Effectiveness of Math Apps in Improving the Performance of the Grade 11 Students in Probability and Statistics

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Abstract: *This study determined the effectiveness of math apps in improving the performance of the grade 11 students in probability and statistics at Bagahanglad National High School, San Jacinto District in the Division of Masbate-Province, school year 2019-2020. The descriptive method of research would utilize in this study. The respondents were 50 Grade 11 students who were currently taking probability and statistics subject. The study used quantitative method to describe the performance level of the grade 11 learners in Probability and Statistics subject along the four identified topics and evaluate the Math Apps being used the Data analysis, and a qualitative method was used to know the effectiveness of the Math Apps in improving the performance of Grade 11 in Probability and Statistics subject. Data were gathered through test administration and interview. A researcher-made test questions and interview schedule were utilized as the main instruments of the study. The data were tabulated, checked, analysed and interpreted using frequency count, mean, interview, and t-test. The findings of the study revealed that the Performance Level results in Pre-test of the control and experimental group along the four identified topics belongs to below 75 and interpreted as low performance while the Performance Level results in post-test of the control are almost belongs to below 75 and experimental group where almost bracket 85-89 and interpreted as very satisfactory. Math Apps is very effective in improving the performance of the students in Probability and Statistics subject. It also revealed that it helped them to compute the mathematics problem easier and faster, and clearly understand the concepts. It also helped them to enhance their knowledge and skill in Probability and Statistics subject. The computed t-test for Control group was 5.685 which were greater than the critical value of 1.795. The computed t-test for experimental group was 9.493 which were greater than the critical value of 1.795. This result showed that the post-test result was higher than the pre-test result. Based from the findings it was concluded that most of the students from experimental group got a passing results in four identified topics. The majority of the grade 11 students did not meet the expectations of the lessons and it has a low performance. The post-test result is higher than the pre-test result. The results revealed that the application was effective instructional materials to the grade 11 students. The Math Apps is very effective in improving the performance of the students in Probability and Statistics subject. Based from the conclusions drawn, the following recommendations are made: the Math apps in Probability and Statistics be submitted for further study and enhancement to ensure high mastery of the learning competencies. The Math Apps may not only focused on unlocking difficulties but also provide more activities during and after the mathematical problems. Design training and workshop to the teachers in secondary to improve the new techniques in probability and Statistics. Trainings and seminar workshop should impose to the students in order for them to alleviate the performance in Mathematics as a whole. Research parallel to this may also be conducted in other subjects and on wider scope.*

1. Introduction

Educational technology has long been recognized as a valuable approach to improving the mathematics achievement (Chang, et. Al, 2013). According to the National Council of Teachers of Mathematics (2000), "Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (p. 11).

DO 78, s. 2010 – Guidelines on the Implementation of the DepEd Computerization Program (DCP), the legal mandate of promoting the right of all citizens to take appropriate steps in making education accessible to all, the Department of Education (DepEd) is geared towards the transformation of education through the DepEd Computerization Program (DCP). DCP aims to provide public schools with appropriate technologies that would enhance the teaching-learning process and meet the challenges of the 21st century. The objectives of the DepEd Computerization Program are as follows: Provide computer laboratory packages to secondary schools; Provide e-classroom to elementary schools; Provide laptop units to mobile teachers; Integrate ICT in the school system; Raise the ICT literacy of learners, pupils, students, teachers and school heads; and Reduce the computer backlog in public schools.

ICT pertain to forms of technology that are used to deliver, process, store, create, display, share or exchange information by electronic means. ICT has many different types of electronic systems that include LCD projectors, Cyber schools, printers, scanners, digital/video cameras, cellular phones, calculators and networks, and computer software.

The primary focus of appropriate teaching is to bring about a desirable change in the behavior of learning. It is brought about by the teacher using teaching strategies to achieve the objectives of the lesson. This makes teaching more difficult yet very challenging because it requires different methods and techniques for different learner abilities and behavior. Based on the study of Meilang Zhang, et, Al (2015) Using Math Apps for improving student learning showed that the use of the math apps improved student learning in mathematics and reduced the achievement gap between struggling students and typical students.

Mobile technology opens a new avenue for teaching and learning mathematics in schools in the 21st century. Based on the study of Etcuban, et. Al (2018) The Effects of Mobile Application in Teaching High School Mathematics, the study revealed that there is an increase in the posttest scores of the control and experimental groups. It was concluded that the use of the mobile application in teaching mathematics to the students had helped enhance students' achievement and learning.

These circumstances as stipulated by different authors are observed to be also true in Grade 11 students of Bagahanglad National High School, where the schools are equipped with ICT infrastructures. The researcher had observed students' low level of achievement in Mathematics. These students performed better on rote learning and poorly on items that require comprehension, and problem-solving skills. With this in mind, the researcher would like to investigate whether a Math application specifically a Data Analysis is of great help in teaching mathematics to Grade 11 students from a public national high school. Also, this could be an instructional tool in the teaching of Probability and Statistics subject for a better teaching-learning experience that could be utilized by all types of learners. It is on this juncture that the researcher engaged in this research endeavor to purposely looking into how effective the Math Apps in improving the performance of Grade 11 students in Probability and Statistics.

Research Questions

This study aimed to determine the effectiveness of Math Apps in improving the performance of Grade 11 in Probability and Statistics at Bagahanglad National High School S.Y. 2019-2020.

Specifically, it sought to answer the following problems:
1) What is the pre-test Performance Level of control and experimental group along:
   a) ANOVA b) Z-test   c) regression correlation d) Pearson-product moments correlation
2) What is the post-test Performance Level of control and experimental group along:
   a) ANOVA b) Z-test   c) regression correlation d) Pearson-product moments correlation
3) Is there a significant difference between the pre-test and post test of the control group and experimental groups along the identified variables?
4) How effective are the Math Apps in improving the performance of grade 11 Probability and Statistics?
5) What training Design could be proposed to address the needs of the respondents?

2. Methodology

This study determined the effectiveness of math apps in improving the performance of the grade 11 students in probability and statistics at Bagahanglad National High School, San Jacinto District in the Division of Masbate-Province, school year 2019-2020.

The study employed the descriptive method research using a questionnaire as the main instrument in its data gathering component.

The study was conducted at Bagahanglad National High School where the researcher also taught. The respondents included 50 Grade 11 students who were taken probability and statistics subject. The students came from different sections.

The appropriate statistical tool such as t-test to determine the difference between pre-test and post-test of control group and experimental group along the four identified variables were used in this study.

The Sample

The researcher focused at the Bagahanglad National High School where she is presently teaching. The respondents were composed of 50 Grade 11 students of Bagahanglad National High School, Bagahanglad, San Jacinto, Masbate, who were taken probability and statistics subject.

To get the sample, purposive sampling was done. 50% of the respondents were the control group and the other 50% of the respondents were the experimental group.

The Instrument

The researcher utilized a questionnaire to determine the effectiveness of Math Apps in improving the performance of Grade 11 in Probability and Statistics subject along the four identified topics.

To determined the index of difficulty and the reliability of the questionnaire the researcher devised a table of equivalent for the percentage equivalent and description and used the Cronbach's alpha score for the level of reliability.

Difficulty Indices

91% - 95%	Very Easy
76% - 90%	Easy
25% - 75%	Average
10% - 24%	Difficult
5% - 9%	Very Difficult

Cronbach's Alpha Score	Level of Reliability
0.0 – 0.20	Less reliable
>0.20 – 0.40	Rather reliable
>0.40 – 0.60	Quite reliable
>0.60 – 0.80	Reliable
>0.80 – 1.00	Very reliable

The instrument for data gathering was composed of 12 items questions about probability and statistics subject along the four identified topics three items each topic.

The instrument reviewed to make sure that it could generate authentic and valid results. A dry run and item analysis was conducted to validate the instrument. The researcher then solicited comments and suggestions from the panel members before proceeding to its final distribution to the respondents.

Data Gathering Procedures

The researcher guided by the following steps in the data gathering procedures. Firstly, the acquisition of the approval of the proposal by the panel, a written permission from the Schools Division Superintendent, and Secondary School Head of Bagahanglad National High School.

The Data Analysis is the math apps being used in Probability and statistics subject along the four identified topics the ANOVA, Z-test, Regression correlation and Pearson-product moment correlation which are discussed after the pre-test of the respondents. The pre-test was conducted one hour before the discussion and the post-test was administered after the discussion of the four identified topics

using the Data analysis, it is for experimental group and traditional instruction for control group.

The respondents given instructions in answering the questionnaire and it would 100% retrieval. March 16, 2020 was the distribution of the questionnaires. The respondents were given instructions by the researcher. They would advise to answer it promptly according to the instruction using the Math apps the Data analysis. There would be enough time to answer the questionnaire.

Upon the retrieval of the questionnaires, an unstructured interview was done regarding to the effectiveness of Math apps in answering the problems. Total of 100% of the questionnaires would retrieve. Finally, the data would collect, tallied, tabulated, analyzed and interpreted.

The secondary sources of data would take from unstructured interview, curriculum guide, and readings from books, unpublished graduate thesis, and journals. The researcher was also use resources from the Internet to widen the ideas and scope of the study.

Data Analysis Procedures
The statistical measures and tools used in this study were the frequency count, mean, interview, and the t-test. Frequency count and mean were used to determine the performance level of the students in pre-test and post-test along the four identified topics: ANOVA, Z-test, Regression correlation, and Pearson-product moment correlation.

To determine the performance level, the mean was used with the following formula:

Mean = no. of correct responses / Total no. of items

Performance Level (PL) = Number of Correct Response X 100% / Total number of respondents / Total number of items

To determine the difference between pre-test and post-test result of control and experimental group along the four identified topics, the t-test was used with following formula:

$$t = \frac{\bar{D}}{\sqrt{\frac{\sum D^2 - \frac{(\sum D)^2}{n}}{n(n-1)}}}$$

Where:
$\bar{D}$ – the mean difference between the Pre-test and the Post-test

$\sum D^2$ - the sum of the squares of the difference between the Pre-test and Post-test

$\sum D$ - the summation of the difference between the Pre-test and Post-test

n – the sample size

To determine the descriptive interpretation of the level of performance, the researcher devised a table of equivalent for the percentage equivalent and description.

Performance Level	Qualitative Description
90 – 100	Outstanding
85 – 89	Very Satisfactory
80 – 84	Satisfactory
75 – 79	Fairly Satisfactory
Below 75	Did Not Meet Expectations

To determine the effectiveness of Math Apps, the interview was used.

3. Results and Discussions

Findings
Based from the data gathered, the following findings were revealed:
1) The Performance Level results in Pre-test of the control and experimental group along the four identified topics belongs to below 75 and interpreted as low performance.
2) The Performance Level results in post-test of the control are almost belongs to below 75 and experimental group where almost bracket 85-89 and interpreted as very satisfactory performance.
3) There is a significant difference between the Pre-test and Post-test of the control and experimental groups along the four identified topics. In Control group, the inference is based from the computed value of 5.685 which is greater than the critical value of 1.795 when the degree of freedom of 24 at .05 level of significance. This result showed that the post-test result is higher than the pre-test result. In experimental group, the inference is based from computed value of 9.493 which is greater than the critical value of 1.795 when the degree of freedom of 24 at .05 level of significance.
4) Math Apps is very effective in improving the performance of the students in Probability and Statistics subject. Based on the interview, it helps them to compute the mathematics problem easier and faster, and clearly understand the concepts. It also helps them to enhance their knowledge and skills in Probability and Statistics subject.
5) Training Design could be proposed to address the needs of the grade 11 students.

4. Conclusions

Based form the findings, the following conclusions are drawn;
1) It is clearly seen that most of the students from experimental group got a passing results along the four identified topics.
2) The majority of the grade 11 students did not meet the expectations of the lessons and it has a low performance.
3) The post-test result is higher than the pre-test result. The results revealed that the application is effective instructional materials to the grade 11 students.
4) The Math Apps is very effective in improving the performance of the students in Probability and Statistics subject
5) Proposed Training Design based on the Result of the Study

5. Recommendations

Based from the conclusions of the study, the following recommendations are made:

1) The Math apps in Probability and Statistics be submitted for further study and enhancement to ensure high mastery of the learning competencies.
2) The Math Apps may not only focused on unlocking difficulties but also provide more activities during and after the mathematical problems.
3) Design training and workshop to the teachers in secondary to improve the new techniques in probability and Statistics.
4) Trainings and seminar workshop should impose to the students in order for them to alleviate the performance in Mathematics as a whole.
5) Research parallel to this may also be conducted in other subjects and on wider scope.

References

[1] Andrew Childress, 2019, retrieved from https://tutsplus.com/authors/andrew-childress.
[2] Education Reform 2014, retrieved from https://www.unrwa.org/sites/default/files/2014_education_reform_report.pdf.
[3] Elaine J. Hom, 2013, retrieved from https://www.livescience.com/37704-phi-golden-ratio.html,
[4] Margaret Rouse, 2015, retrieved from https://www.techtarget.com/contributor/Margaret-Rouse.
[5] Merriam Webster Dictionary, 2006.
[6] Robert J. Havighurst, 1969, retrieved from https://www.psychologynoteshq.com/development-tasks/.
[7] TechTerms, 2010, retrieved from https://techterms.com/definition/ict.
[8] Webster Dictionary, 2006.
[9] Amuko Oyeila Sheila, Integrating Information Communication and Technology in Mathematics Education at Secondary level, A case of Nairobi County, Kenya, March 2016.
[10] Chong Chee Keong, A Study on the Use of ICT in Mathematics Teaching, December 2005.
[11] D Muhtadi, The integration of technology in teaching mathematics, 2017.
[12] Muhammad Saqib Khan_PhD, Irfanullah Khan, Siraj-u-Din, Hafiz Muhammad Ismail, Rafid Khattak, Rahimullah Jan, The impacts of ICT on the students' Performance:A Review of Access to Information, 2015.
[13] Zsolt Lavicza, Integrating technology into mathematics teaching at the university level, January 9, 2010.
[14] Dominique Marie Tetzlaff, Using Mobile Technology to Increase the Math Achievement and Using Mobile Technology to Increase the Math Achievement and Engagement of Students, August 2017
[15] Amuko Oyeila Sheila, Integrating Information Communication and Technology in Mathematics Education at Secondary level, A Case of Nairobi County, Kenya, March 2016
[16] Meilan Zhang, Robert P. Trussell, Benjamin Gallegos, and Rasmiyeh R. Asam, Using Math Apps for Improving Student Learning, April 2015
[17] Darel Deuna Caubang, Competence on Computer Application and Basic trouble shooting of Grade Six Teachers, October 2015.

[18] Karen Bulseco-Gutlay, Effectiveness of Information and Communication Technology (ICT) for Elementary Teachers in Teaching Mathematics VI, March 2016.
[19] Zachariah Kariuki Mbugua, Komen Kibet, George Mungiria Muthaa, George Reche Nkonke, Factors Contributing To Students' Poor Performance in Mathematics at Kenya Certificate of Secondary Education in Kenya: A Case of Baringo County, Kenya, June 2012.
[20] Alan C. K. Cheung andRobert E. Slavin, The Effectiveness of Educational Technology Applications for Enhancing Mathematics Achievement in K-12 Classrooms, July 2011
[21] J. Mariah Brown, DOES THE USE OF TECHNOLOGY IN THE CLASSROOM INCREASE STUDENTS" OVERALL ACADEMIC PERFORMANCE, December 2011
[22] Adnan Baki, Preparing student teachers to use computers in mathematics classrooms through a long-term pre service course in Turkey (2006) retrieved from https://doi.org/10.1080/14759390000200090, in March 2020.
[23] Gary Bitter, Analysis of Learning Outcomes from Mobile Mathematics Applications (2015) retrieved from https://www.researchgate.net/publication/274779992, in March 2020.
[24] Karim Sevari and Maryam Falahi, The Effectiveness of Math Educational Software on Creativity and Academic Achievement (2018) retrieved from http://dx.doi.org/10.19080/PBSIJ.2018.08.555741., in March 2020
[25] Yao-Ting Sung, Kuo-En Chang, and Tzu-Chien Liu, The effects of integrating mobile devices with teaching and learning on students' learning performance (2015) retrieved from https://www.sciencedirect.com/science/article/pii/S0360131515300804, in March 2020
[26] Jonathan O. Etcuban and Leocineza D. Pantinople , The Effects of Mobile Application in Teaching High School Mathematics (2018) retrieved from https://files.eric.ed.gov/fulltext/EJ1227511.pdf, in March 2020
[27] Delia Hillmayr, Lisa Ziernwald, Frank Reinhold, Sarah I. Hofer, and Kristina M. Reiss, The potential of digital tools to enhance mathematics and science learning in secondary schools retrieved from https://doi.org/10.1016/j.compedu.2020.103897, in March 2020
[28] Emin Aydın, The use of computers in mathematics education: a paradigm shift from "computer assisted instruction" towards "student programming" retrieved from https://files.eric.ed.gov/fulltext/ED502604.pdf, in March 2020
[29] Anne Bennison and Merrilyn Goos, Learning to teach mathematics with technology: A survey of professional development needs, experiences and impacts (2010), retrieved from https://link.springer.com/article/10.1007/BF03217558, in September 2019.
[30] Chee-Keong Chong, Jacob Horani, and Daniel, A Study on the Use of ICT in Mathematics Teaching (2005), retrieved fromhttps://www.researchgate.net/publication/2286361

80_A_Study_on_the_Use_of_ICT_in_Mathematics_Teaching, in September 2019.

[31] Ifenthaler, Dirk; Isaias, Pedro; Kinshuk; Sampson, Demetrios G.; Spector, J. Michael, Technology Supported Cognition and Exploratory Learning, retrieved from https://www.questia.com/library/journal/1G1-284221923/technology-supported-cognition-andexploratory-learning, in September 2019.

[32] Joseph Carilus Ateng Ogwel, Technology Integration in Digital Learning Environments (2008), retrieved from https://www.igi-global.com/chapter/technology integration-in-digital-learning-environments/186249, in September 2019

[33] MOE Report, EDUCATION SECTOR PERFORMANCE REPORT (2010), retrieved from https://newndpcstatic1.s3.amazonaws.com/pubication/ MoE_EducationSectorPerfReport_2010+APR.pdf, in September 2019.

[34] Mojgan Afshari, Kamariah Abu Bakar, Wong Su Luan, Bahaman Abu Samah & Foo Say Fooi, Factors affecting teachers' use of Information and Communication Technology (January 2009), retrieved from https://files.eric.ed.gov/fulltext/ED524156.pdf, in September 2019.

[35] Muhammad Saqid Khad,Phd, The impacts of ICT on the students' Performance: A Review of Access to Information (2015), retrieved from https://www.researchgate.net/publication/313768677_The_impacts_of_ICT_on_the_students'_Performance_A_Review_of_Access_to_Information, in September 2019.

[36] Nimer Baya'a, Mathematics Teachers' Readiness to Integrate ICT in the Classroom: The Case of Elementary and Middle School Arab Teachers in Israel (March 2013), retrieved from https://online-journals.org/index.php/i-jet/article/view/2386, in September 2019.

[37] Rebecca Hudson, and Anne L. Porter, ICT use to improve mathematics education in secondary schools (2010), retrieved from https://ro.uow.edu.au/infopapers/2579/, in September 2019.

[38] Sheila Amuko, Marguerite Miheso-O'Connor, and Sophie Ndeuthi, Opportunities and Challenges: Integration of ICT in teaching and learning mathematics in secondary schools, Nairobi, Kenya (2015), retrieved from https://irlibrary.ku.ac.ke/bitstream/handle/123456789/18322/Opportunities%20and%20challenges%20integration.pdf?sequence=1&isAllowed=y, in September 2019.

[39] UNESCO, A Report on an Information & Communication Technology (ICT) and Information Literacy (IL) training initiative at Kgoro Primary School (2007), retrieved fromhttp://portal.unesco.org/en/files/48603/13135076571UP_UNESCO_IL_feedback_report_FINAL17Feb.pdf/UP_UNESCO_IL_feedback_report%2BFINAL-17Feb.pdf, in September 2019.

[40] DepEd Order No. 78, s. 2010, Guidelines on the Implementation of the DepEd Computerization Program (DCP), retrieved from https://www.deped.gov.ph/2010/06/10/do-78-s-2010-guidelines-on-the-implementation-of-the-deped computerization-program-dcp/, in September 2019.