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Effectiveness of Contextualized Problem-Based Learning in Improving the Performance of Grade 6 Learners in Math

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ABSTRACT

The aim of the study is to evaluate the effectiveness of contextualized problem-based learning in improving the performance of grade 6 learners in Math. The study was conducted in San Roque Elementary School, Tanauan II District, Leyte Division with a four-week intervention program utilizing the contextualized problem-based learning model in teaching math. Participants consisted of 29 struggling grade 6 learners in math. A quasi-experimental research design consisting of a pre-test and post-test measure was employed. The pre-test and post-test were given before and after the intervention respectively to ascertain change in participants' performance over a four-week intervention period. Simple percentage and t-test of mean difference were the statistical tools used to interpret the result of the study. Results indicating a statistically significant improvement in the performance among the grade 6 learners after the implementation of interventions such as contextualized problem-based learning model. This outcome underscores the effectiveness of the educational interventions in improving the performance of young learners within the study's framework. It was therefore concluded that contextualized problem-based learning had a significant influence on improvement in learner performance in math.

Keywords — Effectiveness, Contextualized Problem-Based Learning, Performance, Grade 6 Learners, Math

I. INTRODUCTION

Mathematics is one of the learning areas that must be taught at every level of education, especially in elementary school. Mastery of the mathematics concepts for every grade level is needed. Because mathematics subjects can equip learners with the ability to think logically, analytically, systematically, critically, and creatively and the ability to cooperate among groups. To achieve the desired mastery of the mathematics concepts, teachers were innovative in formulating and producing relevant learning activities which will guide the learners in achieving such goals.

Unfortunately, of the many interventions that teachers employ in every classroom, it was still found out that there are learners who performed below their grade level in terms of numeracy performance. This challenges every educator, curriculum writers and policy makers to make the curriculum relevant and meaningful in the lives of the learners. This calls for urgent need to address the problems in the school.

Further, various studies and reports have identified some of the causes that influence the teaching and learning of Mathematics. Some of the factors brought out include teaching methods and approaches, lack of teaching aids and learner

perception towards the subject (Kapolyo, 2019), added that the learners' performance in certain subjects depends on their attitude towards the subject. A positive attitude towards the subjects would encourage a person to learn the subject much better. In a study conducted by Kapolyo (2019), have found that the interest has a positive influence on students‟ performance in Mathematics.

Mathematics education is a global concern, as indicated by the Programme for International Student Assessment (PISA, 2018) and low proficiency levels reported by PISA (2013) and the National Center for Education Statistics (NCES, 2013). In the Philippines, the quality of mathematics education remains low, as evidenced by National Achievement Test (NAT) scores and global rankings (Antonio, 2015).). Particularly, the Philippines ranked 76th out of 140 countries in Mathematics and Science Education, while Filipino students scored significantly lower than the OECD average in Mathematical Literacy according to the 2018 PISA results (Antonio, 2015; PISA, 2018). To address these challenges, policymakers and educators prioritize improving learners' mathematics performance by integrating ICT and contextualizing learning resources (Saeed, Ahmed, & Malik, 2018). However, the lack of instructional materials, including manipulatives, poses challenges to effective teaching and learning (Antonio, 2015). Hence, the researcher formulated the contextualized problem-based learning. Hoping that this method will address the needs of the learners to achieve positive learning outcomes in Math.

Problem-based learning (PBL) is an instructional approach that utilizes inquiry-based learning to support learners working collaboratively with their peers to learn concepts and principles as they engage in complex issues (Yasin, 2022). This type of teaching method, learners are engaging in self-directed learning to identify research and apply knowledge and skills to solve problems. This instructional method encourages learners to become responsible for their learning, develop strategies, construct their understanding, and reflect on what they have learned. It also prepares learners to build 21st century skills, to develop life-long habits to become ready for the next higher level of education.

Thus, it is in this premise that the researcher decided to conduct this study to evaluate the effectiveness of contextualized problem-based learning in improving the performance of grade 6 learners in Math. A proposed improvement plan was formulated based on the findings of the study. Likewise, it is in the rationale that the researcher who is currently a grade 6 teacher in the above mentioned local, would like to delve worthy research undertaking that will benefit herself, the school she is currently teaching and that of her Graduate Program she is enrolled at.

This study evaluates the effectiveness of contextualized problem-based learning in improving the performance of grade 6 learners in Math of San Roque Elementary School, Tanauan II District, Leyte Division for School Year 2023-2024. The findings of the study were the basis for the proposed improvement plan.

Specifically, this study sought to answer the following questions:

1. What is the performance of the grade 6 learners in Math before the utilization of contextualized problem-based learning model?
2. What is the performance of the grade 6 learners in Math after the utilization of contextualized problem-based learning model?
3. Is there a significant difference in the performance of the grade 6 learners in Math before and after the utilization of contextualized problem-based learning model?
4. What improvement plan can be proposed based on the findings of this study?

II. METHODOLOGY

Design. This study employed a quasi-experimental research design utilizing the pre-test and post-test assessments to evaluate the effectiveness of a contextualized problem-based learning model in enhancing the performance of Grade 6 learners in Math at San Roque Elementary School, Tanauan II District, Leyte Division. The research focused on assessing how this instructional approach impacted student learning outcomes. San Roque Elementary School, located in Barangay San Roque, Tanauan, Leyte, provided the setting, accommodating 604 learners across 22 classes overseen by 22 teachers and a school principal. The study targeted twenty-nine Grade 6 learners identified as struggling in Math for the school year 2023-2024, employing a complete enumeration method to select participants. Research instruments included a researcher-made Math test aligned with the 4th quarter Most Essential Learning Competencies (MELCs), administered before and after the implementation of contextualized problem-based learning. Lesson plans were developed following a structured framework, integrating real-world problem-solving into Math instruction. Validation of tests and lesson plans by the District Math Coordinator and School Head ensured alignment with curriculum objectives. The study utilized a matrix to monitor intervention progress, emphasizing the systematic evaluation of educational strategies aimed at improving learner outcomes. This research focused on evaluating the effectiveness of contextualized problem-based learning model in improving the performance of grade 6 learners in Math through the pre-test and post-test and its significant difference. A Proposed Improvement Plan based on the findings of the study is the output.

Sampling. The respondents of this study were twenty-nine (29) Grade 6 learners who were struggling in Math enrolled in the above-mentioned locale for School Year 2023-2024. Complete enumeration was employed in choosing the respondents for the study.

Research Procedure. After the research approval, data gathering commenced with submission of letter requests for study approval to appropriate authorities. Initially, a letter was sent to the Schools Division Superintendent seeking approval to proceed with data collection from identified respondents. Following SDS approval, permission letters were also submitted to the Public Schools District Supervisor and School Principal. Once approvals were obtained, the researcher proceeded with data gathering activities. An orientation session was conducted for the respondents, and parental consent was obtained for their children's participation in the study. The pre-test was administered during Math period. Subsequently, a four-week intervention was implemented, focusing on teaching Math using a contextualized problem-based learning model. Post-intervention, a post-test was conducted, and responses were collected, tabulated, and prepared for statistical analysis. A Matrix of Activities was maintained to monitor data gathering progress throughout the study.

Ethical Issues. The researcher properly secured the permission to conduct the study from the authorities through written communication. In the formulation of the intervention materials that was used in the study, the use of offensive, discriminatory, or other unacceptable language was avoided. The respondents' names and other personal data were not included in this study to protect their privacy. Participation of the respondents was also voluntary. Orientation was conducted for the respondents with their parents. In the orientation, issues and concerns were addressed and consent to be included in the study were signed. The researcher-maintained objectivity in analyzing and discussing the results. All authors whose works were mentioned in this study were properly quoted and were acknowledged in the reference.

Treatment of Data. The performance of grade 6 learners in Math before and after the utilization of contextualized problem-based learning was evaluated using Simple Percentage. Additionally, the t-Test of Mean Difference was employed to assess significant differences in their performances.

III. RESULTS AND DISCUSSION

TABLE 1

PRE-TEST PERFORMANCE OF GRADE 6 LEARNERS IN MATH

Score Range	Description	PRETEST	
		Frequency	%
25-30	Excellent	0	0
19-24	Very Good	0	0
13-18	Good	0	3
7-12	Fair	25	86
1-6	Poor	4	14
Total		29	100
Weighted Mean		**8.34**	**Poor**

Table 1 presents the pre-test performance of Grade 6 learners in Math, detailing their scores across different proficiency levels. None of the learners achieved scores in the Excellent (25-30) or Very Good (19-24) categories, indicating a complete absence of high-level performance. Similarly, no learners fell into the Good (13-18) range, underscoring a deficiency in achieving a satisfactory level of proficiency. The majority of learners, constituting 86% of the sample, scored within the Fair range (7-12), suggesting a basic understanding of Math concepts but with room for improvement. A smaller proportion, representing 14% of the learners, scored in the Poor range (1-6), indicating significant challenges in grasping fundamental Math skills. In total, the table accounts for 29 Grade 6 learners assessed, with a weighted mean score of 8.34 categorizing the overall performance as Poor. This data highlights the need for targeted educational interventions and enhanced teaching strategies to support Grade 6 learners in improving their math proficiency levels effectively. It is evident that utilizing a traditional model of teaching math leaves poor performance among grade 6 learners. Introducing new teaching model is needed to help the learners achieve the desired learning outcomes. In essence, mathematics as a structured and systematic science implies that the concepts and principles of mathematics are intertwined with each other. As the implication, then in learning mathematics to achieve a meaningful understanding of students must have adequate mathematical connection capability (Umanailo, et al., 2019). The ability of mathematical connections is the ability to associate the concept of mathematical concepts between concepts in mathematics itself and associate the concept of mathematics with concepts in other fields (Umanailo, et al., 2019). The strong connection between mathematical concepts implicates those aspects of mathematical connections also contain other mathematical aspects or vice versa. In the school mathematics curriculum, reasoning and mathematical connections are two basic mathematical abilities that must be mastered by high school students. Reasoning is the process of thinking in the process of drawing conclusions.

TABLE 2

POST-TEST PERFORMANCE OF GRADE 6 LEARNERS IN MATH

Score Range	Description	POST TEST	
		Frequency	%
25-30	Excellent	12	41
19-24	Very Good	13	45
13-18	Good	4	14
7-12	Fair	0	0
1-6	Poor	0	0
Total		29	100
Weighted Mean		**23.97**	**Excellent**

Table 2 illustrates the post-test performance of Grade 6 learners in Math, showcasing their achievements across different score ranges. A significant portion of learners, 41%, attained scores in the Excellent range (25-30), reflecting a commendable mastery of Math concepts and skills. Additionally, 45% of the learners scored in the Very Good range (19-24), indicating a strong grasp of the subject matter. However, no learners were scoring in the Good (13-18), Fair (7-12), or Poor (1-6) ranges, suggesting an absence of students performing below the Very Good level. In total, 29 Grade 6 learners were assessed, with a weighted mean score of 23.97, which categorizes the overall post-test performance as Excellent. This data underscores the effectiveness of the instructional methods employed post-intervention, contributing to substantial improvements in Math proficiency among Grade 6 learners. Employing problem-based learning model in teaching math greatly influenced the increase their performance. Problem-based learning as a learning approach that begins with presenting a problem designed in contexts that are relevant to the material that will be learned to encourage students: acquiring knowledge and understanding of concepts, achieving critical thinking, having self-reliance learning, participating skills in group work, and problem-solving skills (Ibrahim & Fadzil, 2013).

TABLE 3

TEST OF DIFFERENCE BETWEEN THE SCORES IN THE PRE-TEST AND POST-TEST OF GRADE 6 LEARNERS IN MATH

Aspects	Test Scores		Computed T	Critical T	Decision	Interpretation
Kindergarten Learners in Fluency	Pre Post	8.34 23.97	2.614	1.214	Reject H_o	Significant

Table 3 presents the test results comparing the pre-test and post-test performances of grade 6 learners in Math, focusing on the statistical significance of the difference. The pre-test score averaged at 8.34, while the post-test score notably increased to 23.97. Using a t-Test analysis with a critical t-value of 1.214, the computed t-value of 2.614 decisively rejects the null hypothesis (Ho), indicating a statistically significant improvement in the performance among the grade 6 learners after the implementation of interventions such as problem-based learning model. This outcome

underscores the effectiveness of the educational interventions in improving the performance of young learners within the study's framework. Mathematics subjects need to be given to all learners ranging from elementary school to equip students with logical, analytical, systematic, critical, and creative thinking skills, as well as the ability to cooperate (Ching-Ter et al., 2017). Looking at the current conditions such in the pre-test assessment, learners are very struggling to solve a problem given by educators, although they are still in accordance with the material they have provided because they do not yet know the structured steps used to resolve the issue. One of the alternative models of learning that can be applied is a problem-based learning model (problem-based learning). Through mathematical learning by implementing a problem-based learning model, learners are more trained to solve problems scientifically, structuring, and systematic. Through a problem-based learning model, students are used to learn from the actual and factual problems in daily life, and students are also used to learn groups and discussions, as well as learn to study issues, seek the relevant information, compile the information obtained, review the existing Solutions alternatives, propose alternative solutions, and compose the completion action. So, students can understand the theory deeply through an empirical learning practice experience (Rachman et al., 2019). According to research by Yanda et al. (2019) and Handayani (2017), the problem-based learning model is effective in increasing understanding of mathematical concepts as well as arousing student motivation. Ariandy (2016) also found that problem-based learning model helps students to increase their understanding of a concept. Arends (2012) also states that “problem-based learning model is a learning model in which students are faced with authentic (real) problems that require an understanding of concepts”.

IV. CONCLUSIONS

Based on the data from Tables 1, 2, and 3, it is evident that the implementation of problem-based learning model in teaching math has significantly enhanced the performance of grade 6 learners. Initially, a majority scored poorly in math performance, but post-intervention, a substantial number achieved excellent scores, reflecting a notable improvement. Statistical analysis further supports these findings, showing a significant increase in mean scores post-intervention. The results underscore the effectiveness of targeted educational interventions in improving the performance of the grade 6 learners in math, highlighting their critical role in enhancing overall learning outcomes. If learners are given an experience, learning will be very effective because learners will not only see mathematical concepts from an abstract point of view but will marry to an experience given to them. The problem-based learning model develop learners’ problem solving and critical thinking skills which will be helpful in solving problems in school and from their everyday lives.

V. RECOMMENDATIONS

1. Utilize the proposed improvement plan formulated.

2. Teachers must implement the problem-based learning model in teaching math.

3. Teachers need much support from their fellow teachers, parents and school leaders as to the effective implementation of the strategies formulated in the study.

4. Explicit instruction in problem solving strategies is critical to achieve mastery learning.

5. School Heads must formulate training design and conduct such to the teachers to acquire knowledge and competencies in teaching math utilizing the problem-based learning model.

6. School Heads must assist and provide technical assistance to the teachers in the formulation of learning activities in problem-based learning model to be used in the class.

7. School Heads must provide resources and other materials needed to produce learning materials to be used in teaching problem solving skills in math.

8. Teachers must create a classroom where learners are free to conduct collaboration among learners especially in achieving tasks in math.

9. Teachers must encourage learners to share their experiences through presenting their output based on the acquired knowledge utilizing the problem-based model in teaching math, and

10. Future researchers should develop further studies on the methods, strategies, and techniques implemented by problem-based learning school administrators and teachers to effectively meet the learning needs of the learners in mathematics.

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REFERENCES

[1] Abadi, M. K. et al., (2016). *Development of Teaching Materials Based Interactive Scientific Approach towards the Concept of Social Arithmetic For Junior High School Student. Journal of Physics*, 8 (12), 25-26.

[2] Adalikwu, S. A., Iorkpilgh I. T., (2012, August 29). *Academic Performance of Senior Secondary School Students in Chemistry in Cross River State*. Retrieved from Global Journal of Educational Research: http://dx.doi.org/10.4314/gjedr.v12i1.6.

[3] Amalia, R., Saiman, S., Sofiyan, S., & Mursalin, M. (2018, September). Designing computer-based fraction worksheets for junior high school. In *Journal of Physics: Conference Series* (Vol. 1088, No. 1, p. 012110). IOP Publishing.

[4] Amiluddin, R., & Sugiman, S. (2016). Pengaruh Problem Posing Dan PBL Terhadap Prestasi Belajar, Dan Motivasi Belajar Mahasiswa Pendidikan Matematika. *Jurnal Riset Pendidikan Matematika*, 3(1), 100-108

[5] Andriotis, N. (2017, June). *Contextualized learning: Teaching made highly effective!* Retrieved August 16, 2020, from efrontlearning.com: https://bit.ly/3gZWbaw

[6] Antonio, G. J. C. (2015). *Academic hardiness, mathematics anxiety, and mathematics performance of high school students*. Unpublished Master's Thesis. Northwestern University, Laoag City, Philippines.

[7] Ariani, D. N. (2018). Pengaruh Model Pembelajaran Berbasis Masalah Dengan Pendekatan Saintifik Terhadap Kemampuan Berfikir Kritis Matematis Mahasiswa/I PGMI. *Muallimuna: Jurnal Madrasah Ibtidaiyah*, 3(2), 108-115.

[8] Bartolome, J. C. S. (2019). *A Self-Learning Kit in Improving the Mathematical Problem-Solving Skills of Grade Six Pupils*. Unpublished Master's Thesis. Laoag City: Divine Word College of Laoag.

[9] Castillo, C. (2019). *Developing Student's Conceptual Understanding in Mathematics through Technology-Enhanced Instructional Materials*. Unpublished Thesis: Laoag City: Mariano Marcos State University. Center for Occupational Research and Development. https://www.cord.org. Accessed 8th October 2019.

[10] Clements, D. H., Sarama, J., & Swaminathan, S. (2018). *Teaching and learning Geometry: Early foundations*. Quadrante, 27(2), 1-31.

[11] Danoebroto, S. W. (2015). Teori belajar konstruktivis Piaget dan Vygotsky. *Indonesian Digital Journal of Mathematics and Education*, 2(3), 191-198.

[12] Department of Education (2016). *K to 12 Curriculum Guide for Mathematics*.
[13] Dimasuay, M. (2015). *Interactive Learning Materials (ILMs)*. Retrieved from https://bit.ly/32HK8tE.

[14] Farhan, M., & Retnawati, H. (2014). Keefektifan PBL Dan IBL Ditinjau Dari Prestasi Belajar, Kemampuan Representasi Matematis, Dan Motivasi Belajar. *Jurnal Riset Pendidikan Matematika*, 1(2), 227-240.

[15] Fonna, M., & Mursalin, M. (2018). Pengembangan Modul Geometri Analitik Bidang Berbantuan Wingeom Software untuk Meningkatkan Kemampuan Representasi Matematis Mahasiswa Program Studi Pendidikan Matematika Universitas Malikussaleh. *UNION: Jurnal Ilmiah Pendidikan Matematika*, *6*(3), 391-402.

[16] Franke, G. R. (2010). Product Moment Correlation. Wiley International Encyclopedia of Marketing.

[17] Gushchin, Y., (2016). *The use of interactive methods of learning in college*. International Journal of Environmental & Science Education, 11 (18), 12528-12539.

[18] Imswatama, A & Lukman, H.,S. (2018). The Effectiveness of Mathematics Teaching Material Based on Ethnomathematics. *International Journal of Trends in Mathematics Education Research*, *1*(1), 35-38. doi:10.33122/ijtmer.v1i1.11

[19] Kaharuddin, A. (2013). Effectiveness Comparative Of Scientific Approach ELPSA And Open-Ended Setting Cooperative STAD Types Of Mathematics Learning At VII Class SMP Negeri Of A Accreditation In Makassar. *Daya Mathematics: Jurnal Inovasi Pendidikan Matematika*, 1(1), 29-44.

[20] Kemendikbud. (2017). Reference List: Jumlah Data Satuan Pendidikan (Sekolah) Per Kabupaten/Kota : Kota Kendari. Dikutip pada 12 Maret 2017 dari http://referensi.data.kemdikbud.go.id/index11.php?kode=206000&level=2. Accessed on August 23, 2018.

[21] Lestari, N. N. S. (2012). Pengaruh Model Pembelajaran Berbasis Masalah (Problem Based Learning) Dan Motivasi Belajar Terhadap Prestasi Belajar Fisika Bagi Siswa Kelas VII SMP. *Jurnal Teknologi Pembelajaran Indonesia*, 1(2).

[22] Masitoh, L. F., & Fitriyani, H. (2018). Improving students' mathematics self-efficacy through problem based learning.*Malikussaleh Journal of Mathematics Learning (MJML)*, *1*(1), 26-30.

[23] Mazana, M. Y. (2018). *Investigating Students' Attitude towards Learning Mathematics*. International Electronic Journal of Mathematics Education, 35-39. Retrieved November 13, 2020 from International Electronic Journal of Mathematics Education.

[24] Mazgon, J., & Stefanc, D. (2012). *Importance of the Various Characteristics of Educational Materials: Different Opinions, Different Perspectives*. The Turkish Online Journal of Educational Technology, 174-176.

[25] Methner, G. (2013). *Perceptions of administrative support and follower readiness in middle school teachers.* Ohio, USA: Published Dissertation: Graduate College at Bowling Green State University.

[26] Mohamed & Osama, (2018). *Role Of Information Communication Technology (Ict) In 21st Century*. IBT Journal of Business Studies, 10-13.

[27] Motteram, G. (2013). *Situated Learning Theory: The Key to Effective Classroom Teaching.* International Journal for Educational, Social Political & Cultural Studies, 10-11

[28] Mouraz, A., & Leite, C. (2013). *Contextualization Tracking the Meaning of a Concept*. Retrieved from Academia Education: https://bit.ly/2FM6voJ.

[29] Mursalin, M., Nuraini, N. L. S., Purnomo, H., Damayanti, N. W., Kristanti, D., Rohim, A., ... & Fonna, M. (2018, September). The development of algebra teaching materials to foster students' creative thinking skills in higher education. In *Journal of Physics: Conference Series* (Vol. 1088, No. 1, p. 012101). IOP Publishing.

[30] Nasir, M. (2016). Efektivitas Model Pembelajaran Berbasis Masalah (Problem Based Learning) Terhadap Kemampuan Pemecahan Masalah Siswa Pada Pelajaran Matematika. *Muallimuna: Jurnal Madrasah Ibtidaiyah*, 1(2), 1-19.

[31] Natividad, E. (2018). *Capability enhancement framework in Mathematics for Secondary School Master Teachers.* Laoag City: Unpublished Dissertation. Divine Word College of Laoag.

[32] NCES (2013). National Center for Education Statistics. Retrieved November 13, 2019 from Organization for Economic Co-operation and Management: https://nces.ed.gov/

[33] Nicolas, M. (2020). *Localized Supplementary Reading Material for Intermediate Grades*. Unpublished Dissertation. Laoag City: Divine Word College of Laoag.

[34] Osiyemi, O. (2016, December 3). *Lack of eLearning materials in secondary schools.* Retrieved August 16, 2020, from eLearning Industry: https://bit.ly/2PY8isw

[35] Paloloang, M. F. B. (2014). Penerapan Model Problem Based Learning (PBL) Untuk Meningkatkan Hasil Belajar Siswa Pada Materi Panjang Garis Singgung Persekutuan Dua Lingkaran Di Kelas VII SMP Negeri 19 Palu. *Jurnal Elektronik Pendidikan Matematika Tadulako*, 2(1).

[36] Permatasari, N. E., Koeswati, H. D., & Giarti, S. (2018). Pengembangan Model Pembelajaran Problem Based Learning Dan Pesawat Sederhana (Probalpena) Untuk Meningkatkan Hasil Belajar IPA Siswa Kelas V SDN Karanganyar 01. *Muallimuna: Jurnal Madrasah Ibtidaiyah*, 3(2), 116-127.

[37] PISA (2018). *Program for International Student Assessment*. Retrieved November 13, 2019, from Organisation for Economic Co-operation and Management: https://bit.ly/2FHyCpi.

[38] Putriani, D & Rahayu, C. (2018). The Effect of Discovery Learning Model Using Sunflowers in Circles on Mathematics Learning Outcomes. *International Journal of Trends in Mathematics Education Research, 1*(1), 22-25. doi:10.33122/ijtmer.v1i1.26

[39] Queirós, A., Faria, D., & Almeida, F. (2017). Strengths and Limitations of Qualitative and Quantitative Research Methods. European Journal of Education Studies.

[40] Reyes, J. D., Insorio, A. O., Ingreso, M. V., Hilario, F. F., & Gutierrez, C. R. (2019). *Conception and application of contextualization in Mathematics education*. International Journal of Educational Studies in Mathematics, 6(1), 1-18.

[41] Saeed, S., Ahmed, M. O., & Malik, U. (2018*). Role Of Information Communication Technology (Ict) In 21st Century*. IBT Journal of Business Studies, 10-13.

[42] Siemens, G. (2004). *Connectivism as a Digital Age Learning Theory*. Retrieved October 26, 2019, from https://bit.ly/33I4gLt.

[43] Silao, Jr. I, (2018). *Factors Affecting the Mathematics Problem-Solving Skills of Filipino Pupils*. International Journal of Scientific and Research Publications, 8(2) 24-28.

[44] Siregar, S. 2017. Statistika Terapan Untuk Perguruan Tinggi. Indonesia: Prenada Media.

[45] Sugiyono. 2016. Statistika Untuk Penelitian. Bandung: Penerbit Alfabeta.

[46] Supardi. 2013. Aplikasi Statistik Dalam Penelitian. Jakarta: Change Publication.

[47] Thahir, M., Roza, Y., & Murni, A. (2018). Validity of learning website of kapita selekta mathematics course at UIN Suska Riau Students. *Malikussaleh Journal of Mathematics Learning (MJML)*, *1*(1), 19-25.

[48] Usmadi & Ergusni (2018). Design of ARCSI Learning Model with Scientific Approach for Teaching Mathematics in School. *International Journal of Trends in Mathematics Education Research, 1*(1), 13-18. doi:10.33122/ijtmer.v1i1.28

[49] Villanueva, J. (2018). *Differentiated Learning Material for Mathematics 2*. Laoag City: Unpublished Master's Thesis. Divine Word College of Laoag.