level of mathematics performance (Table 4) (*M=13.65, SD=2.89*), b) outcome-based was in "satisfactory" level (*M=13.05, SD=3.61*), and c) technology-based was in "satisfactory" level (*M=13.60, SD=3.75*). The control group which is the traditional teaching method had the same "satisfactory" mathematics performance (*M=13.60, SD=3.02*). The two groups showed the same narrow dispersion of scores about the mean.

After the treatment, the experimental groups which are game-based showed the same "satisfactory" mathematics performance level (*M=21.55, SD=3.89*) outcome-based showed the same "satisfactory" mathematics performance level (*M=25.35, SD=6.79*), and technology-based showed same "satisfactory" mathematics performance level (*M=22.30, SD=5.69*). The same "satisfactory" mathematics performance level is revealed in the control group which is the traditional teaching method (*M=21.40, SD=2.58*).

Looking at the overall performance of the respondents, the experimental groups, and the control group both generated a "Satisfactory" performance before the treatment. This implies that the respondents had already prior knowledge of the topics in their previous study in Mathematics. After the treatment, although a higher mean was evident among the experimental groups and control group, still, both groups remained at a "Satisfactory" level of performance. This shows that the respondents demonstrated an improvement in their level of performance after the treatment; however, they remained in the "Satisfactory" level of performance.

Furthermore, the level of performance for each of the experimental groups and the control group is also taken into consideration. Among the experimental groups, respondents assigned with outcome-based got the lowest mean before the treatment. On the other hand, they got the highest mean after the treatment. This implies that the integration of outcome-based in the teaching and learning process is the most effective in enhancing the performance of the students in Mathematics.

The significance of the differences in the experiment was likewise ascertained. To determine if significant differences existed between the groups, the researcher employed Dunnett's t-test for conducting post hoc tests on a one-way analysis of variance (ANOVA). All statistical computations were set at a 0.05 level of significance to determine if the null hypotheses are to be rejected or accepted.

Table 3. Experimental Stages on the Implementation of Four Teaching Strategies.

Pre-Experimental Stage

Before the actual experimentation, the pretest was administered. After administering the pretest, the data were gathered, and the test for the difference between the two pretests. If in case those significant differences were found in the number of participants, the groups were recomposed until no significant difference will be found in the pretest performance of the participants. This procedure must be done to level the playing field before starting the experiment. The experimental stage started only until the time that the playing field was all leveled in both the experimental and control groups. The implementation of teaching strategies lasted for forty-five (45) days, two (2) hours per session twice a week, every Monday and Wednesday simultaneously.

Experimental Stage

Stage	Game-Based	Outcome-Based	Technology-Based	Traditional Teaching Method
Stage 1	**Pre-Game Discussion** This was the introduction of the lesson and the game-based activity that was integrated. The teacher presented the lesson objectives; introduced the materials to be used, the mechanics, rules, and regulations of the games, and the expected learning outcomes.	**Orientation** This was the beginning of the instruction process where the teacher orients the students of the objectives of the lesson, the outputs that will be made, the scheduled time for submission, materials to be used, and the procedures and rules to be followed.	**Introduction to the Lesson** The teacher presented the objectives of the lesson through a PowerPoint presentation.	**Introduction to the Lesson** The teacher presented the objectives of the lesson.
Stage 2	**Integration of Games** This was the stage where the students work independently or collaboratively through games. a. Truth or Dare b. Game of Thrones c. Jeopardy d. Who Wants to Be a Millionaire? e. Family Feud f. Deal or No Deal g. Who's Brainy?	**Outputs Creation** This was the stage where the students conducted research work, activities, and other tasks in creating and complying with their outputs. The tasks of the teacher here were to monitor the students and to provide assistance to them.	**Presentation of the Lesson through Video and PowerPoint Presentations** In this stage, the teacher showed videos of the lessons and gave additional discussions using PowerPoint presentations. a. The video presentation and additional discussions using PowerPoint presentations for the following topics: a.1 Random Sampling a.2 Parameter and Statistics a.3 Sampling Distributions a.4 The Central Limit Theorem a.5 Point and Interval Estimation a.6 The t-Distribution a.7 Interval Estimate of Population Mean with Unknown Variance a.8 Population Proportion a.9 Length of Confidence Interval and Appropriate Sample Size	**Presentation and Discussion of the Lesson** The teacher discussed the contents of the lesson, provided examples, and demonstrated the process, concepts, and principles of the lessons. a. Lecture Method/Conventional Approach of Teaching
Stage 3	**Post-Game Discussion** This was the stage where the teacher assessed the students learning through feedbacking, brainstorming, and allowed students to relate and connect the learning from the games to the lessons.	**Submission, Analysis, and Evaluation of Outputs** This was the stage where students submit their outputs. Also, it was the stage where the teacher rates the output of her students, gives her evaluation towards the submitted outputs, and provides feedback, recommendations, and suggestions. Outputs: a. Notebook with a written research topic as a result of the library work. b. Individual portfolio as a product of their understanding and application of their learning based on research and library works	**Learning Demonstration and Application** The teacher then provided opportunities for the students to share and demonstrate their learning based on the video and PowerPoint presentations shown.	**Application and Evaluation** The teacher provided seatwork exercises and board work activities

Post-Experimental Stage

After forty-five (45) days of teaching strategies integration and if all learning competencies were met, the posttest was administered. The scores of the participants were tabulated, compared, analyzed by the researcher. To interpret the results of the performance of the students both in pretest and posttest, the following norm was used:

Norms	Descriptive Rating
39.80-50	Excellent
29.60-39.79	Very Satisfactory
10.40-29.59	Satisfactory
9.20-10.39	Fair
0.0-9.19	Poor

Table 4. Level of Mathematics Performance of the Students Before and After the Treatment

Category	Mean	Standard Deviation	Description
A. Pretest			
Experimental			
Game-Based			
Outcome-Based	13.65	2.89	Satisfactory
Technology-Based	13.05	3.61	Satisfactory
Control	13.60	3.75	Satisfactory
Traditional Teaching			
Method	13.60	3.02	Satisfactory
B. Posttest			
Experimental			
Game-Based			
Outcome-Based	21.55	3.89	Satisfactory
Technology-Based	25.35	6.79	Satisfactory
Control	22.30	5.69	Satisfactory
Traditional Teaching			
Method	21.40	2.58	Satisfactory

Difference between Pretest Mathematics Performance of Experimental and Controlled Group

There was no statistical significant difference (Table 5) between pretest Mathematics performance of experimental groups and the controlled group as determined by one-way ANOVA [*F(3,76) = 0.145, p = 0.932*]. Therefore, the null hypothesis is accepted. This implies that before the treatment, both the experimental groups and the control group had the same level of performance.

Difference between Posttest Mathematics Performance of Experimental and Controlled Group

There was a statistically significant difference (Table 6) between the posttest Mathematics performance of experimental groups and the controlled group as determined by one-way ANOVA [*F(3,76) = 3.101, p = 0.032*]. Therefore, the null hypothesis is rejected. The overall result indicates that after the treatment, the experimental groups showed improvement in their level of performance in Mathematics. The effect size of 0.2811 means that 28.11% of the change in the mathematics performance can be accounted for by the integration of the four teaching strategies. In other words, the respondents' mathematics performance was 28.11% higher in the post-intervention manifesting a large effect size. According to McLeod (2019), the effect size is a quantitative measure of the magnitude of the experimenter effect. The larger the effect size, the stronger the relationships between two variables.

Since there is a significant difference found between the posttest on mathematics performance of the experimental and controlled group, a Dunnett's t-test post hoc test was administered. As shown in Table 7, it revealed that between the posttest mathematics performance of experimental groups and controlled groups, there is a significant difference in mathematics performance between the posttest of outcome-based and traditional teaching methods (p = 0.015). However, there was no significant difference found between the posttest on mathematics performance of the game-based and traditional teaching method (p = 0.925) and technology-based and traditional teaching method (p = 0.571). Based on the result, among the experimental groups, students assigned with outcome-based had the highest posttest performance as compared to the other control groups. Therefore, it implies that the integration of outcome-based teaching strategy is the most effective among the other teaching strategies.

Table 5. Analysis of Variance (ANOVA) Value on the Differences in the Pre-Test Mathematics Performance between the Experimental and Control Groups.

SV	Sum of Squares (SS)	Degrees of freedom (df)	Mean Squares (MS)	F-ratio	Sig.	Description	Decision	Eta squared (η^2)
Between Groups	4.85	3	1.617					
Within Groups	845.1	76	11.12	0.145	0.932	Not Significant	Accept H_o	0.005
Total	849.95	79						

Table 6. ANOVA value on the Difference between the Post Test on Mathematics Performance of Experimental and Control Groups.

SV	Sum of Squares (SS)	Degrees of freedom (df)	Mean Squares (MS)	F-ratio	Sig.	Description	Decision	Eta squared (η^2)
Between Groups	232.238	3	77.413	3.101	0.032	Significant	Reject H_o	0.2811
Within Groups	1897.15	76	24.963					
Total	2129.388	79						

Table 7. Dunnett's t-Test Value on the Difference between the Post Test on Mathematics Performance of Experimental and Control Groups.

(I) Strategies	(J) Strategies	Mean Difference (I-J)	Sig.	Description	Decision
Game-Based	Traditional Teaching	-.150	.925	Not Significant	Accept H_o
Outcome-Based	Traditional Teaching	-3.950*	.015	Significant	Reject H_o
Technology-Based	Traditional Teaching	-.900	.571	Not Significant	Accept H_o

Table 8. t-Test Value on the Difference between the Pretest and Post Test on Mathematics Performance aof Experimental and Control Group.

Teaching Strategy	Test	Mean	df	t	Sig.	Description	Decision	Cohen's d
Game-Based	Pre	13.65	19	-8.75	.000	Sig.	Reject H_o	-1.96
	Post	21.2						
Outcome-Based	Pre	13.05	19	-7.889	.000	Sig.	Reject H_o	-1.76
	Post	25.45						
Technology-Based	Pre	13.6	19	-9.537	.000	Sig.	Reject H_o	-2.13
	Post	22.3						
Traditional Teaching Method	Pre	13.6	19	-9.831	.000	Sig.	Reject H_o	-2.20
	Post	21.4						

Table 9. ANOVA Value on the Difference in the Mean Gain Scores of Experimental and Control Groups.

SV	Sum of Squares (SS)	Degrees of freedom (df)	Mean Squares (MS)	F-ratio	Sig.	Description	Decision	Eta squared (η^2)
Between Groups	302.838	3	100.946	4.317	0.007	Sig	Reject H_o	0.1456
Within Groups	1777.15	76	23.384					
Total	2079.988	79						

Table 10. Dunnett's t-Test Value on the Difference in the Mean Gain Scores of Experimental and Control Groups.

(I) Group	**(J) Group**	**Mean Difference (I-J)**	**Sig.**	**Description**	**Decision**
Game-Based	Traditional Teaching	-0.25000	0.997	Not Sig	Accept H_o
Outcome-Based	Traditional Teaching	4.60000*	0.010	Sig	Reject H_o
Technology-based	Traditional Teaching	0.90000	0.885	Not Sig	Accept H_o

Difference between the Pre-test and Posttest Mathematics Performance of Experimental and Control Group

The *t*-test for dependence results in Table 8 showed that there is a significant difference between the pretest and posttest of students assigned to game-based (p = 0.000), outcome-based (p = 0.000), technology-based (p=.000), and traditional teaching method (p = 0.000). Although the *t*-value is negative, according to Glen, you can ignore the minus sign when comparing the two *t*-values, as ± indicates the direction; the p-value remains the same for both directions. By examining the result, both the experimental groups and the control group showed an improvement after the treatment. This means that the students exposed to four teaching strategies improved their mathematics performance after the treatment.

The effect size of -1.96 of game-based means that the mathematics performance of the respondents in post-intervention was at 2.5% above the mean of their pre-intervention performance, the overlap was 32.7%, and there was an 8.3% probability that the respondents have a higher score in the posttest than in the pretest. In other words, respondents' Mathematics performance was 2.5% higher in the post-intervention manifesting a huge effect size.

The effect size of -1.76 of outcome-based means that the mathematics performance of the respondents in post-intervention was at 3.9% above the mean of their pre-intervention performance, the overlap was 37.9%, and there was a 10.7% probability that the respondents have a higher score in the posttest than in the pretest. In other words, respondents' Mathematics performance was 3.9% higher in the post-intervention manifesting a huge effect size.

The effect size of -2.13 of technology-based means that the mathematics performance of the respondents in post-intervention was at 1.7% above the mean of their pre-intervention performance, the overlap was 28.7%, and there was a 6.6% probability that the respondents have a higher score in the posttest than in the pretest. In other words, respondents' Mathematics performance was 1.7% higher in the post-intervention manifesting a huge effect size. The effect size of -2.20 of traditional teaching method means that the mathematics performance of the respondents in post-intervention was at 1.4% above the mean of their pre-intervention performance and the overlap was 27.1% and there was a 6% probability that the respondents have a higher score in the posttest than in the pretest. In other words, respondents' Mathematics performance was 1.4% higher in the post-intervention manifesting a huge effect size.

The difference in the Mean Gain Scores between the Experimental and Control Group

A statistically significant difference in the mean gain scores between the experimental groups and the control group (See Table 9) as determined by one-way ANOVA [$F(3,76) = 4.317, p = 0.007$]. This implies that the mean gain of the four teaching strategies was different from each other. The effect size of 0.1456 means that 14.56% of the change in the mean gain scores can be accounted for by the integration of the four teaching strategies. In other words, the group's mean gain scores were 14.56% higher in the post-intervention manifesting a large effect size.

Since the significant difference was found in the mean gain scores between the experimental and controlled groups, a Dunnett's t-tests post hoc test was administered. On the difference in the mean gain scores of experimental groups and controlled groups (Table 10), there is a significant difference in the mean gain scores of outcome-based and traditional teaching methods (p = 0.010). However, there was no significant difference found in the mean gain scores of the game-based and traditional teaching methods (p = 0.997) and technology-based and traditional teaching methods (p = 0.885). Since outcome-based teaching strategy had the highest mean gain score after the treatment; it is an indication that an outcome-based teaching strategy is the most effective among the four teaching strategies. Large effect size was also observed between the mean gains of the four teaching strategies.

CONCLUSION

With the results presented it is safe to conclude that the respondents before the treatment had a "satisfactory" level of mathematics performance. The same level of Mathematics performances among the groups is comparable. The respondents, after the treatment had a "satisfactory" level of mathematics performance and they had maintained the same level of conceptualization that they had before treatment. Both groups have the same level of mathematics performance from the start of the treatment. Students exposed to outcome-based performed better than students who are exposed to other teaching strategies after the treatment. Game-based, outcome-based, technology-based, and traditional teaching methods significantly improved the mathematics performance of students as shown in their mean gain scores; hence, these can be alternative strategies inside the classroom if all the needed resources are available. However, among the four teaching strategies, outcome-based had the highest mean gain scores.

It must be noted that the participant in this study that are on the same section but not match paired in terms of their grade were still in the group, but their

performance is not included in this study, only in the personal records of the teacher.

AUTHORS' CONTRIBUTION

J.T.L.: Conceptualization, methodology, validation, formal analysis, writing original draft, supervision. J.C.P: Conceptualization, formal analysis, investigation, writing original draft.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Development of Romblomanon Legends in Comic Book Form as Mother Tongue-Based Online Supplementary Learning Resource Material in Asi, Onhan and Ini Languages

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ABSTRACT

This study aimed to develop the Romblon legends in comic book form. Specifically, it aimed to investigate the background of Romblomanon legends in the three languages that could be used for promoting Filipino values of children who are still in the process of assimilating the culture of Romblon, investigate ways to conserve and develop these legends into a comic book form and determine the rating of the comic book as supplementary learning resource materials (SLR) in the elementary level as rated by the Learning Resource Management Development System (LRMDS) Team of DepEd. The Evaluation Rating Sheet for Story Book was used in determining the appropriateness of the SLR material in terms of content, format, and technical aspects; and solicited comments and suggestions from the respondents that served as inputs for the improvement and revision of the legends in Comic book form. This paper is a descriptive-evaluative investigation. The research area is the whole Romblon Province. The research sample was determined through a dragnet method wherein key informants, casual informants, and general informants were identified in the field. Evidence was gathered from document analysis and field research. Data collection tools were observation, interviews, and focus group discussions. The research was conducted in five stages: planning, development, validation, final output, and dissemination. Of the four legends, 10 Romblomanon values were extracted and incorporated into the stories. It is highly recommended that the streamlined five-stage development process may be used for the comic book development of the rest of the undocumented legends of Romblon.

Keywords: *comic book evaluation, culture, legends, online supplementary learning resource material, Romblomanon values*

INTRODUCTION

Capturing the Romblomanon legends for the contemporary culture in a contemporary medium like a comic book would benefit the young generations who are still in the process of assimilating the culture and values of the society where they belong. Legends are permanent fixtures of society (Abbot, 2013). Though the presence of legends is permanent, Abbot (2013) added that functions and meanings of legends can fluctuate as the context in which they are told and retold shifts. This fluctuation in context could result from a change in the culture of the members of the society as they move through history.

With the advent of technology and 21st century learners, the teaching method should also cope with the increasing demand of the times and use 21st-century literature. In this sense, transforming the legends to 21st-century genres, like a comic book, printed and softcopy, will lead to an interested audience and a fresh approach to the teaching and learning environment.

The meaning and functions of legends must be handed down to generations. However, the problem is the lack of legend narrator resulting in most children and youths who are either misinformed or, worst, ignorant of their legends because the telling of legends are not perpetuated by the present generations (Saenboonsiri et al., 2015). Saenboonsiri et al. (2015) suggested that for the conservation and the development of folktales or legends in this study, all members of the community must cooperate either by establishing a museum, integrating the folktales in school curriculums, and holding folktale storytelling competitions throughout the region. In the Romblon province setting, however, establishing a museum is still farfetched. On the other hand, holding competitions is doable but would entail a lot of time and resources. Meanwhile, legends are

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already integrated into the curriculum, especially literature subjects, but problems lie in the choice and availability of materials. Teachers usually select known and popular Tagalog legends because of the availability of materials or the lack of knowledge of their local legends. This problem could be solved by developing supplementary learning resource material like a comic book of Romblomanon legends.

Lastly, the COVID-19 pandemic resulted in the shutdown of schools worldwide. The traditional classrooms shifted to online teaching, changing education dramatically and driving the rise of e-learning and online teaching materials. This online comic book of legends is a timely contribution in response to this critical demand. This study aimed to develop a comic book out of the Romblomanon legends in the three languages and determine the rating of the comic book as SLR in the elementary level as rated by the LRMDS Team of DepEd. The Evaluation Rating Sheet for Story Book was used in determining the appropriateness of the SLR material in terms of content, format, and technical aspects; and solicited comments and suggestions from the respondents that served as inputs for the improvement and revision of the legends in Comic book form.

METHODOLOGY

This paper is a descriptive-evaluative investigation. The research area is the whole Romblon Province. The research sample was determined through a dragnet method wherein key informants, casual informants, and general informants were identified in the field. Evidence was gathered from document analysis and field research. Data collection tools are observation, interviews, and focus group discussions. The research period was eight months.

The research was conducted in five stages, as illustrated in Figure 1. There is an additional 6th stage which is a recommendation for further study. The first stage is a documentary investigation period or collection from secondary sources using the paradigm suggested by Perlas (2011). The researcher searched documents, studies, collections, compilations, and internet postings of Romblomanon legends. For the second stage, these documents were collected and authenticated in the field and served as the basis of the research in the writing and illustration of the legends to its comic book form. A graphic artist was commissioned to illustrate the legends in comic form. However, the script and storyboard were a collaborative effort between the researcher, the Filipino psychology consultant (for the extraction and incorporation of Romblomanon values), and the commissioned graphic artist. Filipino psychology consultant and the researcher extracted the Romblomanon values from the legends in comics form. Moreover, the head of the LRMDS Team of DepEd was consulted to ensure the feasibility of the supplementary learning resource material.

After all appointments were in place in the third stage, the researcher submitted the legends draft in a comic book form to the LRMDS Team for their initial scrutiny. The LRMDS team was composed of the DepEd Program Supervisor in Learning Resource Management and two other teachers. The initial result of the consultation was forwarded to the graphic artist for the necessary revision. The revised SLR was then submitted for the second time to the LRMDS team for the final revision and the rating score of the DepEd Evaluation Rating Sheet for Story Book. The evaluation rating sheet comprises two factors: content, and format and technical aspect. In order for the comic book on legends to pass the criterion for a supplementary learning resource material and be allowed or approved, the SLR rating score must at least be 24 points out of the maximum 32 points for content and 9 points out of the maximum 12 points for format and technical aspect.

In the fourth stage, the final output, the result of the rating sheet, underwent analysis, and all comments and suggestions were incorporated in the final draft of the legends in comic book form. A focus group discussion (FGD) was conducted. The final draft was then shown to the respondents for further comments. The final draft was then sent to the graphic artist for final rendering.

The focus group comprised the researcher, the LRMDS Team of DepEd, carriers of the tradition, a graphic artist, and a Filipino psychology consultant. Asynchronous online FGD was done due to the restrictions of the COVID 19 pandemic. Participants in the FGD are asked one or more pre-determined questions in asynchronous online focus groups using FB messenger. Participants move issues ahead through dialogues — or 'threads' — on each question, which are uploaded at various time intervals and sometimes all at once. Questions are based on the LRMDS team and the Filipino psychology consultant’s suggestions for the graphic artist to follow in the revisions of the illustrations. Meanwhile, the carriers of the tradition were asked if the modifications were acceptable and would not change the legend's story drastically.

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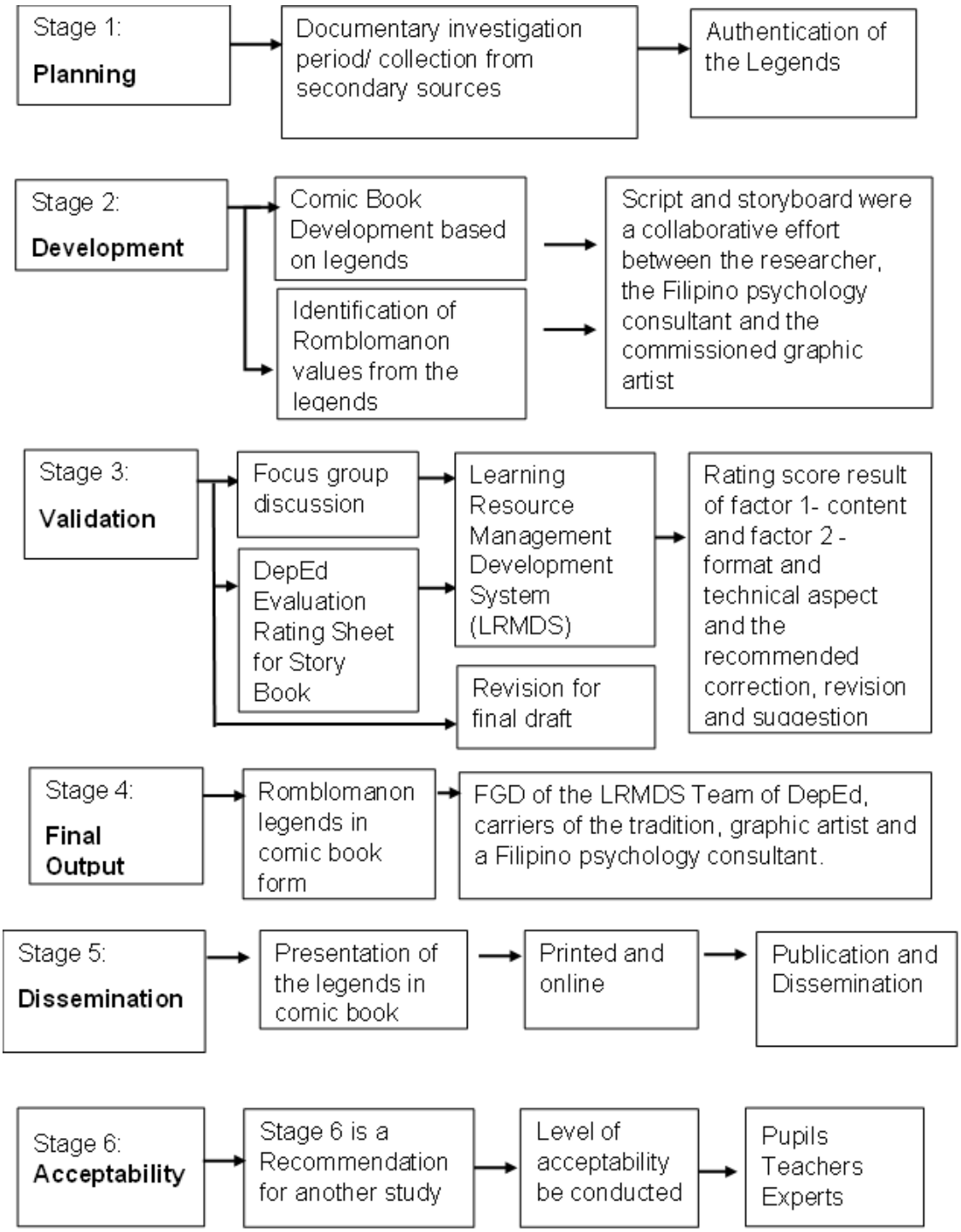

Figure 1. Schematic Diagram.

RESULTS AND DISCUSSION

The supplementary learning resource rating of the Romblomanon legends was determined using indicators and two factors: content and format and technical aspect. The raters are the LRMDS team of DepEd composed of the DepEd Program Supervisor in Learning Resource Management and two other teachers. The DepEd Evaluation Rating Sheet for Story Books and Big books was used.

The content was rated along with the story, socio-cultural sensitivity, developmental aspect, plot, characters, visuals, language, and grammar. Presented in Table 1 are the ratings on the four legends in comic book form by the DepEd evaluation team, along with the factor of content. It shows that the total points of 26 for *Talabukon*, 26 for Cresta de Gallo, 24 for *Bato ni Jimmy* and 28 for *Ibong Parpagayo* pass the SLR criterion of at least 24 points out of the maximum 32 points.

Table 1. Supplementary Learning Resource Rating of the Romblomanon Legends in terms of Content

Factor 1: Content	*Talabukon*		Cresta de Gallo		*Bato ni Jimmy*		*Ibong Parpagayo*	
	Rating	VI	Rating	VI	Rating	VI	Rating	VI
1. Story	3	S	4	VS	4	VS	4	VS
2. Socio-cultural Sensitivity	4	VS	3	S	3	S	3	S
3. Developmental Aspect	3	S	3	S	2	F	4	VS
4. Plot	4	VS	3	S	3	S	3	S
5. Characters	4	VS	4	VS	4	VS	4	VS
6. Visuals	3	S	3	S	3	S	3	S
7. Language	2	F	3	S	3	S	4	VS
8. Grammar	3	S	3	S	3	S	3	S
Total points	26		26		24		28	

Table 2. Supplementary Learning Resource Rating of the Romblomanon Legends Along with the Factor of Format and Technical Aspect

Factor 2: Format and technical aspect	*Talabukon*		Cresta de Gallo		*Bato ni Jimmy*		*Ibong Parpagayo*	
	Rating	VI	Rating	VI	Rating	VI	Rating	VI
1. Prints	2	F	4	VS	4	VS	3	S
2. Book design and layout	4	VS	3	S	4	VS	4	VS
3. Paper and binding	4	VS	3	S	4	VS	4	VS
Total points	10		10		12		11	

This result implies that the LRMDS team recommends the approval of the legends, in terms of content, as a supplementary learning resource for possible use in public schools, provided that the corrections/ revisions included in their report are made. The evaluation team's ratings range from 2, described as fair, to 4, described as very satisfactory. As to the total points, the legends *Talabukon* and Cresta de Gallo got 26 points, the second highest, while *Ibong Parpagayo* got the highest score of 28. Sari et al. (2020) argued that since Folklore is ingrained in the culture, the lessons, and actions of the characters in a story and the values it promotes may be utilized as learning material.

Format and technical aspects were rated along with prints, book design and layout, and paper and binding. Presented in Table 2 are the ratings on the four legends in comic form by the DepEd evaluation team, along with the factor of Format and technical aspects. It shows that the total points of 10 for *Talabukon*, 10 for Cresta de Gallo, 12 for *Bato ni Jimmy* and 11 for *Ibong Parpagayo* pass the SLR criterion of at least 9 points out of the maximum 12 points. This result implies that the LRMDS team recommends the approval of the legends, in terms of format and technical aspect, as a supplementary learning resource for possible use in public schools, provided that the corrections/ revisions

included in their report are made. The evaluation team's ratings range from 2, described as fair, to 4, described as very satisfactory. As to the total points, the legends *Talabukon* and Cresta de Gallo got 10 points each, *Ibong Parpagayo* got 11, while *Bato ni Jimmy* got the highest score of 12.

Romblomanon Values from the Legends

Astillero and Ocbian (2015) extracted cultural characteristics and values in Sorsogueños' poems, and Ocbian et al. (2015) extracted values from big books. These Filipino values are undeniably reflected in literary pieces. Similarly, Romblomanon values and culture are reflected in the legends. The four legends manifested the following Romblomanon values: respect for elders, close family ties, courage and bravery, patient suffering (*pagtitiis*), camaraderie, solidarity, humane (being *maka-tao*), patriotic (being *maka-bayan*), cheerful (*pagiging masiyahin*), fellowship (*pakikipagkapwa*), long for peace (*kapayapaan*), kindness (*kagandahang-loob*), authority figure, don't-be-caught" attitude and obedience.

The legend *Ang Bato ni Jimmy* shows respect for elders. Respect for elders is a value inculcated early in socialization. Although Romblon is predominantly of a Visayan culture, the children are taught to say *"po"* or *"opo"* when talking with elders. This phenomenon is an assimilation of the Tagalog culture. Close family ties are also evident in the legend. There is already interdependence among family members from infancy to old age in terms of economic, social, spiritual, and emotional aspects. Patience (*Pagtitiis*) is also evident, as shown by both Jimmy and his wife. In the legend, *Pagtitiis* is a source of their strength. A Filipino is by nature *matiisin* because he is loving towards the family. He is ready to face the challenge of responsibility for the sake of his loved ones. He is willing to pay the price of doing this with pain and suffering for himself.

The legend *Parpagayo ng Ilog Parpaguya* likewise shows respect for elders. Titles of respect like "*Tito," "Tita", "Mang*" or "*Aling*" or "*Kuya*," "*Manang*," or "*Ate*" and using "*po*" or "*opo*" in talking with elders abound in Filipino languages. There is also camaraderie and solidarity, as shown by their celebration of the fiesta. The legend shows that being humane or *maka-tao* by valuing freedom, love, equality, and peace and being patriotic or *maka-bayan* promotes the common good and builds a just and humane society. Most importantly, the legend shows the cheerful attitude or *pagiging masiyahin* of the community. Filipinos have an innate sense of happiness. We can even find humor in our problems. In the legend, the annual visit of the *Ibong Parpagayo* inspired the annual fiesta celebration of happiness.

The legend of *Talabukon* shows the residents longing for fellowship and peace (*pakikipagkapwa* and *kapayapaan*.) Being regularly raided by Moro pirates and sold as slaves, the people of the place exhibit fellowship. The story also shows patriotism as the characters of the story work together for the common good. Their love for nature or being *makakalikasan* were exemplified by the characters who are shown to care for the environment and utilize resources wisely and economically. Lastly, the legend shows kindness or *kagandahang-loob* in the person of *Talabukon* by helping people in dire need.

Lastly, the legend of Cresta de Gallo shows respect for elders, as shown by the characters. The legend also shows Euphemism wherein an unpleasant truth is stated in an ambiguous term not to hurt the feelings and avoid potential situations for shame or *hiya*. Hiya is perhaps the strongest motivation in the behavior of the Filipino. The Filipino who is *walanghiya* or shameless lacks certain inhibitions and is insensitive to the feelings of others. In contrast, the Filipino who is *mahiyain* develops the value of respect and decency.

The high SLR rating, along with the story; very satisfactory for the legends of Cresta de Gallo, *Bato ni Jimmy* and *Ibong Parpagayo*, may be attributed to the fact that the legends are already ingrained into the consciousness of the community, thus contributing to the heightened interest of the reader. However, one story, the Cresta de Gallo, needs to be retold to be appropriate to the grade level (K to Grade 3) as observed by the LRMDS team. This finding is factual with what Abbot (2013) said about the shift in meaning and functions of legends as it is told and retold. The Cresta de Gallo legend recounts the story of the two siblings who fall in love and commit the great taboo of incest. *Bathala* punished them by striking them with a *dugsak* or the combination of thunder and lightning separating them when a part of the earth was thrown away and became the island of Cresta de Gallo. The hollowed-out area became Lamao Lake. The comic book form of the legend was retold and made appropriate to the grade level by downplaying the incest to the mere accidental peeking of the brother of his sister's undergarment from the lake's reflection. In this manner, the function and meaning remained.

The legends are supposed to garner a higher score for cultural sensitivity since the materials are related to one's own cultural experiences. However, Cresta de Gallo, *Bato ni Jimmy* and *Ibong Parpagayo* got only a satisfactory rating. This result is because some stories lack conflict, as in the case of the *Ibong Parpagayo* as commented by the LRMDS team. The plot of the *Ibong Parpagayo* legend recounts the story of the giant bird who only comes to town when the people are happy. The community celebrates the *Ibong Parpagayo* festival, hoping that the giant bird

will soon revisit them. Another is the deviation from the norm of the story of Ang *Bato ni Jimmy*. The story narrates the plight of Jimmy, who allows his wife to go to Manila to work. The unnamed wife was not able to return for some time. Every day Jimmy climbs a rocky hill to wait for incoming ships, shouting for his wife to return home. It was suggested that Jimmy should be the one to go to Manila because of Filipino values that men should do the work and earn for the family. This suggestion is impossible since the legend is about Jimmy patiently waiting for his wife's return.

Ibong Parpagayo got the highest rating of 4 or very satisfactory for the developmental aspects while *Bato ni Jimmy* got the lowest, two or fair. Meanwhile, *Talabukon* got the highest score of 4 or very satisfactory for the plot, and the rest got satisfactory ratings. These ratings are attributed to the fact that the stories are legends, and deviation from the known plot of the legends sacrifices its authenticity. For the characters, all legends got four or very satisfactory. This result is attributed to the fact that the characters' personalities are all interesting and possess Filipino values. Moreover, the rest of the factors, visuals, language, and grammar, got varied scores. The revision, corrections, and suggestions in this part of the criterion under content are easier to address since they will not interfere with the authenticity of the legends. On the other hand, for the format and technical aspect, the legend of *Talabukon* got the lowest rating score of 2 or Fair. The result is attributed to the recommended font size and font family corrections. The rest of the criteria got high rating scores proving the appropriateness of the layout to the approved grade level.

Lastly, the four legends manifested the following Romblomanon values: respect for elders, close family ties, courage and bravery, patient suffering (*pagtitiis*), camaraderie, solidarity, humane (being *maka-tao*), patriotic (being *maka-bayan*), cheerful (*pagiging masiyahin*), fellowship (*pakikipagkapwa*), long for peace (*kapayapaan*), kindness (*kagandahang-loob*), authority figure, don't-be-caught" attitude and obedience.

CONCLUSION

Romblomanon legends in the three languages could be used for promoting Filipino values for children who are still in the process of assimilating the culture of Romblon. Interestingly, aside from a means for conserving the legends, the comic book development is aptly suited to the 21st-century learner and a timely SLR in the elementary level in this time of the COVID-19 pandemic. Although some countries have rich folklore legacy, it has remained chiefly oral, and no substantial attempts have been made to exploit it as teaching material. Improvements in compliance with prescribed classroom duties were seen after using folklore as teaching materials, and the familiar subject sparked interest among the young students.

However, the rigorous process of comic book development could hinder others from joining this endeavor. Nevertheless, this study developed a streamlined five-stage development process with an additional 6th stage for the test of acceptability. Therefore, it is recommended that the streamlined five-stage development process plus the acceptability test be used for the comic book development of the rest of the undocumented legends of Romblon. Further, published Romblomanon legends in the comic form will be made available for tourism use of the municipalities in Romblon.

Likewise, Romblomanon legends will also be promoted to the whole Philippines through popular media such as the comic book and the Romblon State University as the champion of this cause. The softcopy of the comic book will also be published on websites for broader dissemination and will serve as supplementary learning resource material for use online. Erwinsyah and Andayani (2019) found out that students are more engaged and less bored while learning in class due to the animation of the legendary stories as teaching material. They argued that technological advancements are becoming more rapid. People must follow and stay up, and humans have employed various types of technology in their daily lives, including in the educational system. Lastly, the comic form legend can be channeled to promote Romblomanon culture, nature, and its collective consciousness as an island province, and it will significantly promote Romblomanon values.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

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