*IOSR Journal of Mathematics (IOSR-JM)*
*e-ISSN: 2278-5728, p-ISSN: 2319-765X. Volume 16, Issue 5 Ser. III (Sep. – Oct. 2020), PP 28-35*
*www.iosrjournals.org*

# The role of Calculator use in Mathematics Problem-Solving Abilities of Pupils at the Junior High School in Ghana.

Richard Ayamah[1], Godwin Kofi Awuitor[2], Zutaah Puotier[3]
[1]*(Mathematics/ ICT Department, St. Joseph's College of Education, Bechem-B/A, Ghana.*
[2]*(Mathematics/ ICT Department, Akatsi College of Education, Akatsi-Volta, Ghana.*
[3]*(Mathematics/ ICT Department, Presyterian College of Education, Akropong Akuapem, Ghana.*

***Abstract***
***Background****: With rapid technological advancement, mankind's dealings have been greatly affected in many ways, especially in the fields of learning and teaching of mathematics and other scientifically related subjects in schools, not even talking about the occurrences in our homes, offices, market places and other employment fields. To make dealings with all these aspects of life faster and easier, calculators and other forms of calculating machines, example the computer, are used. However, the use of calculator at the basic level in any Ghanaian school is not allowed by law, either for teaching or in any form of examination. The purpose of the study was therefore to investigate whether the use of calculators in the mathematics problem-solving abilities of pupils at the basic level would enhance their learning of mathematics.*
***Materials and Methods****: Two types of achievement tests namely, pre-test and post-test, were used to collect the data for the study. The data was collected from the University Junior High School, Cape Coast, after instructional sessions with two randomly selected classes. The school was purposively selected for the study. The formulated hypothesis of the study was to find whether there was a significant difference between the mean scores of the experimental and the control groups at five percent level of significance. The data collected was analyzed using the student t-test and covariance.*
***Results:*** *The results showed that at five percent significance level, there was a significant difference between the mean score of the experimental group and that of the control group. Hence, the use of calculators positively affected the performance of the pupils in the mathematical problem-solving abilities.*
***Keywords*****:** *Calculator, Basic school, Experimental group, Control group, Mathematics problem-solving abilities, Covariance, Pre-test, Post-test.*

---

Date of Submission: 30-09-2020 Date of Acceptance: 13-10-2020

---

## I. Introduction

***Brief History of Calculator***

Calculator is a handheld device or a program on a computer that performs mathematical calculations, but this study limits to the handheld device only. The first instrument to help in making mathematical calculation was the abacus which was developed in ancient Babylonian in 3000BC. It was then followed by the invention of the slide rule and the logarithm tables, and this progressed through mechanical calculating machines and then to this modern type of electronic calculators and computers. In 1614, John Napier discovered the logarithms which made it possible to perform multiplications and division by addition and subtraction. This was a great time saver but there was still quite a lot of work required. The mathematician had to look up for two logarithms, add them together and then look for the number whose logarithm was the sum. However, this problem was reduced by Edmund Gunter in 1632 when he constructed a number line in which the positions of the numbers were proportioned to their logarithms. The scale therefore started at one since the logarithm of one is zero, and this led the invention of the slide rule.

In 1614, the first calculating machine which could only add and subtract figures automatically was invented in France by Blaise Pascal at the age of 19. With this, numbers were fed into the calculator via wheels and these turned gears inside the calculator to move dials with the numbers for the results to show on a set of windows. A German scientist, Gottfried Leibnitz also invented a machine which could multiply and divide numbers in 1694.

These mechanical calculators were used till the 1970's during which electronic calculators became more popular up till today's world (http://www.allsands.com).

***Background of the Study***

With rapid technological advancement, mankind's dealings have been greatly affected in many ways, especially in the fields of learning and teaching of mathematics and other scientifically related subjects in schools, not even talking about the occurrences in our homes, offices, market places and other employment fields. To make dealings with all these aspects of life faster and easier, calculators and other forms of calculating machines, example the computer, are used.

However, before 1993, students in Ghana were not permitted to use calculators for General Certificate Examination (G.C.E) Ordinary and Advance Level examinations. They were, however, allowed to use either slide rule or a four-figure table. One interesting part of this story is that, learning and teaching of the use of slide rule and a four-figure table was made part of the mathematics curriculum, but now that most students in the second cycle institutions own calculators and are allowed to use them in all types of examinations, they are not officially taught how to use them even though this has been made part of the teaching syllabus at the Senior High School (SHS) level.

Despite the fact that calculator use is a common feature in this technological era, pupils at the basic level in Ghana are just not only taught the use of calculators, but are also not allowed to use them during examinations, reason being that calculator usage at this level will reduce the pupils' mental exploration rate (Allotey, 1995). This confirms the report by H.M. Cooke (1987-90) that, "students in developing countries were not taught the use of calculator, unlike their advanced countries counterparts".

Meanwhile, some of these pupils at the basic level do use calculators at home as an advance preparation for the SHS course. It will be proper therefore, if calculator usage and learning of its use is made part of the curriculum at the basic level so that, if anything at all, it will prepare them in advance for its effective use at their next level of education. This is in support of Shuard's (1986) argument that, "since many students have access to calculators at home or in school, it is therefore imperative to make sure our pupils learn how to use calculators effectively and efficiently, and if this is not done at school, where else?" Moreover, Lieback (1984) said, "as with all mathematical apparatus, children should be allowed to play with calculators before using it for a definite purpose. Through such plays, they could discover some of its functions and will be able to use it well". This also agrees KafuiAckuaku (2001) who worked on 'an assessment on the use of calculator in the secondary school' and found that both teachers and students had a positive attitude towards the inclusion of the calculator usage in the mathematics curriculum.

According to J.B. Akwetey (1998), many teachers, especially those who did not get the chance to use calculator at their elementary and secondary level of education, are of the view that the use of calculator should not be incorporated into mathematics curriculum at the basic level since it will:

- Promote laziness, since the children will not be in the position to learn basic things like multiplication table, simple addition and subtraction, use of manipulative materials to obtain some basic concepts, etc.
- Limit pupils' thinking ability because the computational work which provides the need for them to think will be done by the calculator.
- Make pupils skip some important steps which portray some concepts in their mathematical computations.

Some teachers too are of the view that:

- It will only put some kind of financial burden on poor parents since most pupils will not be able to maintain calculator well.
- There had not been any significant improvement in the performance of the students in mathematics in the West African Examination Council (WAEC), now West African Senior Secondary School Certificate Examination (WASSSCE), even though students are allowed to use calculator.
- Most teachers are not well vested in the use of calculators themselves so how do they teach the pupils to use calculators.

Also, Cockroft (1982) reported among many reasons that there is a public concern about the use of calculators by children who have not mastered the paper-and-pencil method of computation. It was feared that children who use calculators too early would not acquire skills in computation or confidence in recall of basic facts and this will make students' mind dull.

On the contrary, a research conducted by groups of teachers in conjunction with some researchers led by Dr. John Searl (1994) at the Edinburgh Centre for Mathematical Education on the possibilities of calculators use in the classroom revealed that calculator can motivate pupils and give confidence to those anxious about mathematics. It can be used to develop fluency in number, shape or graph work by providing repeated practice and rapid experience of many examples. It also provides opportunities to facilitate independent learning and gives the scope for open-ended exploration. Not all, it helps children to understand concepts built for themselves at a deeper level. In general, calculator as a tool, if used in the right way, can support and encourage children's mathematical thinking. (www.education.ed.ae.uk/ecme/research/artticles). This agrees with Agyenim-Boateng (1996) and Osafo Affum (1980) who found in their respective researches that calculatorsplay a significant role

in improving students' performances in mathematics and other related subjects.Suydam (1987) maintains that children often learn better and retain more information when they use calculators. He added that, students who use calculators rather than paper-and-pencil alone for most of their classwork score higher on paper-and-pencil test than their non-calculators using counterparts. Also, Hemberee and Dassart (1986) also maintain that students using calculators possess better attitude towards mathematics, including better self-confidence in mathematics than non-calculator using students. And this statement applies to all grades and ability levels.
More to the point, in a study by Moursand (1981) on the summary of several researches, revealed that calculators:

- encourage problem solving, estimation and approximation;
- motivate and encourage students' curiosity to explore;
- help in the concept development and understanding of computation.

In view of the above findings, this study will help in answering such research questions as:

- Will pupils' interest in mathematics be aroused if they are allowed to use calculator?
- What will be the impact of the use of calculator on the pupils' ability in mathematical problem-solving?

This study is therefore designed to investigate whether pupils who use calculator will perform better in mathematics than those who do not use them.

## II. Material And Methods

***Population and Sample Selection***

University Junior High School in Cape Coast was selected for this study based on proximity advantage. JHS two was selected for the fact that the JHS three pupils had completed school and therefore the immediate form was the JHS two pupils who had been in the school for two years and had covered most of the topics in the mathematics syllabus. There were eight classrooms, named from A to H, for the JHS form two alone. Twenty-five pupils each from the JHS 2B and 2E classes were randomly selected. Again, the 2E and the 2B classes were randomly selected as the experimental and the control groups respectively.

***Research Instruments and Data Collection***

The research instruments used were two achievement tests, namely pre-test and post-test. The purpose of the pre-test was to determine the entry ability levels of the pupils from the two classes. The pre-test was made up of four essay type questions covering the topics; 'simplification', 'substitution' and 'area of a triangle'.
The post-test was also made up of six essay type questions (covering the topics; 'substitution' and 'area of a circle) and it focused on the pupils' ability to:

- use computational skills
- solve questions systematically by the use of algorithm
- properly apply principles and facts learnt
- reason analytically

The pre-test was first conducted and marked, after which both the experimental and the control groups were given tuition before the post-test was also conducted and marked, using well coordinated marking schemes. Lesson plans were prepared for every lesson taught. The JHS 2E class (the experimental group) was taught with the use of calculators, while the JHS 2B class (the control group) was taught without the use of calculators. Both groups were taught on different occasions on the topics; 'substitution' and 'area of a circle'. The lessons for each topic were treated on the same day for the two groups using 50 minutes each time and this covered a period of two weeks.

The data on the pupils' pre-test scores was analysed by using t-test from Statistical Package for Social Science (S.P.S.S) to test the hypothesis. However, covariance was used to analyse the pupils' post-test scores since there was a significant difference between the mean scores of the experimental and the control groups in the pre-test.The result of the covariance analysis was then used to determine whether there was a significant difference between the performances of the experimental and the control groups.

## III. Results

***General Analysis of the Pupils' Test Results***

Pupils' responses to the four items in the pre-test were scored over twenty, with question one carrying four marks, question two carrying eight marks, question three carrying three marks and question four carrying five marks.

**Table no 1**: The Pupils' Pre-Test Scores

| Code | Control group | Experimental group |
|---|---|---|
| 001 | 2 | 3 |
| 002 | 9.5 | 1 |
| 003 | 14.5 | 2.5 |
| 004 | 3.5 | 2.5 |
| 005 | 13 | 7.5 |
| 006 | 14.5 | 3 |
| 007 | 4 | 6 |
| 008 | 6.5 | 1 |
| 009 | 9 | 4 |
| 010 | 3 | 4 |
| 011 | 5.5 | 1 |
| 012 | 6 | 5.5 |
| 013 | 15 | 3.5 |
| 014 | 2 | 2 |
| 015 | 15 | 3 |
| 016 | 15 | 1.5 |
| 017 | 5.5 | 6.5 |
| 018 | 5.5 | 1 |
| 019 | 5 | 4 |
| 020 | 4.5 | 4 |
| 021 | 5.5 | 1 |
| 022 | 1.5 | 8.5 |
| 023 | 5 | 10.5 |
| 024 | 2.5 | 6.5 |
| 025 | 15 | 12 |

**Table no 2**: S.P.S.S (Numerical) Analysis for the Pupils' Pre-Test Scores

| Group Statistics | | | | | |
|---|---|---|---|---|---|
| | **Pre-Test** | **N** | **Mean** | **Std. Deviation** | **Std. Error Mean** |
| **Scores Of Test** | **Experimental** | 25 | 4.200 | 3.0242 | .6048 |
| | **Control** | 25 | 7.520 | 4.8744 | .9749 |

Perceptually, comparing the raw scores of the pupils in the experimental group to that of those in the control group for the pre-test (Table 1 above), the control group appears to have scored higher marks than the experimental group. Again, the mean scores of the experimental and the control groups were 4.200 and 7.520 respectively. The standard deviations of the experimental and the control groups were also 1.9121 and 4.8744 respectively (Table 2). The standard deviation of the control group compared to that of the experimental group shows that the pupils in the control group scores are more dispersed about the mean score than that of the experimental group in the pre-test.

The researcher tested the hypothesis as to whether there is a significant difference between the mean scores of the two groups at 5% significance level, as follows:

$H_0$: There is no significant difference between the mean score of the experimental group and that of the control group.

$H_1$: There is significant difference between the mean score of the experimental group and that of the control group.

**Table no 3**: S.P.S.S (t-test) Analysis for the Pupils' Pre-Test Scores

| Independent Statistics Test | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **Levene's Test for Equality of Variances** | | **t-test for Equality of Means** | | | | | |
| | | **F** | **Sig.** | **T** | **Df** | **Sig. (2-tailed)** | **Mean Difference** | **Std. Error Difference** | **95% Confidence Interval of the Difference** |

| | | | | | | | | | Lower | Upper |
|---|---|---|---|---|---|---|---|---|---|---|
| **SCORES OF TEST** | **Equal variances assumed** | 10.272 | .002 | -2.894 | 48 | .006 | -3.3200 | 1.1473 | -5.6267 | -1.0133 |
| | **Equal variances not assumed** | | | -2.894 | 40.092 | .006 | -3.3200 | 1.1473 | -5.6386 | -1.0014 |

Using t-test from the S.P.S.S (Table 3), the p-value was 0.006 which is less than 0.05, the critical value for the test. Since the p-value = 0.006 is less than the critical value = 0.05, the null hypothesis ($H_0$) was rejected in favour of the alternative hypothesis ($H_1$), hence there was significant difference between the mean score of the experimental group and that of the control group in the pre-test.

With the post-test, the six items were scored over twenty-five with questions one and two carrying three marks each; questions three, four and five carrying four marks each and question six carrying seven marks.

**Table no 4**: The Pupils' Post-Test Scores

| Code | Control group | Experimental group |
|---|---|---|
| 001 | 17 | 14 |
| 002 | 12.5 | 17 |
| 003 | 20 | 20.5 |
| 004 | 13.5 | 15.5 |
| 005 | 16 | 16 |
| 006 | 16.5 | 17 |
| 007 | 12.5 | 18 |
| 008 | 13 | 17.5 |
| 009 | 12.5 | 15.5 |
| 010 | 12 | 14 |
| 011 | 13.5 | 14.5 |
| 012 | 13 | 13.5 |
| 013 | 11.5 | 16.5 |
| 014 | 17 | 18 |
| 015 | 14 | 17 |
| 016 | 12 | 18 |
| 017 | 12 | 16.5 |
| 018 | 12 | 15.5 |
| 019 | 13.5 | 15.5 |
| 020 | 12.5 | 16 |
| 021 | 13 | 20.5 |
| 022 | 15 | 18 |
| 023 | 13 | 23 |
| 024 | 13 | 15 |
| 025 | 13 | 16.5 |

**Table no 5**: S.P.S.S (Numerical) Analysis for the Pupils' Post-Test Scores

| Group Statistics | | | | | |
|---|---|---|---|---|---|
| | Groups Of Pupils | N | Mean | Std. Deviation | Std Error Mean |
| Test Scores Of Pupils | Control | 25 | 13.740 | 2.0510 | .4184 |
| | Experimental | 25 | 16.760 | 2.1943 | .4389 |

Comparing the raw scores of the pupils in the post-test (shown in Table 4), it appears the experimental group scored higher marks than the control group. Moreover, the mean scores of the experimental and the control groups were 16.760 and 13.740 respectively, meaning the pupils in the experimental group averagely scored higher mark than those in the control group. Also, the standard deviations of the experimental group and the control group were 2.1943 and 2.0571 respectively (Table 5). This means that the pupils in the control group scores are slightly less dispersed about the mean score than that of the experimental group in the post-test.

**Table no 6**: Overall Covariance Analysis of Pupils' Post-Test Scores

| Covariances: Experimental, Control | | | | | | |
|---|---|---|---|---|---|---|
| | Covariance | | | | Levine's Test (any continuous distribution) | |
| | Experimental | Control | Test Stat. | Sig. | Test Stat. | Sig. |
| Experimental | 4.81500 | | 7.310 | 0.020 | 1.958 | 0.047 |
| Control | 0.94542 | 4.23167 | 7.310 | 0.020 | 1.958 | 0.047 |

**Table no 7**: Individual Covariance Analysis of Pupils' Post-Test Scores

| Control group | Experimental group | Covariance |
|---|---|---|
| 17 | 14 | 0.9076 |
| 12.5 | 17 | 1.335938 |
| 20 | 20.5 | 1.400284 |
| 13.5 | 15.5 | 0.368802 |
| 16 | 16 | 0.394558 |
| 16.5 | 17 | 0.52 |
| 12.5 | 18 | 0.51108 |
| 13 | 17.5 | 0.57804 |
| 12.5 | 15.5 | 0.616782 |
| 12 | 14 | 0.609375 |
| 13.5 | 14.5 | 0.43 |
| 13 | 13.5 | 0.516582 |
| 11.5 | 16.5 | 0.502959 |
| 17 | 18 | 0.409722 |
| 14 | 17 | 0.25 |
| 12 | 18 | 0.32 |
| 12 | 16.5 | 0.416667 |
| 12 | 15.5 | 0.34375 |
| 13.5 | 15.5 | 0.02551 |
| 12.5 | 16 | 0.125 |
| 13 | 20.5 | -0.24 |
| 15 | 18 | -0.0625 |
| 13 | 23 | 0 |
| 13 | 15 | 0 |
| 13 | 16.5 | 0 |

Now, using covariance to analyse the pupils' scores in the post-test, from code 001 to code 020 had positive covariance, code 021 and code 022 had negative covariance, and code 023 to code 025 had zero covariance (Table 7). However, the overall covariance of the pupils' scores in the experimental group correlating with that of those in the control group was 0.9452(Table 6), which is positive. This implies that higher than average scores of the pupils in the experimental group are associated with higher than average scores of the pupils in the control group. Hence, if the control group had also used calculators, they would have performed better than what they did in the post-test.

Moreover, the p-value was 0.020 which was less than 0.05, the critical value for the hypothesis testing (Table 6). This indicates a significant difference between the mean score of the experimental group and that of the control group. Therefore, the null hypothesis ($H_0$) was rejected in favour of the alternative hypothesis ($H_1$) at 5% significant level.

## IV. Discussion

The researcher wanted to find out whether pupils' mathematical abilities in problem-solving would be enhanced by the use of calculators.

The study showed in the covariance analysis (Tables 6 and 7) that the experimental group appear to have performed better than the control group. However, if the control group had used calculators, they would have also performed better. Hence, there was a significant difference between the performances of the two groups.

During the instructional period, pupils in the experimental group demonstrated positive attitudes towards the use of calculators. One interesting observation made was that most of the pupils in the experimental group were found fidgeting with the calculators to the extent of writing words like “Barcelona” with them instead of paying attention to what was being taught. It was later found that some of the pupils use calculators at home and those who don’t were fascinated about the numerous functions and operations the calculator can perform.

During the conduct of the post-test, while the pupils in the control group demanded for the use of $\pi = \frac{22}{7}$ or calculator (instead of $\pi = 3.142$ given in question five) for easy computation, those in the experimental group tackled the questions without any complain or demand. It was clear that most of the pupils in the experimental group were able to attempt the difficult questions, especially those which involved decimal fractions and long divisions with ease while those in the control group were complaining. This is in agreement with the findings of Suydam (1985) that pupils were less afraid to attempt difficult problems when they used calculators. This observation also supports Campbell and Steward (1993) findings that students show greater ease in mathematics problem-solving when using calculators.

The study also revealed that the use of calculators helped in alleviating the tedious computations by only paper-and-pencil method. This supports Eshun’s (2006) idea in Advance Study of Elementary Mathematics that the use of calculators at the basic level will help ease pupils’ tension on mathematics.

It was also revealed that the use of calculators did not affect the pupils’ ability to recall formula and perform basic computations, rather it helped the pupils in the experimental group to work at a faster rate. This contradicts to Cockroft (1986) report on public concern that children who use calculators too early would not acquire computational skills or confidence to recall basic facts, hence making their mind dull.

However, it was observed during the marking that most of the pupils in the experimental group were skipping some steps in their strategies in solving the problems.Meanwhile, many of the pupils in the control group demonstrated abilities to communicate, reason, connect and explore problems during the instructional period. Some too were anxious to know the concept behind such terms as pie ($\pi$) and why it has no unit.

## V. Conclusions

Analysis of the data revealed that the use of calculators positively affected the performance of the pupils in the mathematical problem-solving abilities. It also speeds up the pupils’ rate of solving mathematics problems.

Furthermore, using calculator helps in the avoidance of computation errors in their examinations. The pupil involved in this study demonstrated gains in achievement and conceptual development of the mathematics topics taught during the instructional period. They also developed more positive attitude towards mathematics, especially immediately after the instructional period.

It is clear that mathematics problem-solving requires ability to reason analytically. The problem solver must understand the facts, clearly understand what is required, given and needed to analyse the problem in order to arrive at the solution. The use of calculators in this situation will therefore accelerate the rate of solving this problem because during the test, the pupils in the experimental group finished long before the pupils in the control group. This supports Wheatley, et al (1970) assertion that “calculators are excellent aid for developing skills in problem-solving at a faster rate”.

The use of calculators motivates pupils because those who are frightened by tedious and complex mathematical computations are relieved from this burden when they are taught to use calculators effectively. With this, they also discover the beauty of mathematics.

## VI. Recommendations

The findings of the study suggest the following:

- The calculator use should be incorporated in mathematics education at the basic level.
- That teaching pupils to use calculator effectively should be made part of the teacher training course.
- That parents should acquire calculators for their wards to be used during mathematics lessons and practice its use at home.
- That pupils should be helped to learn to use calculators appropriately rather than rely on it for simple mental computations.
- That the West African Secondary School Certificate Examination (WASSCE) should allow the use of calculators in mathematics and other mathematics application subjects at the Basic Education Certificate Examination (BECE).

## References

[1]. Ackuaku K. An Assessment of Calculator use in three selected Senior Secondary Schools in the Cape Coast Municipality.A Project Work Presented to the Department of Science Education. University of Cape Coast, Ghana. 2002.
[2]. Agyenim-Boateng. The Effect of the Use of Hand-Held Calculators on Attitudes And Computational Skills of Second Year Students of St. Peter's Senior Secondary School, Nkwatia-Kwahu. A Dissertation Presented to the Department of Education. University of Cape Coast, Ghana. 1996.
[3]. Campbel P. & Stewart E. Calculators and Childhood Mathematics. NCTM Research Interpretation Project, Macmillan Publishing Company, New York. 1993; 251-268.
[4]. Cockroft W H. Mathematics Count Report on the Committee of Inquiring into the Teaching of Mathematics in Schools. (HMSO).1982.
[5]. Dessart J and Hembree R. Effect of Hand-Held Calculators in Pre-College Mathematics Education: A Mata-Analysis, Journal for Research in Mathematics Education. 1986; 16(2): 87-99.
[6]. Liebeck P. How Children Learn Mathematics. Penguin Publishing Group, U.K. 1984.
[7]. Moursand D D. Calculator in Classroom. John Wiley and Sons Inc. U.S.A. 1981.
[8]. Osafo A B., et al. Using Electronic Calculators, Module 51 of Ghana Education Service, Teacher Education Division. 1987.
[9]. Shuard H. Primary School Today and Tomorrow. SCDC Publications. 1986.
[10]. Suydam M N.Research on Instructional Materials for Mathematics. Eric Document Reproduction Service. Columbus, OH: Calculator Information Centre. 1985: 27659.
[11]. SuydamM N. Research on Instruction in Elementary School Mathematics. A Letter to Teachers. Eric Document Reproduction Service. Columbus, OH: Calculator Information Centre. 1987: ED293728.
[12]. Wheatley G, et al. Calculators in Elementary Schools: Arithmetic Teacher. NTCM Journal, U.S.A.1970; 27(1).

**Web Sites**

http://educationit.com//story//successtory
http://www.mste.wuc.edu/dildine/thesis
http://www.webcom.com/calc/classification.html
www.education.ed.ae.uk/ecme/research/articles

## Acknowledgement

We give our ultimate thanks to the Almighty God for the grace He granted us during the conduct of this research.

Richard Ayamah, et. al. "The role of Calculator use in Mathematics Problem-Solving Abilities of Pupils at the Junior High School in Ghana." *IOSR Journal of Mathematics (IOSR-JM)*, 16(5), (2020): pp. 28-35.