Socscistatistics Integration on Test and Evaluation in Statistics (SITES): Mastering Statistics Using Free Online Resource

Reynaldo C. Collado Jr.
reynaldo.colladojr@deped.gov.ph/ reynaldo.collado@depedmandaluyong.org
Highway Hills Integrated School
Department of Education
Mandaluyong City, Philippines

Abstract: *Statistics is kernel part of Mathematics designed to ease future research endeavors of students taking it. With its mastery, learners would be able to easily justify their research results in a manner that is not challenging to them at all. Traditionally, they are taught in a way that exhausting long computations take place so that each test statistic will be determined. Careful solving is necessary for them to achieve the correct values which will then affect the overall interpretation of the results. With such profound tasks, they tend to have very little confidence in achieving their understanding. This study is about shifting the mindset of learners in mastering statistics using free website called socscistatistics. This website can be easily accessed in any search engines and functions like Statistical Package for the Social Sciences (SPSS) but is more friendly to learners and start-up researchers. It employed the quasi-experimental design. To determine the overall performance of students in statistics, a pre-test was conducted. Scores obtained are subjected to 3 levels namely Poor Level (0% to 70%), Good Level (71% to 85%) and Satisfactory Level (86% to 100%). This test was done after the full discussions of statistical tools such as mean, median, mode, variance standard deviations, correlation analysis, relationship tests and difference tests. Results of the tests were used as a basis in implementing the intervention called SITES or Socscistatistics Integration on Tests and Evaluation in Statistics. A post-test was then given after 2 months of utilizing the mentioned website. Results indicated a higher performance in posttest. Results were tested at 0.05 alpha level of significance using a t-test which indicated that there was a significant difference between the means of pre-test and post-test scores of the respondents.*

1. Introduction

In the year 2012, the Department of Education of the Philippines implemented the K-12 Curriculum also known as the Enhanced Basic Education Act of 2013 (Republic Act 10533). According to the then President Benigno Aquino III, this will pave the way to most Filipino students while providing basic education that is at par with international standards. This act created the now called "Senior High School".

In relation to this, Senior High School offers 5 tracks for which the students can choose from. Regardless of these tracks, students have "common" subjects which are called "Core and Applied Subjects". Among these subjects is the Statistics and Probability which is a pre-requisite for the Research subjects to be taken later on by these students.

Statistics for a fact is simple. It uses simple operations from basic ones up to exponents and roots. Other than that, what makes it complicated is the thorough and step-by-step process for which the learners have to carefully do to arrive at the correct values they needed. With such delicate steps, several studies have been conducted to improve students' performance in this particular subject.

A study conducted by [4] indicated that the rapid development and growth of technology can be of great help in enhancing student's academic performance specifically on statistics.

They attempted to determine the relationship between Information Technology (IT) capabilities, learning experiences and performance of teaching and learning Mathematics. Developing the application called Multimedia Probability and Statistics System (MMPASS), they have found that students' learning experiences and performances of their academic achievement have been improved by using MMPASS.

Another study was designed to improve student performance in statistics through the use of flipped classroom. [7] found that those taught using the flipped classroom approach perceived the module significantly more interesting and the proportion of students who perceived the module to be difficult was roughly half that under the traditional teaching approach. Moreover, a study led by [2] revealed that peer-tutoring those students who have low performance in undergraduate statistics is another way of alleviating their statistics performance. In relation to this, [3] suggested that a mat word-problem a day improves the overall problem solving skills of students which is also another efficient way to deal with such research problem.

This research is conducted to determine the level of academic performance of the selected Grade 11 students of Highway Hills Integrated School in statistics. Upon identifying certain problems about this case, the researcher will also attempt to apply Socscistatistics Integration in Tests and Evaluation in Statistics (SITES) strategy to upscale the academic performance of the selected respondents.

2. Conceptual Framework

Statistics mastery is crucial in the future research endeavors of most studennts in senior high school. Without mastery on such subject, performance in research subjects will definitely be affected. Thus, resolving such problem is necessary.

This study is anchored to the Behaviorism Theory of Thorndike. According to [6] behaviorists believe external encouragement influences one's learning behavior, rewards and punishment can change one's learning performance. Researchers and scholars confirmed that Behaviorism has greatly promoted and effectively implemented in programmatic instruction, and has strongly promoted and widely applied in computing-assisted-instruction and the development of educational technology.

Also, the Theory of Diffusion of Innovations describes the steps of technology innovation, process and characteristics of accepting new technologies, as well as receivers' role in the receiving process of technological innovation. Everett M. Rogers, its proponent groups people, according to the degree of acceptance of innovation, into various stages: innovators, early adopters, early followers, late followers and laggards. Understanding the trainees' receiving capacities of new technologies can assist training institutions and trainers to design and deliver the training more effectively.

In this regard, this study uses the IPO (Input-Process-Output) framework which shows the Grade 11 students' statistics performance as the input, and the test scores before using the Socscistatistics Integration in Tests and Evaluation in Statistics (SITES) strategy. The process, was the administration of the pre-test, the implementation of the strategy for 2 months, the administration of post-test examination, and the computation for test for the difference between the pre-test and post-test scores. The output was difference between the test scores of Grade 11 students' statistics performance and after using the SITES. Below is the Figure1. which presents the Paradigm of the Study.

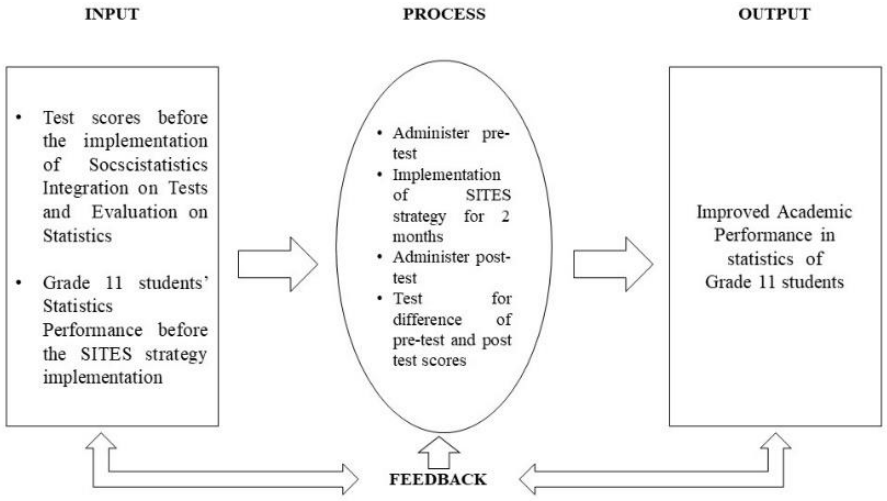

Figure 1.Conceptual Paradigm of the Study

3. Statement of the Problem

This research is conducted to determine the impact of Socscistatistics Integration in Tests and Evaluation in Statistics (SITES) in upscaling the performance on Statistics of selected Grade 11 students of Highway Hills Integrated School for the academic year 2020-2021.

Specifically, it aimed to answer the following questions:

1. What is the level of performance on Statistics of Grade 11 students before the implementation of Socscistatistics Integration in Tests and Evaluation in Statistics?
2. What is the level of performance on Statistics of Grade 11 students after the implementation of Socscistatistics Integration in Tests and Evaluation in Statistics?
3. Is there a significant difference between the results of pre-test and posttest after employing the SITES strategy?

4. Hypothesis

The hypothesis stated that there is no significant difference between the results of the pre-test and post-test of the Grade 11 students on their performance in Statistics through the use of Socscistatistics Integration in Tests and Evaluation in Statistics intervention at 0.05 alpha level of significance.

5. Scope and Limitations

This action research was limited to the one-hundred Grade 11 students of Highway Hills Integrated School for the school year 2020 - 2021. The respondents are composed of 55 males and 45 females. These students are given pre-test on Statistics after the discussion of descriptive statistics, and hypothesis testing and post-test after they have undergone the SITES intervention program for 2 months.

6. Research Design

The researcher made use of the following research design and method; quasi-experimental design, and one shot pretest and posttest design. The researcher selected to use quasi experimental because the study wanted to determine the level of performance in Statistics of the respondents and the effects of the intervention after it was utilized. The study measured the significant difference between the two assessments.

SITES is an intervention devised by the researcher to solve the said research problem. This intervention is done by utilizing the use of free site called socscistatistics to upscale the test scores of students on tests involving descriptive statistics, differences and relationship tests and interpreting results from hypothesis testing. This website functions just like an SPSS which when studied carefully on its usage, will allow easier interpretations on the part of students. Just like SPSS, its main functions include the requirement of just simple input of raw data and the rest of the work will be done by this site. Solving, interpreting and presenting results will be done and students will just have to arrange them in a manner expected by the statistics teacher.

A pretest was conducted on Statistics after the discussion of descriptive statistics, and hypothesis testing and post-test after they have undergone the SITES intervention program for 2 months. Discussions on how to place inputs in each of statistical tools and tests was done. Practice exercises were given to test their mastery on usage of the website. A monthly test to determine the state of students is then conducted to observe the impacts of the said intervention.

7. Sources of Data

The target-respondents were one-hundred (100) Grade 11 students who were enrolled in Highway Hills Integrated School during the school year 2020-2021. The respondents belong to the class of the researcher. There were 55 boys and 45 girls. The study was conducted from November 2020 to January 2021 before the start of daily discussions.

8. Instrumentation and Data Collection

This study made use of quasi-experimental design, and one shot pretest and posttest design to gather the needed data. The researcher used the Socscistatistics Integration in Tests and Evaluation in Statistics (SITES) strategy to improve the performance on Statistics of the respondents.

The data is gathered by recording a weekly evaluation of the students tests in statistics. A table graph was used to determine if there is a certain trend on the pre-test and post-test results. This action research was conducted at Highway Hills Integrated School using the selected Grade 11 as respondents.

The researcher administered a 50-item pre-test on statistics after their discussion on descriptive statistics and hypothesis testing to determine the level of performance in statistics of the respondents. Then, an action research proposal was given to the principal of the school to implement the intervention program. After which, the socscistatistics website was thoroughly discussed to the students in terms of the “how to” of its usage. This was done per topic in statistics and after each discussion, a practical exercise was given for the respondents to do. After making sure that the respondents have mastered the use of the site, a formative assessment was given.

A 50-item post-test composed of the same scope as the pre-test but of different variant was conducted after the implementation of the SITES Strategy. Both the two tests are designed by the researcher and are subjected to Cohen’s Kappa statistic to determine the inter-rater reliability. The supervisor in-charge in Mathematics was invited to rate the tests. It was found that the Kappa statistic is 0.89 justifying that there is a significant agreement between the raters signifying a satisfactory inter-rater reliability.

9. Tools for Data Analysis

To provide valid and accurate findings from the generated data, appropriate statistical tools were employed by the researcher.

For problem 1 and 2

To determine the Grade 11 students' level of performance in statistics the following formulae were used:

$$\text{Academic Performance Level in Statistics} = \frac{\text{Number of correct answers}}{\text{Number of questions}} \times 100\%$$

Academic Performance Level of the Grade 11 students was classified as follows:

Level	Level of Ability
Satisfactory	86%-100%
Good	71%-85%
Poor	70% below

Note that these cut off scores are solely based on the assigned point system by the researcher considering the passing score of 75% and taking into account that using three scales results to 33.33% per scale and adjusting it to a more appropriate scale which is not that low and at the same time not that high.

For problem 3

To determine the significant difference in the level of problem solving skills of the Grade 11 students before and after the assessment, a pre-test post-test T-test was used.

10. Results and Discussions

Level of Academic Performance of the Grade 11 Students in Statistics Before the Use of SITES Strategy

The researcher proponent administered a pre-test on statistics involving 100 Grade 11 students enrolled during the school year 2020-2021. The test aimed to determine the level of problem solving skills of the Grade 11 students. Based on the pre-test results, the students are classified into three (3) levels: satisfactory, good, and poor.

Table 3.1 reflects the results of the pre- test and the performance level in statistics of the Grade 11 students before the use of Socscistatistics Integration in Tests and Evaluation in Statistics (SITES) strategy.

Table 1
Result of the Pre-Test on Statistics

Problem Solving Ability	Frequency	Percentage
Poor	70	70%
Good	23	23%
Satisfactory	7	7%
Total	100	100%
Mean Score	22. 14	

Mean Percentage Score	44.28%

It can be seen from table 1 that out of 100 students, only 7 of them have Very Satisfactory Level in terms of their performance level in statistics. Also, it can be observed that 23 out of 100 or 23% of the students are at Good Level. Moreover, 70 out of 100 or 70% of the students are under the Poor Level with respect to their performance level in statistics subject.

Moreover, it can be seen that there is a mean percentage score of 44.28 % (obtained from the mean score in pretest of 22.14) which is way below the passing rate of 75%.

These results are analogous in the longitudinal study conducted by [5] which revealed that there is a significant projecting influence on later mathematics achievement for self-perceived competence. Also tenacity, attitude, and positive attributional dimension of internality have an additional significant contribution.

Level of Academic Performance of the Grade 11 Students in Statistics After the Use of SITES Strategy

Table 2 presents the level of performance of the Grade 11 students in statistics subject after the implementation of Socscistatistics Integration in Tests and Evaluation in Statistics (SITES) strategy.

Table 2
Result of the Post-Test on Statistics

Problem Solving Ability	Frequency	Percentage
Poor	13	13%
Good	57	57%
Satisfactory	30	30%
Total	100	100%
Mean Score	40.15	
Mean Percentage Score	80.3%	

It is remarkable that after employing the SITES strategy, it can be observed that 13% of the students are at the Poor Level of academic performance in statistics signifying a great decline. Also, 57% of the students are at the Good Level of performance in statistics. In connection to this, 30% of the students became to the Satisfactory level in terms of their performance in statistics. Moreover, it can be seen that the mean percentage score is 80.3% (obtained from the mean score in pretest of 40.15) which has significantly amplified compared to the pre-test mean percentage score.

These results are similar on the publication of [1] which claimed that the future of mathematics education after the COVID-19 pandemic is the one with which teachers use technology to teach students rather than reverting back to the old ways of teaching process.

Difference Between the Pre-Test and Post Test Results in Problem Solving

Table 3 presents the difference between the pre-test and post-test results in level of performance in statistics of the 100 selected grade 11 students of Highway Hills Integrated School after the implementation of the Socscistatistics Integration in Tests and Evaluation in Statistics (SITES) strategy.

After the execution of the strategy, the scores on the pre-test and post-test results of 100 students were compared and analyzed to determine if there is a significant difference. T-test for two dependent means was used having 0.05 alpha level of significance and 99 degrees of freedom. Table 3 shows the significant findings of the inferential analysis.

Table 3
Difference Between the Pre-Test and Post Test Results in Statistics

Category	Mean Score	Degrees of Freedom	Computed t-value	Critical t-value	Interpretation
Pre-Test	22.14	99	5172.98	2.626	Significant
Post-Test	40.15				

Based on these results, the null hypothesis which states that there is no significant difference between the results of the pre-test and post-test of the Grade 11 students on their performance level in statistics through the use of Socscistatistics Integration in Tests and Evaluation in Statistics (SITES) strategy at 0.05 alpha level of significance is hereby rejected. The rejection of the null hypothesis is due to the fact that the computed t-value of 5172.98 is higher than the tabular value of 2.626.

Thus, there is a significant difference between the results of the pre-test and post-test of the Grade 11 students on their performance in Statistics through the use of Socscistatistics Integration in Tests and Evaluation in Statistics intervention at 0.05 alpha level of significance. From these results, it could be deduced that the use of proposed SITES strategy enhanced/improved the performance on statistics of the respondents. Hence, employing such strategy would eventually upsurge the performance level of the students.

This result is the same with [8] which signified that integrating digital technology in mathematics education uplift the level of performance of the learners. It has been suggested that teachers should have efforts in showing and guiding students on how to effectively use the digital tools rather than just merely giving them these and letting them explore on their own.

11. Conclusions

In view of the findings, the following conclusions were drawn.

1. There are 70 identified students under poor level of performance in statistics, 23 under good level and 7 under satisfactory level of students before the SITES intervention.
2. There are 13 identified students under poor level of performance in statistics, 57 good level students, and 30 satisfactory level students after the SITES intervention.

3. At 0.05 alpha level of significance, there is a significant difference between the results of the pre-test and post-test of the 100 selected Grade 11 students on their performance in Statistics through the use of Socscistatistics Integration in Tests and Evaluation in Statistics intervention.
4. Socscistatistics Integration in Tests and Evaluation in Statistics can enhance level of performance in statistics of students through time.

12. Recommendations

With the above conclusion, the following recommendations are offered:

1. Mathematics teachers shall use socscistatistics website in teaching statistics on a daily basis to improve the level of performance of the students.
2. The Socscistatistics Integration in Tests and Evaluation in Statistics (SITES) strategy shall be used as an intervention to improve the level of performance of the students under poor level.
3. The school shall constantly monitor the level of performance of the learners and provide technical assistance on improving it.
4. A similar study shall be conducted to ascertain the findings of this research.

Acknowledgements. The author would like to thank his family, specially Jen, Arjhen and Iah for always inspiring him to do better.

References

[1] Borba, M.C. The future of mathematics education since COVID-19: humans-with-media or humans-with-non-living-things. Educ Stud Math (2021). https://doi.org/10.1007/s10649-021-10043-2

[2] Charcape M. et,. Al. (2019). Improving Exam Performance in an Undergraduate Statistics Course for At-Risk Students through Peer Tutoring. Psychology Teaching Review, v25 n2 p3-17 2019

[3] Collado, R. (2020). Enhancing the Problem Solving Skills of Selected Grade 11 Students of Highway Hills Integrated School Through One Word Problem a Day (OWPaD). Electronic Proceedings of the 25th Asian Technology Conference in Mathematics.

.

[4] Krishnasamy, S., Ling, L. & Kim, T. (2020). Improving Learning Experience of Probability and Statistics using Multimedia System. International Journal of Emerging Technologies in Learning (iJET), 15(1), 77-87. Kassel, Germany: International Journal of Emerging Technology in Learning. Retrieved August 15, 2021 from https://www.learntechlib.org/p/217059/

[5] Mercader J, Presentación M-J, Siegenthaler R, Molinero V, Miranda A. Motivación y rendimiento académico en matemáticas: un estudio longitudinal en las primeras etapas educativas. Rev Psicodidáct. 2017;22:157–163.

[6] Ouyang, J. & N. Stanley. (2014). Theories and Research in Educational Technology and Distance Learning Instruction through Blackboard. Universal Journal of Educational Research, v2 n2 p161-172 2014

[7] Price, C. & M. Walker. (2021). Improving the accessibility of foundation statistics for undergraduate business and management students using a flipped classroom, Studies in Higher Education, 46:2, 245-257, DOI: 10.1080/03075079.2019.1628204

[8] Viberg, O., Åke Grönlund & Annika Andersson (2020) Integrating digital technology in mathematics education: a Swedish case study, Interactive Learning Environments, DOI: 10.1080/10494820.2020.1770801