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INNOVATIVE TEACHING STRATEGIES AND LEARNERS COMPUTATIONAL ABILITIES

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Abstract: **Teacher research plays a vital role in the classroom. They may utilize varied teaching approaches, strategies, technique, instruction materials, and assessment. This study determined the relationship between innovative teaching strategies and the computational abilities of learners. This causal comparative study employed 247 Mathematics Teachers in the elementary level. Data were collected using innovative teaching strategy scale and the mean grade of each pupil in mathematics for the three (3) grading periods. Findings shows that mostly of the respondents are baccalaureate degree holders and they used innovative teaching in their classroom often. Almost 50% of the pupils belong to the satisfactory level of computational ability ranging from 80% to 84%. Critical thinking exhibits a high positive significant relationship with computational abilities. It also showed a slight positive correlation between creativity and computational abilities. Innovative teaching strategy is found out to be a good predictor of computational abilities. Only critical thinking has the greatest predictive power on computational ability of learners followed by creativity, social skills and ICT skills with a negative coefficient.**

Keywords: **computational abilities, innovative teaching, linear regression, predictive ability, mathematics, quantitative.**

I. INTRODUCTION

In today's hastily changing world, knowledge itself is in the process of continuous change and development. Learning how to acquire learning is as important as learning the information itself. It is possible to assist students in obtaining the desired knowledge through the implementation of innovative applications. Innovation is comprehensive and has a broad meaning. However, the author emphasized that innovation, apart from being goods or services, is also a process, which relates to putting new ideas into practice for the first time (Yalcinkaya, 2012).

To adapt the changing conditions, using new methods in social, cultural and administrative environments" (Aydar, 2014). Innovation related to the development of new products in the result of the use of new ideas and knowledge together. According to the definition of a scientific organization, innovation is transformation process of knowledge into products by using labor and infrastructure (Arıkan et al., 2013).

Innovation is comprehensive and has a broad meaning. However, apart from being goods or services, is also a process, which relates to putting new ideas into practice for the first time (Yalcinkaya, 2012). Musoglu (2017) Innovation is confused with the word creativity. He also indicated that creativity is one of the factors that make up DNA of innovation.

The world of public education has evolved to include advanced technological tools and resources that have changed how teachers teach, and students learn (Moeller & Reitzes, 2016). The constructivist learning theory fits well within the technology integrated classrooms that utilize Web 2.0 tools, mobile technologies, and other similar resources.

However, constructivism as a learning theory is not new in public education as it has advocated by theorists such as Jean Piaget, John Dewey, Maria Montessori, Joseph Bruner, and Vygotsky (Luterbach & Brown, 2015). It is child-centered where each child constructs his or her unique meaning through individually owned cognitive processes (Jonassen & Landreth, 2012).

Learners learn actively and collaboratively in processing new information and linking to prior experiences (Barkley, 2012; Cross & Major, 2014). Bruner (1966) highlighted three critical principles of constructivism: 1) classroom instruction must provide the experiences and context that make students willing and prepared to learn; 2) classroom instruction must be easily grasped and understood by the student; and 3) classroom instruction should facilitate and allow for the extension of knowledge. By giving students opportunities to collaboratively process new information, using Bruner's (1966) principles of constructivism, authentic tasks in the classroom become an essential component of constructivist theory. Authentic tasks give real-world relevance, and when integrated across the curriculum, they provide appropriate levels of rigor. Children learn whole to part, not incrementally, in constructivist theory. The ideas and interests of children drive the learning process. Teachers become the facilitator in the classroom and are flexible (Moeller & Reitzes, 2015). Additionally, active learning leads to higher retention and higher-level thinking (Marzano & Toth, 2014).

Researchers stated the relationship between education and innovation and expressed that education is the primary driver of innovation which seen as a way of thinking (Gümüştekin, 2018). A relationship exists between training and innovativeness. The purpose of innovation in education is to provide high-quality training, develop creative minds, and train self-confident students who establish good communication within their environment, who can adapt to teamwork, who successfully make use of information technologies, and produce creative ideas under the capacities of the 21st century. It is essential to create appropriate learning environments and selecting instructional strategies to realize education and innovation (Morgan, 2015).

Developing learner's 21st-century skills, including creativity, critical thinking, and problem-solving, has been the widespread concern in our globalized and hyper-connected society (Gretter & Yadav, 2016). Because our world is more globalized than ever, 21st-century skills like critical thinking, creativity, and communication require an integrated approach to education where different disciplines come together to bolster students' academic and personal skills (Goodwin & Sommervold, 2012).

Past research has repeatedly shown that students perform lower in mathematics than the national set standards (Grady, et al., 2013; Peterson et al., 2014; Vidor, 2013). English proficiency among teachers emerged as a statistically significant predictor of mathematics scores. Coefficients revealed that mathematics scores increased simultaneously with English proficiency but inversely with grade level (Henry, 2013). Enjoyment and pride explained a significant amount of variance in the final grades, self-regulation, and self-efficacy, even after accounting for the variance explained by gender and anxiety. Although the results cannot interpret as indicating a causal relationship between positive emotions and achievement, the results indicate how positive emotions in mathematics learning can contribute to a more balanced picture of the role of affective states in mathematics learning (Villavicencio & Bernardo, 2016).

The positive impact of technology implementation on elementary student mathematics achievement has been well documented (Hlodan, 2012; Lu & Overbaugh, 2013; Okeke, 2014). The study results may contribute to these prior findings to further provide the global community of current and future researchers with more information regarding the impact of technology implementation on elementary mathematics students. The results from this research may also contribute to existing research into the use of technology for the potential to reduce or eliminate the gap between K to12 mathematics students and their global counterparts (Vigdor, 2013), which may empower educators' decisions and attitudes towards the implementation of technology, especially for underserved students.

Past research has also been conducted on the effects of technology in the classroom and shown higher classroom assessment scores due to increased student engagement (Bartsch & Murphy, 2012) and significant learning moments when such technology is present (Bruce et al., 2012). Studies have also explicitly concentrated on learners and classroom achievement (Bartsch & Murphy, 2013); (Bruce et al., 2012); (Drijvers et al., 2013); (Li & Ma, 2012); (Polly, 2014); (Wang et al., 2014). A significant achievement gap remains among students of different socioeconomic status and gender which were noted as an essential factor in mathematics achievement (Arroyo et al., 2013).

Although the current landscape in education emphasizes the importance of developing students' 21st-century skills through a variety of standards (Partnership for the 21st century, 2014), little has been done to implement innovative teaching in a way that enhances creativity and critical thinking across the K to12 curriculum. To address this gap and to support teachers 'integration of innovative teaching strategies in the classroom, the present paper highlights two initiatives that connect creativity and innovation with computational abilities of students. The study may provide conclusions to aid the educational community further to solve the Philippine gap in mathematics achievement as supported by technology.

Objectives of the Study

The study examined the relationship between the innovative teaching strategies and the computational abilities of learners. The specific objectives were to:

1. Determine the learner's level of computational abilities;

2. Explore the significant relationship between teacher's innovative teaching and learner's computational abilities;

3. Determine the predictive ability of innovative teaching strategies on the computational ability of learners.

II. METHODS

Research Design

This study investigated the relationship between teacher's innovative teaching strategies and computational abilities of learners. It was a causal since it attempted to identify the predictive power of innovative teaching strategies of teachers on computational abilities of learners. Causal research is conducted to identify the extent and nature of cause-and-effect relationships. Causal research can be conducted to assess impacts of specific changes in existing norms, various and processes. Causal studies focus on an analysis of a situation or a specific problem to explain the patterns of relationships between variables. (Zikmund et al., 2012).

Research Setting

This study conducted in the Division of Iligan City. The City of Iligan geographically located along the northern coast of Mindanao facing Iligan, Bay. The city is bounded on the south by the municipalities of Balo-i and Linamon, both of Lanao del Norte; on the North by the province of Misamis Oriental; on the east the territories of Lanao del Sur and Bukidnon provinces; and on the west by Iligan Bay. This study administered to public elementary school teachers in the division of Iligan City. The ten (10) school districts in the division included and only teachers with a minimum of three (3) years' experience were part of the respondents. The ten districts had a total of 85 elementary schools and composed of 1560 elementary grade teachers.

Respondents of the Study

The subjects of the study were the public elementary school teachers in the DepEd-Division of Iligan City. A proportionate sampling technique was used to determine the total number of respondents in every district. The sample size was determined using raosoft online sample size calculator. Using the population of 1560 teachers, with a confidence level of 95%, the sample size determined at 50% response distribution. Only teachers who are teaching mathematics in Grades 1 to Grade 6 a total of 247 teachers are part of the research.

Research Instrument

In gathering data for the study, the following were the research instrument used:

A. Innovative Teaching Strategy Scale. This scale was developed by the researcher using Exploratory Factor Analysis (EFA). A total of 40 items with constructs in Critical Thinking, Creativity, Social Skills and ICT Skills.

B. Mean grade of pupils in mathematics under the teacher respondents. The average of the three (3) grading periods are considered for this study. Documentary analysis as a secondary source of data was employed in this research using the grade sheets of teachers.

Data Gathering Procedure

A letter sent to the Schools Division Superintendent of the Division of Iligan City, asking permission to gather data by administering the instrument of the study. Upon approval, the researcher personally administered the instrument to the target respondents. The researcher and the respondents agreed what particular date the tool would be retrieved. Two (2) weeks after the administration of the 3rd periodic exam the researcher then requested for the mean math grade. Other essential research activities like tallying of responses, an organization of data, analysis, and interpretation followed.

Ethical Issues

Ethical Considerations specified as one of the most critical parts of the research. Before the study, a full consent obtained, and privacy of the participants ascertained. The principle of informed consent involves the researcher providing sufficient information and assurance about taking part to allow participants to understand the implications of participation and to reach an entirely informed, considered and freely given the decision about whether or not to do so, without the exercise of any pressure. Moreover, participants reported that their participation is voluntary and they have rights to withdraw from the research at any stage if they wish to do so.

Data Analysis

All the data gathered from the respondents were analyzed using Statistical Package for Social Sciences (SPSS). The analysis includes both descriptive and inferential analysis. The researcher used descriptive analysis using mean and standard deviations. Pearson Product-Moment Coefficient of Correlation (Pearson's r) was used to establish a relationship between variables. Simple linear regression was used to determine the predictive power of innovative teaching on mathematics achievement.

III. RESULTS AND DISCUSSIONS

Pupils' Computational Abilities

Table 1 shows the profile of pupils with their computational abilities. This investigation involves mean grade of learners in mathematics for three grading periods. Data shows that 43% (n=5361) of the pupil's computational abilities belonged to the satisfactory level (80-84), 27% (n=3366) belonged to fairly satisfactory level (75-79), 19% (n=2369) belonged to very satisfactory level (85-89), and only 9% (n=1122) has an outstanding (90-100) computational ability. A minimal two percent (n=249) did not meet the expectations. This data imply that the computational abilities of learners across grade level are satisfactory. This can be attributed to the different teachers who are responsible for carrying out the teaching and learning process inside the classroom. The 2 percent (n=249) that did not meet the expectations is an indicator that the remedial program of every school is effective. D.O. 8 s 2015 directs every teacher to conduct remedial teaching even just after the first grading to avoid failing learners at the end of the school year.

Table 1: Profile of Computational Ability of Learners

Description	**%**	*n*
Outstanding (90-100)	9	**1122**
Very Satisfactory (85-89)	19	**2369**
Satisfactory (80-84)	43	**5361**
Fairly Satisfactory (75-79)	27	**3366**
Did not meet the Expectations (Below 75)	2	**249**
Over-all	100	**12467**

Correlation between Innovative Teaching Strategies and

Computational Abilities.

Pearson correlation analysis was performed to identify the correlation between the innovative teaching strategies subscale and computational abilities of the pupil. The result showed that there is a slight, positive, and significant correlation between creativity and computational abilities (r=0.23, p=0.02) (Table 2). The coefficient of determination (r2=0.05) suggested that creativity and computational ability of pupils accounted for 5% of the variance in one another. The highest bivariate correlation was between critical thinking and computational ability (r=.76, p=0.000). There was not any significant correlation between social skills and computational ability or ICT skills and computational ability (p >0.05).

Table 2: Correlation between Innovative Teaching Strategies and Computational Abilities

Variables	***r* Value**	r^2	***p*Value**
Critical Thinking and Computational Abilities	0.76	0.57	0.000***
Creativity & Computational Abilities	0.23	0.05	0.02**
Social Skills and Computational Abilities	-0.08	0.0064	0.35
ICT Skills and Computational Abilities	0.20	0.04	0.18

Notes:

Correlation Values

0.0 – 0.20 Negligible Correlation	**** - Highly Significant at 0.01 alpha*
0.21 – 0.40 Low or Slight Correlation	*** - Significant at 0.05 alpha*
0.41 – 0.70 Marked/Moderate Correlation	*NS - Not Significant at 0.05 alpha*
0.71 – 0.90 High Correlation	
0.91 – 0.99 Very High Correlation	
1.00- Perfect Correlation	

Predictive Ability of Innovative Teaching Strategies on Computational Ability

Table provides the R and R^2 values. The R value represents the simple correlation and is 0.844 which indicates a high degree of correlation. The R^2 value indicates how much of the total variation in the dependent variable; computational ability, can be explained by the independent variable; critical thinking; creativity; social skills; and ICT skills. In this case, 71.3% can be explained, which is very large.

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Data indicates that the regression model predicts the dependent variable significantly well. This further indicates the statistical significance of the regression model. Moreover, $p < 0.0005$, which is less than 0.01, indicates that, overall, the regression model statistically significantly predicts the outcome variable it is a good fit for the data. The coefficient table provides us with the necessary information to predict computational abilities from innovative teaching strategy, as well as determine whether innovative teaching strategies contributes statistically significantly to the model. As shown in the tables below it is only critical thinking has the greatest positive predictive power on competition ability of pupils followed by creativity, social skills, although ICT skills exhibit a negative predictive power on pupil's computational skills.

Table 3: Model Summary of r and r^2

Model	r	r^2	Adjusted r^2	Std. Error of the Estimate
1	.844[a]	.713	.483	1.70379

a. Predictors: (Constant), ICT Skills, Creativity, Social Skills, Critical Thinking

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	43578389.985	6	3445558.996	3.099	.000[b]
1	Residual	56343431.515	240	566762.903		
	Total	99921821.500	246			

a. Dependent Variable: Computational

b. Predictors: (Constant), ICT Skills, Creativity, Social Skills, Critical Thinking

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	49.329	19.802		2.491	.000
	Critical Thinking	19.496	5.840	1.095	3.339	.000
1	Creativity	1.822	4.853	.104	.375	.723
	Social Skills	.847	2.074	.128	.408	.700
	ICT Skills	-4.509	2.674	-.569	-1.686	.153

a. Dependent Variable: Computational

The regression equation is:

Computational Ability = 43.329 + 19.496 (Critical Thinking) + 1.82 (Creativity) + 0.847(Social Skill) - 4.509 (ICT Skills)

IV. SUMMARY OF FINDINGS

This study explains the relationship between the innovative teaching strategies and computational abilities of learners. The following topics discussed: (1) learners level of computational abilities; (2) significant relationship between teachers innovative teaching and learners computational abilities; (3) predictive ability of the innovative teaching strategies on learners computational ability.

Results showed that almost one-half of the learners got satisfactory computational ability with grades ranging from 80-84. However, only 2% of the pupils did not meet the expectations. Moreover, a slight, positive, significant relationship exists between creativity and computational abilities and a high positive correlation between critical thinking and computational abilities. The computational ability can be explained by the independent variable, critical thinking, creativity, social skills, and ICT skills as the predictors. However, critical thinking has a higher positive predictive ability compared to other constructs in the scale. Although ICT skills exhibit negative predictive ability or inversely proportional to computational ability.

V. CONCLUSION

Innovative teaching with the construct in Critical Thinking, Creativity, Social Skills and ICT Skills is an essential predictor of computational abilities of learners. Necessary information can predict computational abilities from innovative teaching strategies of teachers, as well as determine whether innovative teaching strategies contributes statistically significant to the model.

Based on the findings and conclusions of the study the following are the recommendations: (a) School heads may identify teachers who are good in teaching mathematics and give her opportunity to share her knowledge through Learning Action Cell (LAC) session in schools; (b) Teachers may intensify the remedial teaching for learners who have difficulties in mathematics to address learners who belong to the 2% who did not meet the expectations. (c) The division office will advocate training workshop on innovative teaching strategies that will address critical thinking of teachers in the classroom especially those who have high competence in ICT skills.

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