Section: Research Paper

IMPLICATIONS OF LAPTOP UTILIZATION AND COMPETENCY TO TEACHING PRACTICES OF MATHEMATICS

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Abstract
Mathematics has been challenging subject to be taught. The used of technology aids teaching practices, which one is the use of laptop as digital device, which further could be varied depending on subject matter. So, it is important to find-out factors relating laptop to teaching practices, especially in Mathematics. Hence, this study identified the determiners of Mathematics teaching practices out from its association with the laptop utilization and competency of Mathematics public secondary school teachers from the National High Schools in the Schools Districts of Bohol, Philippines. Employing correlational survey design, data were gathered using a valid and reliable online survey from 108 teachers of 20 sample schools chosen by two-stage random sampling. Percentages and descriptives on the respondents' distribution on level of laptop utilization and competency to level of mathematics teaching practices suggest positive association. Furthermore, bootstrapped multiple regression analysis revealed that laptop utilization and laptop competency determines Mathematics teaching practices. Thus, capacitating the teachers on the how to fully utilize laptops and strengthening their competencies is a great help to uphold teaching practices, particularly in Mathematics.

Keywords: *mathematics teaching, laptop device, utilization, competency, regression*

Introduction

Mathematics is considered as the 'queen of all sciences' (Waltershausen, 1856). It acts different significant roles which requires critical thinking and mastery of knowledge for work and life itself. It is can observed in nature, technology, engineering, education, etc. Evidently, Mathematics should be taught comprehensively. (Hom, 2013).

However, Mathematics is difficult to teach to some learners (Abdul & Sarabi, 2015; Archaya, B, 2017). Hence, several studies was conducted to draw learners to embrace Mathematics by enhancing Mathematics teaching (Grouws and Cebulla, 2000; Thompson, 2003; Akyuz, et al, 2013; Abramovich, et al, 2019) including the use of Information and Communication Technologies (ICTs) and digital devices (The Mathematical Association, 2005; Schuck, 2016; Arthur et al, 2017; Yeh et al, 2019). The 21st century education has been broadly changed since the advent of ICT, especially on Mathematics teaching. The integration of

different digital devices such as laptops has a positive impact on enhancement Mathematics teaching (Schuck, 2016). In the Philippines, the education sector had always been budgeted the highest allocation from the National Budget most especially this year (DBM, 2021). Still, the Philippine basic education performed lower compared to school from different countries around the globe as revealed in Trends in International Mathematics and Science Study (TIMSS) 2019 and Programme for International Student Assessment (PISA) 2018 results (TIMSS, 2020; PISA, 2019).

In an unending pursuit of true academic excellence, the Philippines instituted the K to 12 Program upon the enactment of Republic Act No. 10533 known as Enhanced Basic Education Act 2013. By this law, the Mathematics curriculum had been reformed. The twin goals of Mathematics in the basic education levels are critical thinking and problem solving which has to be achieved with an organized and rigorous curriculum content (Numbers and Number Sense, Measurement, Geometry, Patterns and Algebra, and Probability and Statistics), a well-defined set of high-level skills and processes (knowing and understanding, estimating, computing and solving, visualizing and modelling, representing and communicating; conjecturing, reasoning, proving and decision-making, and applying and connecting), and desirable values and attitudes (accuracy, creativity, objectivity, perseverance, and productivity) while taking into account the different contexts of Filipino learners (Mathematics Curriculum Guide, 2016). The Mathematics basic education curriculum also recognizes that the use of appropriate tools in teaching Mathematics. These include manipulative objects, measuring devices, calculators, digital devices, and Internet (Mathematics Curriculum Guide, 2016).

Digital devices are very much associated to the advent of technology. These are technological machines with hardware and software that is capable of processing information, one of which is laptop, which supports the learning process and holds the promise of new solutions to all the challenges that education is facing (Oduma, 2014). The use of laptop in the mathematics classroom has primarily held of particular concern to mathematics educators. Teachers have to grasp the mechanics of accessing and utilizing these devices in teaching and learning. However, digital devices serve as a tool for learning, those teachers can maximize its impact in mathematics education (British Educational Communications and Technology Agency, 2003). Digital devices in mathematics teaching and learning are associated to many factors including teacher's profile, teaching experience, training, etc. (British Educational Communications and Technology Agency, 2004; Balanskat, et.al, 2006; Buabeng-Andoh, 2012; Kay, 2006; Schiler, 2003). On the other hand, laptop is small portable clamshell designed personal computer (PC) having screen, touchpad and keyboard all in one device. It has similar functions to desktops, however, it is more portable (IBM Archives, 2003).

Technologies in education can be viewed also as one of the country's thrust as stated in the 1987 Philippine Constitution, Article XIV, Section 10 which states that "Science and technology are essential for national development and progress. The State shall give priority to research and development, invention, innovation, and their utilization; and to science and technology education, training, and services. It shall support indigenous, appropriate, and self-reliant scientific and technological capabilities, and their application to the country's productive systems and national life." The use of digital devices in education and training will not only

provide avenue for efficient and effective teaching and learning of any modes, but also enables productivity, sustainability, and national identity,

Teachers are the prime implementers of teaching and learning initiatives both national and local. As a noble and great challenge, the Code of Ethics for Professional Teachers, Article IV, Section 2 states that: "Every teacher shall uphold the highest possible standards of quality education, shall make the best preparation for the career teaching, and shall be at his best at all times at the practice of profession."

This section emphasizes the pressure on teachers to do their best as they pursue the teaching and learning. Another challenge to engage and upgrade themselves to the latest innovations of digital devices. As the noblest profession, teachers must have to shadow some teaching principles into practices successfully teach Mathematics and others subjects. In their recent book, Corpuz and Salandanan (2015) elaborated that teaching is a many-sided task since teachers must have to engage to formulation of learning objectives, selection and organization of content, selection and use of teaching strategies, selection and use of instructional materials, assessment of learning, and, class management. Moreover, Mathematics teaching has three stages namely: planning, implementing, and assessing (Corpuz and Salandanan, 2015). Correspondingly, digital devices takes a very important role as teachers indulge to the aforesaid stages (Roblyer, 2016).

With the aforementioned literatures, this study aimed to determine whether level of laptop utilization and competency are related to mathematics teaching practices.

Methodology

Correlational survey research design was employed which is popular in educational researches. Relationship between independent and dependent variables were analyzed. This design also provided an opportunity to predict the behavior of the variable based on the relationship among variables based on the results of the survey (Creswell & Creswell, 2018).

The study was conducted in the Schools Division of Bohol, Region VII Central Visayas. It has 56 schools districts with 107 national, 13 technical-vocational, and a science high schools scattered all over the main island and surrounding islets in Bohol. The population for the study were the secondary public-school teachers who are handling Mathematics subjects in either or both the Junior High School and Senior High School level in the National High Schools. Moreover, school samples were selected using two-stage random cluster sampling design. There is are twenty (20) sample schools and then, 108 Mathematics teachers from each randomly selected school within the congressional districts were chosen.

An online survey form using Google Forms was used as the data gathering instrument. Informed consent was tendered and three-part survey questions for laptop utilization, competency, and mathematics teaching practices. A pilot-study was conducted to establish the validity and reliability of the questionnaire (Creswell & Creswell, 2018). Respondents were the one-hundred fifty (150) secondary Mathematics teachers from thirteen (13) Technical-Vocational High Schools of the province. Content and face validity of the questionnaire was

established with the help of the research adviser, critic, and experts. Additionally, the questionnaire has an overall acceptability of 98.03% in six 6 descriptive attributes namely, logic, readability, accuracy and fitness, comprehensiveness, answerability, and style and formatting were determined (Uzzaman, A & Karim, A., 2017). Results where KMO of .80 - .95 interpreted as meritorious to marvelous adequate sampling. Moreover, the table also revealed that the correlation matrices of each scaled variable form no identity matrix with the given Barlett's Sphericity chi-square coefficients and its corresponding *p values* < .000 which indicate that the variables are correlated to some extent, hence, attaining construct validity in the scaled variables. On the other hand, Cronbach's alpha ranges from .91 - .98 which evidently indicate that the scaled variables are also reliable.

After the collection of data, it was followed by analysis and interpretation of findings and results. Ordinary least squares (OLS) - Multiple Regression Analysis (MRA) was used to determine whether laptop utilization and competence significantly determine Mathematics teaching practices. *P*-values were compared to 5% significance level. Bootstrapping with 95% Bias corrected accelerated will be applied to reduce bias associated with normality and sample size (Field, 2018).

Results and Discussion

ANOVA statistics show that generally, the regression model is significant F=6.462, p=0.000, r=0.530, R^2=0.2814. More specifically, model summary statistics reveal that the laptop utilization with b=0.326, t=4.468, p=0.000 and laptop competency with b=0.168, t=1.137, p=0.001 are statistically significant determiners of Mathematics teaching practices, b=149.026.

Analysis of Significant Determiners of Mathematics Teaching Practices

Variables	Model Summary Statistics				ANOVA Statistics				
	Coefficients B	*t*	*p-value for t*	Result	*F*	*p-value for F*	R	R^2	Result
Constant	149.026	7.276	0.000	*					
Device Utilization	.326	4.468	0.000	*	6.462	0.000	0.530	0.2814	*
Device Competency	0.186	1.137	0.001	*					

Note: If "*", statistic is significant since p$\leq$0.05. All results are performed with bootstrapping with 95% BCA, n=1000.

Dependent : Mathematics Teaching Practices

Predictors: (Constant), Age, Years in Math Teaching, Training Attendance, Device Functionality, Device Utilization, and Device Competency

Thus, 28.14% of the variance in the Mathematics teaching practices is associated by the changes in the teacher's laptop device utilization and laptop device competency. Henceforth, the regression model for desktop is defined as

$$Mathematics\ teaching\ practices = 149.026 + 0.326\ utilization_{laptop} + 0.186\ competency_{laptop}$$

This implies that an increase in the teacher's laptop utilization and competency will enhance their Mathematics teaching practices. Ultimately, laptops had been a buddy in accomplishing and performing duties and responsibilities of a teacher for the school, students, and others. With the teacher's utilization and competencies on laptop could heighten Mathematics teaching practices where digital devices are much-needed (Jalal et al., 2015; Blackley and Walker, 2015; Awan, 2012; Washington, 2017).

Conclusion and Recommendations

The researcher concluded that Mathematics teachers can be best aided with the use of laptop. Moreover, laptop utilization and competency determine Mathematics teaching practices. Administrative policies and support to schools and teachers may center on making laptops available for teacher's use subject to the school rules and regulations on borrowing or lending school facilities and equipment. Laptops may be highly encouraged by teachers in their practice of Mathematics teaching, hence, reshaping the curriculum from class to school level. Teacher's competencies on the use of laptops in class may be improved which may also reinforce the mathematics teaching practices. Performance-based evaluation could be used as data gathering procedure for future competency-based studies which would draw a more meaningful teaching result. Mathematics teacher's capability program on the utilization of laptops in Mathematics teaching while applying digital device competencies is ultimately encouraged to augment the teaching practices of Mathematics teachers.

References

Abdul, G. and Sarabi, M. (2015). Nature of mathematics that impacts difficulties in learning it: A comparison of student perspectives on learning school subjects from Kerala. All India Association for Educational Research Annual cum International Conference on Standards and Benchmarks for Excellence in Learning, Teaching and Research (26-28 Nov 2015). Department of Education: University of Kerala.

Abramovich, S., Grinshpan, A. Z. and Milligan, D. L. (2019). Teaching Mathematics through concept motivation and action learning. Education Research International. https://doi.org/10.1155/2019/3745406

Akyuz, D., Dixon, J. K. & Stephan, M. (2013) Improving the quality of mathematics teaching with effective planning practices, Teacher Development, 17:1, 92-106.

Archaya, B. R. (2017). Factors affecting difficulties in learning Mathematics by Mathematics learners. International Journal of Elementary Education. 6(2): 8-15.

Arthur, C., Badertscher, E., Goldenberg, P., Moeller, B., McLeod, M., Nikula, J., & Reed, K. (2017). Strategies to improve all students' mathematics learning and achievement. Waltham, MA: EDC.

Awan, R. (2012). A Study of Teachers Opinions and Experiences on the Use of Computers and Laptops in Classrooms in the United Arab Emirates. International Conference on Management and Education Innovation, 12 (1).

Balanskat, A., Blamire, R. & Kefala, S. (2006), The ICT Impact Report: A Review of Studies of ICT Impact on Schools in Europe, European School net. http://unpan1.un.org/intradoc/groups/public/documents/unpan/unpan037334.pdf

Blackley, S. and Walker, R. (2015). One-to-one laptop programs: Is transformation occurring in mathematics teaching? Issues in Educational Research, 25(2).

British Educational Communications and Technology Agency (2003). "Laptops for Teachers: An Evaluation of the First Year of the Initiative". ICT in Schools Research and Evaluation Series – No.19.

British Educational Communications and Technology Agency (2004). A review of the research literature on barriers to the uptake of ICT by teachers. Coventry.

Buabeng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. International Journal of Education and Development using Information and Communication Technology (IJEDICT), 8 (1), 136-155.

Corpuz, B. B. & Salandanan, G. G. (2015). Principle of teaching 1. 4th ed. Metro Manila: Lorimar Publishing.

Creswell, J. W. & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5ed ed.). Los Angeles, CA: SAGE Pbulications, Inc.

Department of Education. (2016, August). K to 12 Basic Education Curriculum – Mathematics Grade 1 to Grade 10 Curriculum Guide.

Field, A. (2018). Discovering statistics using IBM SPSS Statistics (5th ed.). Los Angeles, CA: SAGE Publications

Grouws, D. A. and Cebulla, K. J. (2000). Improving student achievement in mathematics. Educational Practices Series. International Academy of Education (IAE) & International Bureau of Education. UNESCO.

Hom, E. J. (2013). What is Mathematics? from https://www.livescience.com/38936-mathematics.html

IBM Archives: IBM Personal Computer. 23 January 2003. Retrieved 16 May 2021.

Jalal, A. Ayub, A., Tarmizi, R., and Bakar, K. (2015). Assessing Teachers' Attitude and Use of Laptops for Teaching and Learning Among Primary School Mathematics Teachers. 7th International Conference On Research And Educations In Mathematics - ICREM7.

Kay, R. H. (2006). Evaluating strategies used to incorporate technology into preservice education: A review of the literature. Journal of Research on Technology in Education, 38(4), 383-408.

Oduma, C.A and Ile, C.M. "ICT Education for Teachers and ICT Supported Instruction: Problems and Prospects in the Nigerian Education System." African Research Review. vol. 8, no. 2, 2014, pp. 199-216.

PISA (2019). Programme for International Student Assessment 2018 results. Organization for Economic Co-operation and Development.

Rahman, H. (2014). The role of ICT in open and distance education. Vol. 15 (4)-9. Turkish Online Journal of Distance Education.

Republic of the Philippines (2013). Republic Act 10533. Enhanced Basic Education Act of 2013.

Roblyer, M. D. (2016). Integrating Educational Technology into Teaching. Pearson: Boston.

Schiler, J. (2003). Working with ICT: Perceptions of Australian principals, Journal of Educational Administration, 41(3), 171-185. http://dx.doi.org/10.1108/09578230310464675

Schuck, S. (2016). Enhancing Teacher Education in Primary Mathematics with Mobile Technologies. Australian Journal of Teacher Education, 41(3). http://dx.doi.org/10.14221/ajte.2016v41n3.8

The Mathematical Association (2005). Enhancing Mathematics Teaching through New Technology. Mathematics in School. 33 (3), 4-5.

Thompson, I. (2003). Enhancing primary mathematics teaching learning. Open University Press.

TIMSS (2020). Trends in International Mathematics and Science Study 2019 International Results in Mathematics and Science. Trends in International Mathematics and Science Study: Boston College.

Uzzaman, A & Karim, A. (2017). Emotional Intelligence Scale: Assessing its Psychometric Characteristics in Bangladeshi Culture, International Journal of Indian Psychology, Volume 4, Issue 2, No. 86, ISSN:2348-5396 (e), ISSN:2349-3429 (p), DIP:18.01.032/20170402, ISBN:978-1-365-68609-2

Waltershausen, Sartorius Freiherr von (1856). Gauss zum Gedächtnis (Gauss to Memory). Germany: S. Hirzel.

Washington, M. (2017). The Impact of Laptops in the Classroom: An Assessment on Participation, Motivation in Teaching and Learning. International Journal of Business, Humanities and Technology, 7 (2).

Yeh, C., Cheng, H., Chen, Z., Liao, C., and Chan, T. (2019). Enhancing achievement and interest in mathematics learning through Math-Island. Research and Practice in Technology Enhanced Learning. 14:5. https://doi.org/10.1186/s41039-019-0100-9s