

Contextualized and localized up-to-Date Data Driven Lesson Materials in Statistics and Probability



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ABSTRACT: Statistics and Probability has always been one of the most challenging subjects introduced through a spiral approach in the implementation of K-12 Education Curriculum. A stigma that has been apparent long before the COVID-19 Pandemic. But has become more evident for both the learners and teachers during distance learning. The researcher therefore aims to provide an intervention that is applicable even during situations of mandatory implementation of distance learning modalities. Specifically for schools who have no access to online learning modalities. The researcher used *Contextualized and Localized Up-to-Date Data Driven Lesson Materials in Statistics and Probability* to Grade 11 GAS learners of San Antonio National High School (SANHS) for SY 2022-2023. The materials were developed by the researcher and includes data from the school. Two materials were used in teaching the following competencies: (a) Calculates the mean and the variance of a discrete random variable *M11/12SP-IIIb-2*; (b) Interprets the mean and the variance of a discrete random variable *M11/12SP-IIIb-3*; and (c) Solves problems involving mean and variance of probability distributions *M11/12SP-IIIb-4*.

The study also includes presenting how these Contextualized and Localized Up-to-Date Data Driven Lesson Materials have affected the attitudes of the respondents towards Statistics & Probability using the *Survey of Attitudes Toward Statistics – 36 (SATS-36)* by *Schau, 2003*. The conduct of this action research therefore aimed to answer the following research questions: (1) What contextualized and localized up-to-date data driven lesson materials can be used in teaching Statistics & Probability for the following Most Essential Competencies: (a) Calculates the mean and the variance of a discrete random variable. *M11/12SP-IIIb-2*; (b) Interprets the mean and the variance of a discrete random variable. *M11/12SP-IIIb-3*; (c) Solves problems involving mean and variance of probability distributions. *M11/12SP-IIIb-4*. (2) What is the attitude towards Statistics & Probability of Grade-11 GAS students before and after using the developed lesson materials? (3) What are the effects of the developed lessons materials on the students' academic performance on the chosen competencies?

Results of the action research conducted from August – October are as follows: (1) two contextualized and localized up-to-date data driven lesson materials were developed in teaching the following competencies: (a) Calculates the mean and the variance of a discrete random variable *M11/12SP-IIIb-2*; (b) Interprets the mean and the variance of a discrete random variable *M11/12SP-IIIb-3*; and (c) Solves problems involving mean and variance of probability distributions *M11/12SP-IIIb-4*. (2) The Grade 11-GAS learners showed improvement towards their attitudes towards statistics and probability. Specifically in terms of affect, cognitive competence, difficulty, interest, and effort. (3) The developed contextualized and localized up- to-date data driven lesson materials have improved the academic performance of the Grade 11- GAS learners. Specifically, with reference to the administered teacher-made pre/post-test, the respondents showed increase in performance level to each of the three competencies. But such increases performance level was not enough for the respondents to achieve mastery level. Hence, the results suggests that there is a need to further improve the developed materials.

KEYWORDS: Contextualized and Localized Data-Driven Lesson Materials, Attitudes in Statistics and Probability

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The researcher is also indebted to all the Grade 11 GAS students of San Antonio National High School, the respondents who provided the data of the study. The researcher would also like to thank her co-teachers in the Senior High School Department for the encouragement given before, during and after the implementation of the study.

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CONTEXT AND RATIONALE

The Philippine Mathematics Curriculum has two main goals namely: developing students' critical thinking and problem-solving skills. Specifically, in terms of (1) Numbers and Number Sense; (2) Measurement; (3) Patterns & Algebra; (4) Geometry; and (5) Statistics and Probability (DepEd, August 2016 & Albay Numeracy Assessment Tool (ALNAT) of SDO- Albay).

Sadly, the stigma on students' perception that mathematics, specifically Statistics and Probability, is a very difficult subject has become more evident during the distance learning modality. This was observed among the Grade 10 students of San Antonio National High School (SANHS) during SY 2021-2022. Where the Grade 10 students' ALNAT results under Statistics and Probability gained a Mean Percentage Score (MPS) of 23.95% with the description "Needs Major Support" or NMS. Additionally, the Grade 10 students showed an MPS of 20.40% - "Needs Major Support" under the Numeracy Skill: *Computing and Solving*. While the Grade 11-GAS students also showed an average academic performance of 79.3 in Statistics and Probability during the first Quarter of SY 2021-2022. Exhibiting a Mean Percentage Score (MPS) of 34% or "Low Mastery" from the 1st Quarter Summative Test.

According to Ashaari et al. (2010), students' difficulties in comprehending statistics may be traced on two factors, cognitive and non-cognitive (Chiesi, F., & Primi, C. (2010)). Cognitive Factors pertains to characteristics of the person that affect performance and learning, these factors involve cognitive functions like attention, memory, and reasoning (Danili & Reid, 2006). While noncognitive attributes pertain to non-academically and occupationally relevant skills and traits that are not specifically intellectual or analytical in nature. These includes ranges of personality and motivational habits and attitudes (Rosen, J. A et al., 2010)

INNOVATION, INTERVENTION AND STRATEGY

Contextualization as one of the growing approaches in education was used by the researcher as the main intervention for this study. The study uses contextualized and localized up-to-date data driven lesson materials developed by the researcher. The developed lesson materials were used to discuss the chosen competencies. According to the Contextualized Motivation Theory (CMT) student motivations for understanding Mathematics fall under two major categories, intellectual-mathematical motivations, and social personal motivations (Hart, J.M., 2010). The intervention therefore intends to provide a contextualized module and a learning activity sheet that uses localized and up-to-date data, so that the students will be able to relate intellectually and socially to the topic discussed.

Expectancy Value Theory (Vroom, 1964) postulates that motivation for a given behavior or action is determined by two factors: (a) *expectancy*, ie, how probable it is that a wanted outcome is achieved through the behavior or action; (b) *value*, ie, how much the individual values the desired outcome. As such, the researcher observed the Grade 11 GAS students' expectancy and value through the use *Survey of Attitudes Toward Statistics – 36 (SATS-36)* by Schau, 2003 before and after the conduct of the intervention. The SATS-36 contains 36 questions that assesses six attitude components namely: *Affective, Cognitive Competence, Value, Difficulty, Interest, and Effort*.

The results of the study can be used by other Mathematics teachers as basis in exploring other possibilities of using the proposed intervention in teaching other areas in Mathematics and as a means of observing related behaviors in pursuit of creating a positive stigma towards Mathematics.

Engagement and use of contextualized data are some of the suggested strategies in motivating students towards statistical literacy (Tishkovskaya & Lancaster, 2010). While, the availability of statistical data is continuously increasing, particularly in the Philippines under **Republic Act No. 11315** where the state adopts a community-based monitoring system which generates updated and disaggregated data across different localities in the country. Hence, the researcher developed one contextualized module and one localized data-driven learning activity sheet as lesson materials as the main intervention in the conduct of this study. Use of Contextualized and Localized Up-to-Date Data Driven Lesson Materials in Statistics and Probability were done by developing a contextualized modules and using up-to-date data driven learning activity sheet lesson materials. Data used for the activity sheet was the Grade 11 GAS height, weight, and age. The modules and activity sheets were developed with accordance to the format provided and given by the SDO-Albay.

The main focus of the study is to determine the effectiveness of the developed contextualized and localized up-to-date data driven lesson materials in terms of the respondents' academic performance to the identified competencies and their attitude towards statistics and probability before and after the conduct of the study. A pretest and posttest of the teacher-made test were used to collect the needed data for interpreting results on the respondents' academic performance. While the SATS was also given before and after the conduct of the study. Data collected from the SATS presents the respondents' change in attitude along six categories namely: *Affective, Cognitive Competence, Value, Difficulty, Interest, and Effort*.

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This study was conducted from the 4th week to the 5th week of SY 2022-2023. The respondents of the study are the Grade 11 GAS students of San National High School.

ACTION RESEARCH QUESTIONS

Generally, this study will present the changes in academic performance and attitude of Grade-11 GAS students in using contextualized and localized up-to-date data driven lesson materials in statistics and probability.

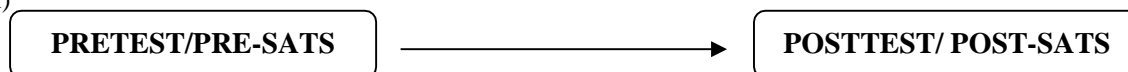
Specifically, this will answer the following questions:

1. What contextualized and localized up-to-date data driven lesson materials can be used in teaching Statistics & Probability for the following Most Essential Competencies:
 - a. Calculates the mean and the variance of a discrete random variable. M11/12SP-IIIb-2
 - b. Interprets the mean and the variance of a discrete random variable. M11/12SP-IIIb-3
 - c. Solves problems involving mean and variance of probability distributions. M11/12SP-IIIb-4
2. What is the attitude towards Statistics & Probability of Grade-11 GAS students before and after using the developed lesson materials?
3. What are the effects of the developed lesson materials on the students' academic performance on the chosen competencies?

ACTION RESEARCH METHOD

This study employed the non-experimental type of research design making use of pre-experimental design.

Treatment (X)



This type of research design is found to be appropriate since the study employed one group of respondents. A pretest and presurvey administered before giving the treatment. After administering the treatment, a post test and post survey was given.

a. Participants and/or Sources of Data and Information

This study made use of Purposive Sampling. On this type of sampling design, the researcher chose to conduct the study to all Grade 11 GAS learners for SY 2022-2023 at San Antonio National High School.

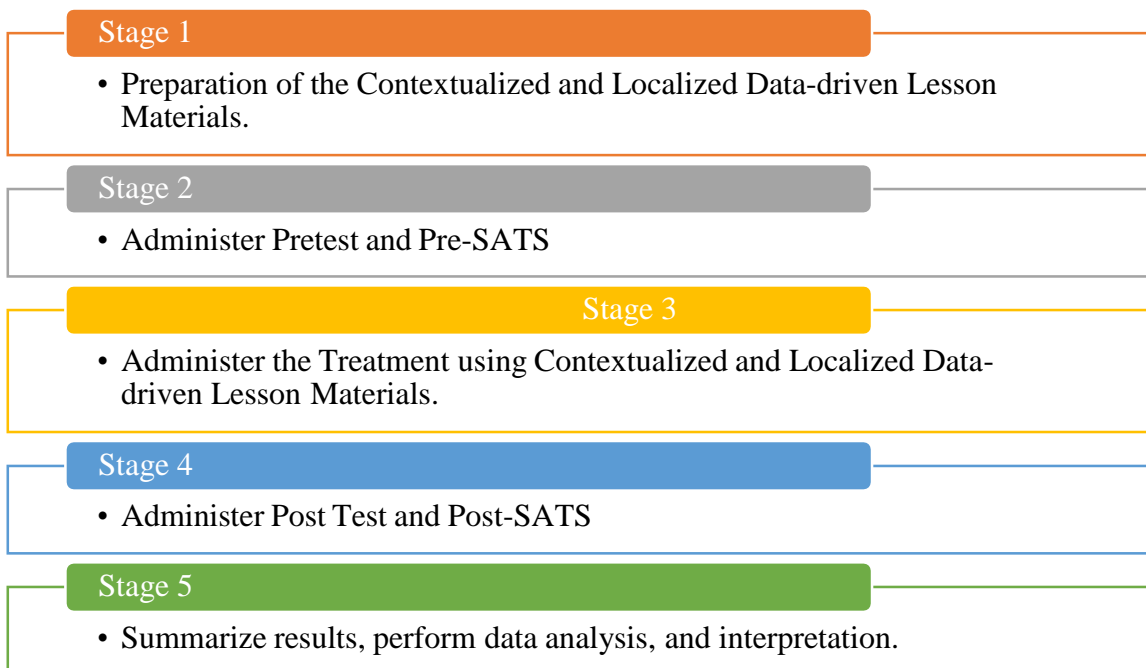
The following instruments were used in gathering the data needed to substantiate the posed problems on this study.

1. Teacher Made Contextualized and Localized Data-driven Lesson Materials. This refers to the lesson resource material developed by the researcher. It served as the treatment in the study. One contextualized module and one localized up-to-date data driven learning activity sheet lesson materials were developed based from the identified competencies.
2. Pre-Test/Post Test. This is a 15-item test derived from the three competencies that has two parts. Part I, is a 10-item multiple choice test that evaluates the respondents' conceptual knowledge of the three competencies. While Part II, evaluates the respondents' interpretation and computation skills. The results of the test determined the effectiveness of the resource materials in enhancing the respondents' academic performance.
3. Survey of Attitudes Toward Statistics – 36 (SATS-36) by Schau 2003, this contains 36 questions that assesses six attitude components namely: *Affective, Cognitive Competence, Value, Difficulty, Interest, and Effort*. The survey was administered before and after the conduct of the study.

b. Data Gathering Methods

The following stages were observed in gathering necessary data which substantiate the posed action research problems.

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DISCUSSION OF RESULTS AND REFLECTIONS

Summary of the results collected from the pre and post-tests collected and analyzed in presenting how the developed Contextualized and Localized Up-to-Date Data Driven Lesson Materials affected the respondents' academic performance along the three competencies. While data collected from the pre and post SATS were used to present how the intervention affected the respondents' attitude towards Statistics and Probability.

ACADEMIC PERFORMANCE OF THE RESPONDENTS

Using pre – experimental research design, the proponent purposively has chosen the Grade11 GAS students of San Antonio National High School to be the respondents of the study.

A 15-item test in Mathematics was administered to the respondents both during the pre – test and post – test. The competencies were used as basis in constructing the test items. Table 1 presents the data on the scores of the respondents during the pre – test and the post – test.

Table 1: Competency-based Summary of Results for Part I (10 items)

Competencies	No. of Items	No. of Learners withormanceLevel Correct Answers				Mastery Level	
		Pre	Post	Pre	Post	Pre	Post
Calculates the mean and the variance of a discrete random variable.	5	72	125	27%	47%	Low Mastery	Low Mastery
Interprets the mean and the variance of a discrete random variable.	2	27	39	25%	37%	Low Mastery	Low Mastery
Solves problems involving mean and variance of probability distributions.	3	51	85	32%	53%	Low Mastery	Near Mastery

Table 1 shows the summary of results on the learners' academic performance during the conduct of the teacher-made pre/post-test.

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Specifically, the multiple-choice part of the test which has a total of 10 items. Results show that per competency, the learners showed higher performance level. For the first competency, the learners gained a performance level of 27% to 47%, while for the second competency gained a performance level of 25% to 37%, and for the third competency gained a performance level of 32% to 53%. Among the three competencies, the learners showed the greatest improvement on the third one which is *solving problems involving mean and variance of probability distributions*. Because from a mastery level of “Low Mastery” during the pre-test, the learners achieved “Near Mastery” during the post-test. This implies that the lesson materials developed in this study are effective resources for teaching the three competencies.

Table 1.2: Over-all Summary of Results for Multiple Choice Items Part I (10 items)

	Pre-Test	Post-Test
Mean Score:	2.8	4.7
Mean Percentage Score (MPS):	6%	14%
Performance Level:	28%	47%
Mastery Level:	Low Mastery	Low Mastery

Table 1.2 presents the over-all summary results for the multiple-choice part of the teacher-made pre/post-test. Results show that the learners gained a Mean Percentage Score of 6% during the pre-test and 14% during the post-test. While their performance level improved from 28% to 47%. Despite gaining the same over-all mastery level of “Low Mastery”, it is evident that the learners have shown improvement. This implies that the contextualized and localized up-to-date data driven lesson materials developed were effective learning resources with regards to developing the conceptual skills of the learners on the learning competencies involved in this study. But these lesson materials will still be needing enhancement to further provide greater academic performance among the Grade 11 GAS learners.

Table 2: Competency-based Summary of Results for Part II (25 points)

Competencies	Highest Possible Score	Mean Score		Performance Level		Mastery Level	
		Pre	Post	Pre	Post	Pre	Post
Calculates the mean and the variance of a discrete random variables	18	0	7.65	0%	42%	No Mastery	Low Mastery
Interprets the mean and the variance of a discrete random variables	4	0	0.15	0%	4%	No Mastery	No Mastery
3) Solves problems involving mean and variance of discrete random variables probability distributions.	3	0	0.18	0%	6%	No Mastery	No Mastery
TOTAL:	25	0	7.98	0%	17%	No Mastery	No Mastery

Table 2 presents the summary results for the skill related part of the teacher-made pre/post-test. Results show that the learners showed minimal but relevant improvements. Because along the three competencies all the respondents showed an over-all performance level of 0% during the pre-test and showed an over-all performance level of 17% during the post-test. Among the three competencies, the learners showed the greatest improvement in the first competency, that is *calculating the mean and the variance of a discrete random variables*. The learners from “No Mastery” during the pre-test showed “Low Mastery” during the post-test under this competency. While for the second and third competency, the learners showed increased performance level of having 0% to 4% (for the second competency) and 6% (for the third competency). This implies that the learners showed skill improvements among the respondents of the study.

The assessment results of the pre and post -test implies that the developed contextualized and localized up-to-date data driven lesson materials are effective resource materials in teaching the three competencies in statistics and probability but may need further improvement.

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Table 3: Summary of Results on Grade 11- Gas Learners' Attitudes Towards Statistics

	Affect		Cognitive Competence		Value		Difficulty		Interest		Effort	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	4.38	4.63	4.27	4.40	5.34	4.39	3.13	4.91	5.78	6.31	6.09	6.35
Percentage	63%	66%	61%	63%	76%	63%	45%	70%	83%	90%	87%	91%

Table 3 shows the summary of results regarding the respondents' attitude towards Statistics and Probability before and after using the contextualized and localized up-to-date data driven lesson materials. The respondents' attitudes were measured in six categories namely: (a) Affective;

(b) Cognitive Competence; (c) Value; (d) Difficulty; (e) Interest; and (f) effort. Results show that the respondents had an increase percentage rate in five out of the six categories. Namely, in the affect domain from 63% to 66%; in the cognitive competence from 61% to 63%; in the difficulty domain from 45% to 70%; in the interest domain from 83% to 90%; and in the effort domain from 87% to 91%. While for the value domain, the respondents showed a decreased percentage rate from 76% to 63%. One of the reasons according to the respondents is that they still cannot see immediate application of the concepts and skills learned from Statistics and Probability to other subjects and real-life situations. Over-all, results imply that the respondents gained a more positive attitude towards the subject Statistics and Probability.

ACTION PLAN

Below is the action research work plan and timeline followed during the duration of the study.

Activities	Target Date	Status of Implementation
Preparation of Teacher- Made Contextualized and Localized Up-to-Date Data Driven Lesson Materials	June – July, 2022	Done
Preparation of Action Research Proposal	July, 2022	Done
Week approval for Implementation.	July, 2022	Done
Administer the Pre-Test and Pre-SATS	4 th Week of SY 2022-2023	Done
Administering the Treatment	4 th Week to 5 th Week of SY 2022-2023	Done
Administer the Post Test and Post-SATS	6 th Week of SY 2022-2023	Done
7. Analysis of Data	6 th Week of SY 2022-2023	Done
Preparation and Submission of completion report	1 st Week of February 2023	

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FINANCIAL REPORT

From personal fund of the researcher, below is the expenditures incurred during the conduct of the study.

Nature of Expenses	Cost
Printing/reproduction of TeacherMade Pre/Post Test.	₱ 2500.00
Printing/reproduction of SATS.	
Printing/reproduction of Teacher Made Contextualized and LocalizedUp-to-Date Data Driven Lesson Materials	
TOTAL	₱ 2500.00

Raw Data Files may be accessed from the link below:

<https://tinyurl.com/ARFilesJenBien>



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