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ASSESSING SCIENCE TEACHERS' USE OF MS EXCEL IN COMPUTATION OF AVERAGE SCORES FOR EFFECTIVE LARGE CLASS ASSESSMENT IN SENIOR SECONDARY SCHOOLS IN NSUKKA EDUCATION ZONE

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Abstract: The study has examined extent of Science, Technology, Engineering or Mathematics (STEM) Teachers' use of MS Excel in computation of average scores for effective large class assessment used mainly by teachers and school administrators. Descriptive survey research design was employed. The study was carried out in secondary schools in Nsukka Education Zone of Enugu State. A sample of 180Teachers was drawn from a population of 360 STEM Teachers in the zone using purposive random sampling technique. A 24-item questionnaire developed by the researchers and named MATEPH constituted the instrument for the study which was validated by three Computer experts. Its reliability was found to be 0.84 using Spearman-Brown formula. Collected data were analysed using mean, standard deviation and independent samples t-test for the research questions and null hypotheses respectively. The results revealed that all the STEM Teachers do not equally utilize MS Excel in computation of average scores of basic concepts in their specific areas. Mathematics Teachers however utilized the package more. The researchers recommended that workshops on the use of MS Excel be organized based on the findings.

Keywords: Teachers; Science, Technology, Engineering or Mathematics (STEM)Teachers; MS Excel and Average; Effective assessment; Large class, Senior Secondary Schools.

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Introduction

All school Administrators and responsible classroom teachers desire and also endea vour so much in their duties to ensure that formal teaching and learning are carried out in every Nigerian Secondary Schools including Enugu State. A good teacher teaches effectively resulting to learning by students. Teaching is found in every sector of life including Education, Civil Engineering, Medicine and other areas. Teaching involves average performance of learners. This is why teachers are often seen using average in taking decision on students' performance. Average and Mean/Arithmetic Mean are used interchangeably. According to National Teachers Institute (NTI (2020), average or mean or arithmetic mean of -a set of number is the sum of the numbers divided by the number in the set. Average can be computed both manually and electronically using Computer. Manual method of computing average waste a lot of teachers' time especially time for Science, Technology, Education or Mathematics (STEM) teachers that perform experiments often and assess students regularly on practical and class work using average in taking decisions. The problem is more pronounced when large classes are involved in manual computation of average.

Average also known as mean (Arithmetic mean) can be computed electronically using Microsoft Excel (MS Excel) installed in Computer. In line with this, Web Images News (2018) stated that one of the key benefits of using Excel functions is that they help simplify one's formulas. That using Average as an example, for cells

B1,B2,B3,B4,one can enter in B5 this formula for average thus =AVERAGE(B1,B2,B3,B4). The formula automatically cause the result to be seen in cell B5 after pressing the enter key. Symbol of cross will be seen in a corner of the cell bearing the average and by dragging the cross downwards while holding down the left mouse, other averages for other entered data will be seen below B5.Using the same cells B1,B2,B3,B4 above as examples, another formula for average which can produce the same result is given as =AVERAGE(B1:B4).Simplifying formulas for both sum and average using MS Excel is done faster than manual method of computing especially by applying filling in method instead of repeating the formulas for every row and column. According to Kolawole (2014), to calculate Average score of data entered in cells C4:G4, simply type the following formula into the first cell of the average column; =AVERAGE (C4:G4).The average of the cells in the range defined by(C4:G4) will be given very fast. By copying down the formula for the following cells below (C4:G4) or using filling in procedure(alias dragging method),all the values for average for the other students appear immediately. In agreement to this statement, Usman (2016) indicated that ICT including MS Excel provide more creative solutions to different types of learning inquiries including assessment of students. Similarly, Yakubu (2017) stated that with MS Excel, one can tabulate data, perform arithmetic and statistical calculations faster than manual computations. Assessment of students after teaching helps teachers to take decision. It is generally stated by educators in the field that every lesson taught is incomplete without assessment. Defining assessment, Merriam (2018) presented it as an act of judging or deciding the amount, value, quality, or importance of something. That educational assessment involves the process of documenting knowledge, skills, attitudes, and beliefs.

According to Career (2021), STEM teachers are educators who teach Science, Technology, Engineering or Mathematics. STEM teachers often conduct practical, projects and assess students regularly in both laboratory and ordinary classrooms. Average is needed in taking decision on students' performance. STEM refer to Science, Technology, Engineering or Mathematics. Many other subjects are involved namely: Biology, Computer studies, Chemistry, Physics, Engineering, Mathematics to mention but a few. STEM according to Wikipedia (2018) is a combination of Science, Technology, Engineering and Mathematics. STEM Teachers teach student show to acquire skills right from secondary schools that will make them more employable and ready for current labour demand. STEM can enable other subjects to grow and develop by the help of effective STEM teachers. This is why Akpan, Etiubon & Udosen (2017) stated that STEM education is a catalyst for national development. That science believes that STEM is the greatest value to man and its environment. STEM teachers can educate others to be more creative and innovative. Since no one gives what one has not acquired, the researchers are interested in the extent of use of MS Excel for computation of average by STEM teachers in the following subject areas: Mathematics, Biology and Physics.

Computer teachers use MS Excel always in computing average, grading students… and are always faster in getting the results ready than when manual method is applied. In line with this, Audu and Senchi (2016) stated that entrepreneurship skills are needed by all and that Computer teachers teach students computer concepts and basic skills of operation to enable students use Excel to solve Mathematical and Statistical problems faster than manual method. Every teacher ought to use MS Excel in computing average for both effective and efficient teaching and also evaluation especially STEM teachers.

Previous research shows that STEM teachers sparingly use Excel in Computer in software development (Onah,2015). Some use calculator which has no facility for "filling in". Filling in facility found in Excel enables one to enter data for all the students involved after which formula is entered for only the first name's data. Enter key is pressed and cursor returned to the required solution and dragged down by holding left mouse, thereby, filling in the answers to all the keyed in data within a twinkle of an eye. When teachers use Excel in computation of Average during assessment, effective assessment is obtained since result is obtained at appropriate time. Azare (2016) defined Excel as having ability to perform calculations using formula in Computer. Kolawole (2014) stated that Computer especially MS Excel for computation can be described as a tool that everyone can use to do certain work faster and more easily. The implication is that every teacher ought to be using Excel for timely assessment leading to economic growth in education industry.

Common statement is that time is money and it is necessary to explore the extent of use of MS Excel in assessment by STEM teachers of Mathematics, Technology and Physics for effective assessment of basic concepts in their areas. Other Science and Arts teachers can follow suit since STEM subjects especially Mathematics is Queen of Science subjects and King of Arts(Life as cited in Onah,2015).One may ask: What can a teacher of Mathematics, Biology and Physics teach and assess students using average to promote economic growth? In the views of some authors in the field ,there exist basic concepts in every subject .Basic concepts in Mathematics include Knowledge of : Common symbols used in statistics, Laws of Indices, Logarithms and their basic rules, Concepts of significant digits and rounding off of numbers, Probability as a game of chance using ludo game and coin tossing as examples, Linear equations and simultaneous equations, Factorials and their calculations, Measures of Central tendency – Mean, Median and Mode especially Mean which is the same as average. For Claude (2016), Biology deals with living things and their surroundings and basic concepts in Biology according to Ude (2011) include: Cell division, Mitosis/Meiosis, Taxonomy of Plants/Animals, Population ecology, Photosynthesis, Metabolism, Diffusion/Osmosis, Biodiversity/Homeostasis. Some technology teachers inthe zone also teach biology, hence the two subjects are used interchangeably in this work.

Physics according to Ugwuanyi (2016) is the study of movements of matter through space and time deal with the following basic concepts: Second law of thermodynamics, Rotational Kinetic energy, Moment of inertia, Conservation of mechanical energy, Newton's first, second and third laws, Newton's laws of universal gravitation, Conservation of angular momentum, Torques and their conditions of equilibrium. Each of the above basic concepts in Mathematics, Biology and Physics can be transferred and used in another field especially by Senior Secondary Students (SSS) being prepared to enter tertiary institutions. When SSS are well taught and adequately assessed using MS Excel, there will be increase in assessment speed of STEM teachers leading to economic growth. According to Investopedia (2018), economic growth is an increase in capacity of an economy to produce goods and services compared from one period of time to another. Economic growth exist in Education sector when teachers utilize appropriate teaching materials in classroom thereby giving timely assessment seen in MS Excel computation result. Microsoft Excel (MS Excel) has facilities for summing up large numbers, finding averages; positioning students especially in large classes.MS Excel can perform many other functions. MS Excel, according to NTI (2012) is a spread sheet application programme developed by Microsoft Corporation to tabulate data, perform arithmetic and statistical calculations, as well as draw graphs and charts.MS Excel is highly needed for calculations and assessment involving large classes seen in STEM subjects like Mathematics, Biology and Physics. Effective classroom assessment is called for especially when large classes are involved. National Policy on Education (6th edition, 2013) recommended only 35 students per class while in many schools, more than 40 students are found in a class. According to Dele (2016), there are cases, especially in urban and rural areas where one may discover teaching as many as 40 students or more in a class which is higher than the number recommended in the National Policy on Education. In such a situation which is challenging, one can use Average in MS Excel for effective teaching and learning. One of the challenges of a large class is difficulty in managing students' activities such as assessment. Azare (2016) suggested that one can use ICT including MS Excel to enhance teaching and learning. That the greatest advantage of using MS Excel comes from their most useful tool: mathematical formulas. In this case, cells are set up with formulas which can calculate information based on the contents of other cells and the formulas enable one to instantly calculate and arrive at needed information. Udoh, Ohaju and Ado (2016) lamented that science teachers are involved with large number of students leading to poor performance after assessment. Since no one gives what one hasn't got and STEM teachers are expected to utilize and also teach other teachers the use of Excel in computing average, the problem of this study is therefore to find out the extent of STEM Teachers use of MS Excel in computation of average for effective large class assessment in senior secondary schools.

STEM teachers evaluate students using average which can be computed manually and electronically using MS Excel. Manual method of computation wastes a lot of time especially time of STEM teachers in large classes. This ugly situation delay results after assessment and also affect economic growth in education industry since when students are timely assessed, mistakes can be

corrected and individualized instruction can take place early enough. Every teacher uses average for assessment and it is obvious that the use of MS Excel for computing average promote assessment. Entering data in computer in another job opportunity since the use of MS Excel is full of advantages and STEM teachers' use of the package may promote economy in Education industry and create job opportunity for job seekers, it is necessary to investigate the extent of the use by STEM teachers in senior secondary schools in Enugu State.

Purpose of the Study

The main purpose of this study was to ascertain the extent of STEM teachers' use of MS Excel in computation of average for effective large class assessment in Senior Secondary Schools in Enugu State. Specifically, the study examined the extent of STEM teachers' use of MS Excel in computation of average score for:

1. Effective assessment of basic concepts in Mathematics.
2. Effective assessment of basic concepts in Technical Education.
3. Effective assessment of basic concepts in Physics.

Research Questions

The following research questions guided the study:

1. To what extent do Mathematics teachers use MS Excel for effective assessment of basic concepts in Mathematics?
2. To what extent do Technical teachers use MS Excel for effective assessment of basic concepts in Technical Education?
3. To what extent do Physics teachers use MS Excel for effective assessment of basic concepts in Physics?

Hypotheses

The following null hypotheses were testedat0.05 level of significance:

Ho_1: There is no significant difference between the mean responses of Mathematics and Technical Education Teachers in the use of MS Excel for effective assessment of basic concepts.

Ho_2: There is no significant difference between the mean responses of Mathematics and Physics Teachers in the use of MS Excel for effective assessment of basic concepts.

Methodology

Design adopted in this study is descriptive survey research design since the researchers' elicited information from STEM teachers on their opinion on the extent of use of MS Excel in computation of average for effective large class assessment in Senior Secondary Schools. The study was conducted in Nsukka Education zone of Enugu State. The population comprised all the 480 STEM teachers from the 60 Government Secondary Schools in the zone .Sample for the study was 180 Mathematics, Technical Education and Physics teachers (60 per Subject area) selected from the population using purposive sampling. The instrument for this study called Mathematics, Technology Education & Physics (MATEPH), containing eight(8) basic concepts in each of the three(3) subjects, was used to collect data on the extent of use of MS Excel in computation of students' average after teaching the basic concepts. The 24 MATEPH-items ranging from Highly Used (HU= 4 points), Used(U= 3points), Used Sometimes(US= 2points) and Not Used(NU= 1point) was developed by the researchers and used for data collection after being validated by the experts and corrections made. Reliability of MATEPH was found to be 0.*84* using Spearman-Brown formula. This indicates that the instrument was reliable and suitable for the research. After data analyses, Research Questions were answered using Mean and Standard Deviation while t- test for independent samples was used for the formulated Null Hypotheses at 0.05 level of significant. Criteria for taking decision are as shown: For research questions, Mean score of 2.5 and above shows High Extent of Use (**HEU**) while below 2.5 shows Low Extent of Use(**LEU**). For Null Hypotheses, when independent t-calculated value is greater than the table value, it shows significant(**S**) while not significant (**NS**) is recorded when the calculated value is less than the table value at 0.05 level of significant.

Results

Research Question 1: To what extent do STEM teachers use Average in MS Excel for effective assessment of basic concepts in Mathematics?

Table 1: Mean and Standard deviation scores of STEM teachers on the extent of use of MS Excel for effective assessment of basic concepts in Mathematics

S/N	ITEMS	n1	Mean	SD	Decision
1.	Common Symbols used in statistics.	60	3.18	0.98	HEU
2.	Laws of Indices.	60	3.82	0 .74	HEU
3	Logarithms and their basic rules.	60	3.09	0.94	HEU
4	Concepts of significant digits and rounding off of numbers.	60	3.10	0.92	HEU
5	Probability as a game of chance using ludo game and coin tossing as examples.	60	2.92	1.13	HEU
6	Linear equations and simultaneous equations.	60	2.74	1.12	HEU
7	Factorials and their calculations.	60	3.01	1.06	HEU
8	Measures of Central tendency – Mean.	60	3.00	0.92	HEU

Key for the Tables 1,2,3: n1,n2 ,n3 respectively stand for number of STEM Teachers involved for Mathematics/Biology/Physics. Mean with its corresponding Standard Deviation are used in taking decision on each of the 24items (8 items for each STEM Subject.

From Table 1 above, Mathematics Teachers employed Average using MS Excel in assessing students in all the basic concepts listed from items 1 to 8. Although each of the Means indicated High Extent of Use (HEU) during assessment, there in need for improved usage especially after teaching the students Linear equations and simultaneous equations as seen in Mean for item 6 when compared with other Means.

Research Question 2 : To what extent do STEM teachers use MS Excel for effective assessment of basic concepts in Biology Education.?

Table 2:Mean and Standard deviation scores of STEM teachers on the extent of use of MS Excel for effective assessment of basic concepts in Biology for living things

S/N	ITEMS	n2	Mean	SD	Decision
9.	Cell division.	60	2.87	1.40	HEU
10.	Mitosis and Meiosis.	60	2.88	1.36	HEU
11	Taxonomy of plants/animals.	60	2.66	1.52	HEU
12	Population ecology.	60	2.75	1.04	HEU
13	Photosynthesis.	60	2.13	0.98	LEU
14	Metabolism.	60	2.62	1.19	HEU
15	Diffusion and Osmosis.	60	2.91	1.14	HEU
16	Biodiversity and Homeostasis.	60	2.87	1.40	HEU

From Table2 above, item 13 bearing Photosynthesis registered Low Extent of Use (LEU) by Biology Teachers. Other items in the table registered High Extent of Use (HEU).

Research Question 3: To what extent do STEM teachers use MS Excel for effective assessment of basic concepts in Physics?

Table 3: Mean and Standard deviation scores of STEM teachers on the extent of use of MS Excel for effective assessment of basic concepts in Physics

S/N	ITEMS	n3	Mean	SD	Decision
17.	Rotational Kinetic energy.	60	2.87	0.98	HEU
18.	Second law of thermodynamics.	60	2.97	1.39	HEU
19.	Moment of inertia.	60	2.96	1.39	HEU
20.	Conservation of mechanical energy.	60	2.63	1.19	HEU
21.	Newton's Ist, 2nd & 3rd laws of motion.	60	2.37	1.62	LEU
22.	Newton's laws of universal gravitation.	60	2.83	1.12	HEU
23.	Conservation of angular momentum.	60	2.91	1.14	HEU
24.	Torques /conditions of equilibrium.	60	2.87	1.40	HEU

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From **Table 3** above, Low Extent of Use (LEU) was observed for Physics Teachers in item 21 which deals with the three laws of motion. Other basic concepts in Physics were assessed using Average in MS Excel as seen in High Extent of Use (HEU)

Ho_1: There is no significant difference between the mean responses of Mathematics and Biology Education Teachers in the use of MS Excel for effective assessment of basic concepts.

Table 4: Analysis of t-test statistics of Mean responses of Mathematics and Biology teachers on the extent of use of MS Excel in computation of average for assessing students

Teachers	n1,n2	Mean	Std. Deviation	Df	t-cal	Sig.t (2-tailed)
Maths Trs	60	3.12	1.31	118	13.90	.000
BIO. Trs	60	2.71	1.26			

Key for Tables4&5: n1,n2 = number of STEM Teachers involved for Mathematics/Biology; n1,n3 for (Mathematics/Physics), df=degree of freedom 60+60-2=118, t-cal =calculated value of t and Sig.t=table value of t for 2-tailed test.

Table 4 reveals that the calculated value of t (13.90) for the difference in the extent of use of MS Excel in computation of average for assessing students had an associated probability value of 0.00.Since the probability value of 0.00 is less than the 0.05 level of significance, the null hypothesis was not accepted. Thus, there is a significant difference between the mean responses of Mathematics and Technical Education Teachers in the use of MS Excel for effective assessment of basic concepts in favour of the mathematics teachers who had higher means.

Ho_2: There is no significant difference between the mean responses of Mathematics and Physics Teachers in the use of MS Excel for effective assessment of basic concepts.

Table 5: Analysis of t-test statistics of Mean responses of Mathematics and Physics teachers on the extent of use of MS Excel in computation of average for assessing students

Teacher	n1,n3	Mean	Std. Deviation	Df	t-cal	Sig. (2-tailed)
Maths Trs	60	3.12	1.31	118	17.80	.000
Physics Trs	60	2.80	1.19			

Table 5 reveals that the calculated value of t (17.80) for the difference in the extent of use of MS Excel in computation of average for assessing students by mathematics and physics teachers had an associated probability value of 0.000. Since the probability value of 0.000 is less than the 0.05 level of significance, the null hypothesis was not accepted meaning that there is a significant difference between the mean responses of Mathematics and Physics Teachers in the use of MS Excel for effective assessment of basic concepts in favour of the mathematics teachers.

Discussion

The findings of from Table 1revealed that in all the eight (8) basic concepts in Mathematics, teachers of Mathematics utilized Average in MS Excel in assessing students after teaching. This finding is in line with the findings of Onah, Agbo, Onah & Ukwueze (2016) that Computer Educators, Technical Instructors& Mathematics Educators utilized e-Learning in teaching and learning. Also, the findings are supported by the work of Adebiyi (2010) that a great Mathematician- Charles Babbage was regarded as the father of Computer. This means that Mathematics and Computer are father and son. Teachers of the two subjects need to carry other STEM teachers along for faster computations in MS Excel especially Average used in taking decision on students.

Also, in items 9 to 16 from Table 2 bearing basic concepts in Technical Education, it was found that the Technical Education teachers did not utilize Average in MS Excel in assessing students after teaching all the basic concepts. This finding is in line with the findings of Ude and Onah (2017) that STEM teachers do not always use educational compact disc in teaching. This ugly situation needs to be addressed urgently. Also, Yakubu (2018) stated that by writing the formula =AVERAGE(C4:G4), average of the values of the cells defined by (C4:G4) is given immediately. ADAPPTI (2016) equally indicated that by filling in from the first average computed from Excel and

holding down the left mouse, other values of average for entered data are found at a glance.

Result from Table 3 revealed that Physics Teachers do not use Average MS Excel in assessment of students after teaching Newton's three laws of motion and the laws involve basic concepts in Elementary Mechanics. From Table 4's result, there is a significant difference between the mean responses of Mathematics and Technical Education Teachers in the use of MS Excel for effective assessment of basic concepts in favour of Mathematics Teachers. This is in line with the findings of Onah, Ude& Obe (2017) that Mathematics Teachers utilize ICT in teaching more than other STEM Teachers.

Also, the result from Table 5shows that there is a significant difference between the mean responses of Mathematics and Physics Teachers in the use of MS Excel for effective assessment of basic concepts. This finding is in line with the findings of Ugwuanyi (2016) that STEM Teachers especially Physics Teachers need more training in Computer Application in this technological age. Mathematics Teachers however utilized the MS Excel in computation of average more than Technical Education and Physics Teachers.

Conclusion

Based on the findings of this study, the researchers conclude that all the STEM Teachers do not equally utilize MS Excel in computation of average. Mathematics Teachers utilized the package more than Biology/Technical Education and Physics Teachers. Time is money and timely decision is needed from every teacher. In this 21st century, everyone is encouraged to be Computer friendly. Using MS Excel to perform calculations involving Average is, therefore, called for by all and sundry especially by STEM Teachers that are busy in classrooms and laboratories with large class every now and then. When this is done, economic growth in education industry leading to development will follow since when students are timely assessed, mistakes can be corrected and individualized instruction can take place early enough leading to meaningful Education which according to Adebola (2017) is capable of enriching individuals and empower them for meaningful living in a society. STEM Teachers especially Biology and Physics Teachers in secondary schools should, therefore, embrace MS Excel in computation of Average for a stitch in time saves nine.

Recommendations

Researchers recommended that workshops on MS Excel be organized based on the findings for all the STEM Teachers on the use of MS Excel in computing average for effective assessment of:

1. Linear equations and simultaneous equations for Mathematics Teachers.
2. Photosynthesis for Biology/Technology Education Teachers on living things.
3. The three laws of motion for Physics Teachers.

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