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Pedagogical Content Knowledge, Information and Communications Technology Competency, Occupational Stress and Teachers' Performance in Mathematical Word Problems

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Abstract: ***The purpose of this study was to develop a structural model of teachers' pedagogical content knowledge, information and communications technology competency, occupational stress and performance in mathematical word problems. This study was conducted among 790 Grades IV to VI teachers in Region X. The data were gathered through the use of survey questionnaires. Teachers had an overall satisfactory rating in word problem solving performance. The comprehension and extraction was the highest, followed by construction of equations and solving of equations. Mathematics teachers were highly knowledgeable in terms of pedagogical content knowledge. They were highly knowledgeable of the curriculum and of teaching strategies and moderately knowledgeable in the knowledge of content. Information and communications technology competency was also regarded as high among mathematics teachers. They were highly competent in basic computer operations, and office and technology productivity tools. Internet and network applications, and information and data management were described moderately competent. On occupational stress, teachers were highly stressed with all measures being consistent in description arrange in particular order as job exhaustion/demands, extra load handled, anxiety, role conflict and time pressure management Teachers' mathematical word problem solving performance showed significant correlation with pedagogical content knowledge with content knowledge. It was also correlated with information and communications technology competency with internet and network applications. Occupational stress also manifested correlation with extra load handled as a measured variable. The best predictors of mathematical word problem performance were the knowledge of content, knowledge of the curriculum and extra load handled. The goodness-of-fit captured the teachers' mathematical word problem solving performance as a blend of information and communications technology competency and occupational stress.***

1. Introduction

1.1 Background of the Study

Mathematics is one of the most important learning areas across all educational levels. It is practically a part of human existence since everything we do have some mathematical connections. Thus, it is important that teachers have the necessary competence to teach the mathematical skills embedded in the mathematics curriculum in order to achieve quality mathematics education.

This long standing quest for quality is the very reason for the rapidly changing curriculum. But, realistically speaking, how far is the actual performance below the quality standards set by the Department of Education?

The result of the National Achievement Test speaks of the current state of our country's education. It fails to achieve the quality target of 75% especially on the aspect of Mathematics and Sciences. NETRC, DepEd reported that the NAT result for the elementary level for SY 2012-2013 is only 68.88 percent with Science, English and Mathematics as the three lowest scoring subjects.

Since most of the test questions are stated in a word problem situation this scenario requires the enabling skills of teachers as facilitators of learning for pupils to fully grasp word problems and build on their skills of solving word problems in various methodologies that they find most comfortable with. "Elementary teachers need a strong foundation of mathematics so that can facilitate learning in a coherent, reasoned activity and be able to express its elegance and power" (Conference Board of the Mathematical Sciences [CBMS], 2001. Tambara (2015) also revealed that majority of the teachers were stacked to the traditional method of teaching mathematics wherein pupils were required to follow in to-to the steps in solving word problems thus grabbing them the chance to develop critical thinking skills.

According to Kilpatrick, Swaffold and Findell, as cited by Yee (2014) problem solving is the focus of Mathematics learning and instruction should give students daily experiences with it. In this case, teachers must ensure that pupils are taught the concepts of Mathematics in the context of word problems in order to hone their skills in solving real-life problems.

Word problem solving particularly those involving fractions is especially unappealing to pupils. Literature reveals that students at all levels find word problems solving with fractions difficult (Kocaoğlu & Yenilmez, 2010). Lopez (2008) contended that "English language learners typically experience difficulty understanding and therefore solving word problems especially among pupils in the higher grades where problems are becoming more complex". Ahmad (2011) added that students find it hard to understand word problems because of their language difficulty. They find it hard to understand the problem and eventually translate the problem into mathematical equations.

The quality and competence of teachers greatly affects the academic success of students. Several research conducted has proven this notion. That is why, education invested so much on teacher trainings and other professional development activities in order to build adequate competence among teachers and to keep them abreast with the new trends of education. As new generation of learners unfolds, new ways of learning occurs and new approaches and techniques of teaching is required. Mc Kinsey (2007) posited that the "quality of an education system cannot exceed the quality of its teachers". This means that the pedagogical content knowledge of the teachers in mathematics play a significant role in educational achievement.

However, it cannot be denied that many of the elementary grade teachers, being generalist, only have basic training in mathematics during their pre-service years. Thus, they do not have mastery of all the contents of mathematics that they are supposed to teach especially in the higher grades. This is proven by the dismal result of the teachers in the Process Skills Test in Science and Mathematics where elementary school teachers only scored 46.03 percent . The Teacher Test in Science and Mathematics, meanwhile, aimed to assess "teachers' proficiency in English to teach elementary and secondary science and math" (Phil. EFA Review, 2015).

Teachers need to spend ample time learning the content that they are to teach the following day in order to teach with confidence the subject matter. This entails additional stress on the part of an already multi-tasked teacher.

Teachers are only required to render 6 hours of teaching loads but the remaining two hours is never actually enough for other ancillary services required of a classroom teacher. The preparation of IM's and numerous reports already consume the 2-hour allotted to the teacher for teaching related activities making it impossible for them to do coaching, remedial teaching, home visitations and many others if they do not extend their time.

The availability of the information and communication technology is believed to lighten the burden of the teachers in preparing lessons for the pupils and is believed to help improve the quality of learning. NCTM (2003) recommends the use of technology as an essential tool for teaching and learning in mathematics since it can "extend the scope of its content and the range of problem situation available to students".

Though the World Bank (2003) supported the idea that ICT improves the teaching learning process, it did not confirm that the availability of computers in the classroom improved learning outcomes unless it was well-planned and education policy for ICT was in place.

It is for the above reasons that the researcher finds the investigation of the possible relationship of pedagogical content knowledge, ICT competency, occupational stress and word problem solving performance in fraction of mathematics teachers relevant and practicable.

2. Conceptual Framework

Through the review of related literature discussed in some preceding statements, the following concepts are hereby given which provide the bases for this study:

The problem solving performance of teachers in fractions utilizes the model of Mayer (1983) which has 2 major parts: problem representation and problem solution phase. It is broken down further into Problem Representation phase which consist of three steps, namely: Comprehension, Extraction and Construction of Equations. The second is the Search for Solutions Phase which consist of solving equations and giving the final answer (Ahmad, 2008).

This study however, merged together comprehension and extraction into one in the problem representation phase and the also solving equations and answer in the search for solutions phase. It is believed that the concrete manifestation of comprehension is when the problem solver is able to list down given variables and information and make diagrams to represent and visualize the problem which happens in the extraction step. In like manner, the solving equations step necessitates that proper labeling of the answer will be done.

The study of Lelis (2013) also investigated on the self-efficacy in terms of content knowledge and pedagogy, and problem solving performance on fractions of pre-service teachers. Furthermore, Sibuyi (2012) also included in the investigation of his study the three elements of PCK, namely; knowledge of the subject matter; knowledge of teaching strategies; and knowledge of learners' conceptions.
Teachers who are teaching mathematics even if this is not their field of expertise, are still oblige to learn the content that they are supposed to teach through self-exploration of learning modules available online or in print, through collaboration with other teachers or through the use of ICT. Jean Piaget's theory of constructivism contends that teachers are active learners over time. Humans construct knowledge and meaning from their experiences and through collaboration with others (Nge Ann Polytechnic, 2018). Learner reflection and cognitive conflict are valued and it encourages peer interaction (Alzahrani, et al, 2018).

Information and communications technology competency is based on the theory of connectivism known as the "learning theory for the digital age" which believed that learning happens in an individual and within and across networks (Siemens, 2005). Learners are encouraged to seek out information on their own online and express what they find.

The advent of ICT in education would be a great help in improving the quality of education. However, the World Bank (2003) claimed that although ICT can support changes in pedagogy and improves in teaching-learning, providing computers in the classroom does not improve outcomes unless it is well-planned. Pedagogical content knowledge of teachers and the appropriate use of ICT can improve the quality of education.

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The occupational stress associated with the many different factors in a teacher's life may hamper the teacher's burning desire to achieve the desired quality of education. Causes of occupational stress include environments, organizational climate, and conflict arising from the job demands of the employees (Mustafa, 2017). Moreover, stress gets multiplied when the teachers don't get to teach subjects of their choice and expertise (Naithani, 2011) because the work demands does not match the knowledge and skills of the workers or their needs (Addae & Wang (2006).

However, the cognitive-relational model of stress that is based around a cycle of appraisal of environmental stress and consequent coping explained that appraisal and coping are mediating processes that seek to reduce stress.

Therefore, the intensity of the effect of stress upon a person is dependent on her coping mechanisms.

In view of the foregoing, Table 1 captures the codes, nature and measure of the variables under study while Figures 1-5 illustrates the hypothesized models of teachers' performance.

Table 1: The nature and measure of the variables used in the study

Variables	*Code*	*Nature*	*Measure*
Pedagogical Content Knowledge	PCK	Exogenous	PCK Questionnaire
Knowledge of Content Knowledge of Teaching Practices Knowledge of Curriculum	PC_CO PC_TP PC_CU		
Information and Communications Technology Competency	ICTCOM	Exogenous	ICT competency questionnaire
Basic Computer Operations	ICT_BC		
Office and Teaching Productivity Tools	ICT_OT		
Internet and Network Applications and Resources	ICT_IN		
Information and Data Management	ICT_ID		
Occupational Stress	OCSTRESS	Exogenous	Occupational Stress questionnaire
Job Exhaustion/ Demands	OS_JE		
Time/Pressure Management	OS_TP		
Anxiety	OS_AX		
Role Conflict	OS_RC		
Extra Load Handled	OS_EL		
Mathematics Teachers' Word Problem Performance Comprehension and Extraction	MTPER TP_COM	Endogenous	Mathematics Teachers' Word Problem Performance questionnaire
Construction of Equations	TP_CON		
Solving Equation	TP_SOL		

Hypothesized Model 1

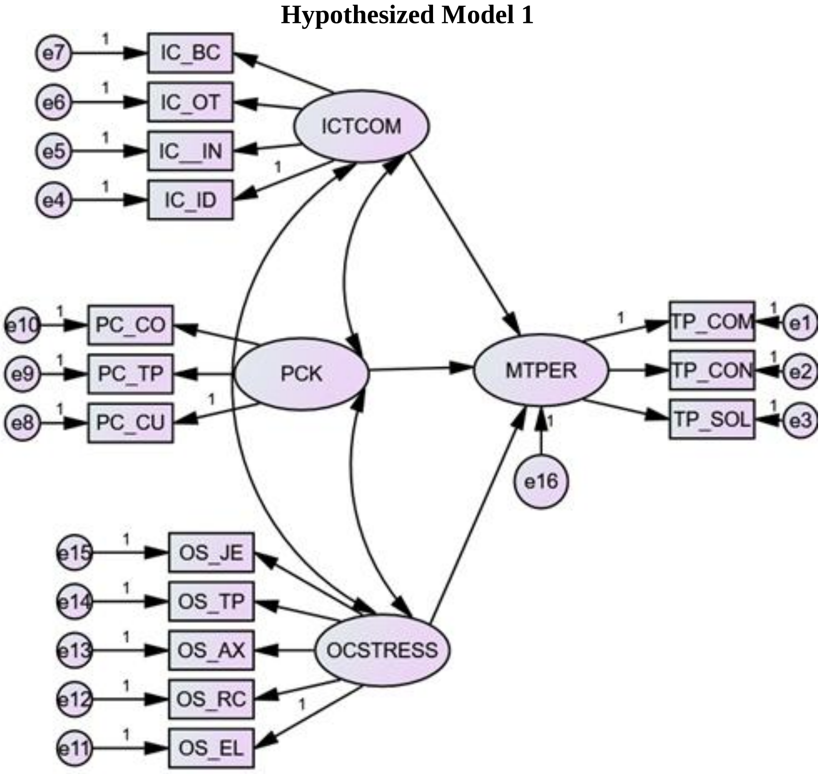

Figure 1: Hypothesized structural model 1 on Mathematics teachers' performance on word problem

Legend:

MTPER= Mathematics Teachers' Word Problem Performance	ICT_BC= Basic Computer Operations ICT_OT= Office and Teaching Productivity Tools
TP_COM= Comprehension and Extraction TP_CON= Construction of Equations	ICT_IN= Internet and Network Applications and Resources ICT_ID= Information and Data Management
TP_SOL= Solving Equation PCK= Pedagogical Content Knowledge	OCSTRESS= Occupational Stress OS_JE= Job Exhaustion/ Demands
PC_CO= Knowledge of Content PC_TP=Knowledge of Teaching Strategies	OS_TP= Time/Pressure Management OS_AX= Anxiety
PC_CU= Knowledge of the Curriculum	OS_RC= Role Conflict
ICTCOM= Information and Communications Technology Competency	OS_EL= Extra Load Handled

Hypothesized Model 2

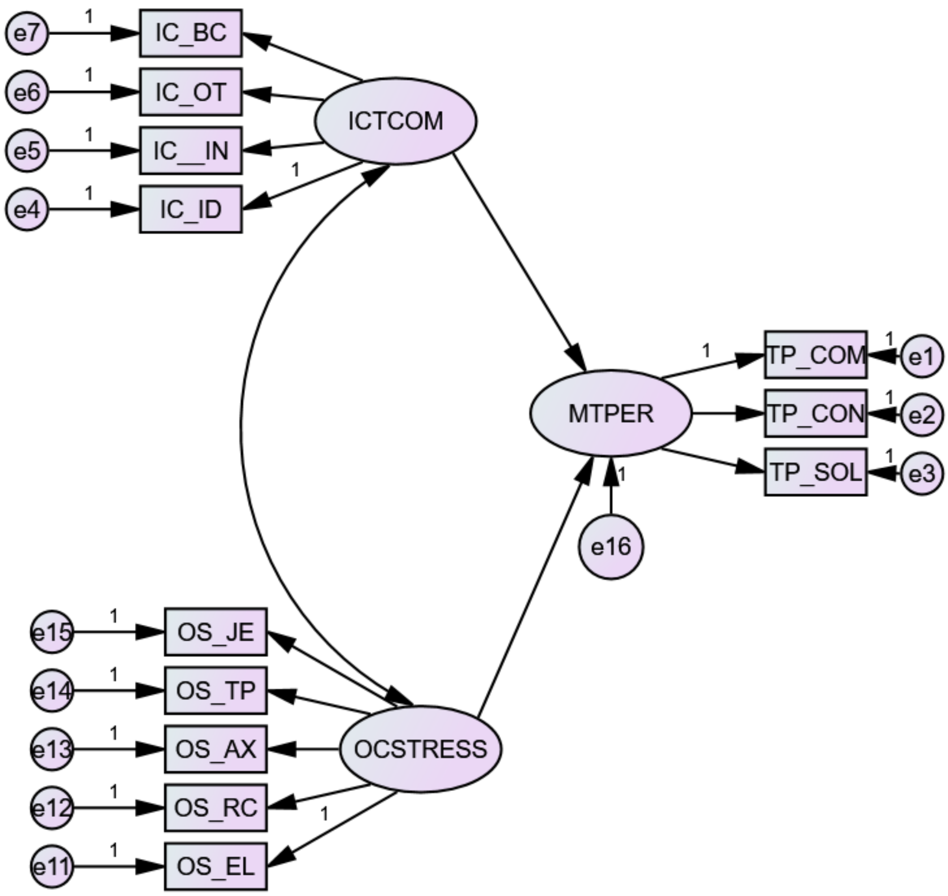

Figure 2: Hypothesized structural model 2 on Mathematics teachers' performance on word problem

Legend:

MTPER= Mathematics Teachers' Word Problem Performance	ICT_IN= Internet and Network Applications and Resources ICT_ID= Information and Data Management
TP_COM= Comprehension and Extraction	OCSTRESS= Occupational Stress
TP_CON= Construction of Equations	OS_JE= Job Exhaustion/ Demands
TP_SOL= Solving Equation	OS_TP= Time/Pressure Management
ICTCOM= Information and Communications Technology Competency	OS_AX= Anxiety OS_RC= Role Conflict
ICT_BC= Basic Computer Operations	OS_EL= Extra Load Handled
ICT_OT= Office and Teaching Productivity Tools	

Hypothesized Model 3

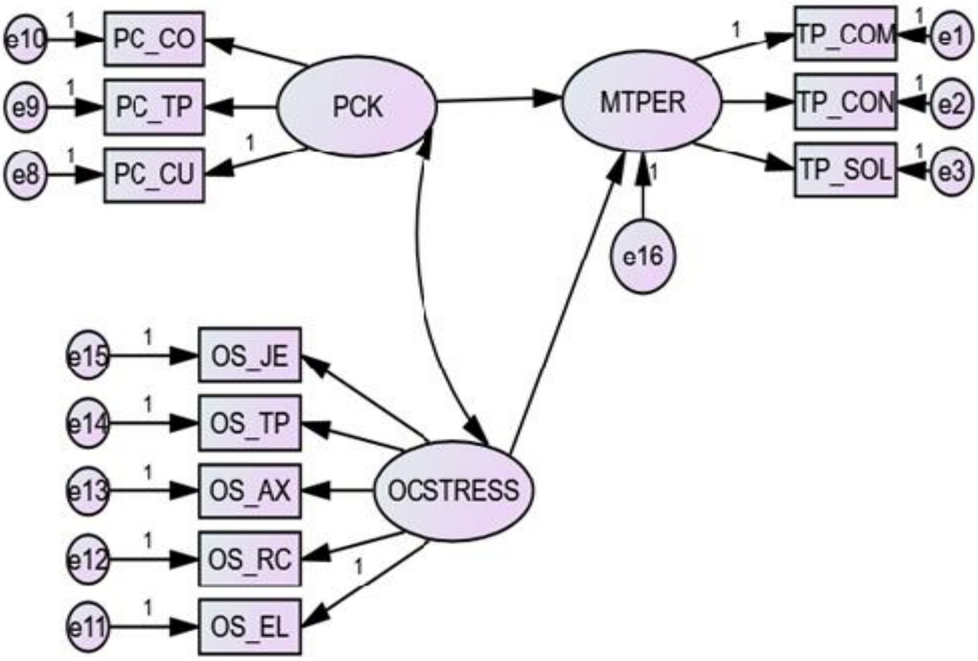

Figure 3: Hypothesized structural model 3 on Mathematics teachers' performance on word problem

Legend:

MTPER= Mathematics Teachers' Word Problem Performance	PC_CU= Knowledge of the Curriculum OCSTRESS= Occupational Stress
TP_COM= Comprehension and Extraction	OS_JE= Job Exhaustion/ Demands
TP_CON= Construction of Equations	OS_TP= Time/Pressure Management
TP_SOL= Solving Equation	OS_AX= Anxiety
PCK= Pedagogical Content Knowledge	OS_RC= Role Conflict
PC_CO= Knowledge of Content	OS_EL= Extra Load Handled
PC_TP=Knowledge of Teaching Strategies	

Hypothesized Model 4

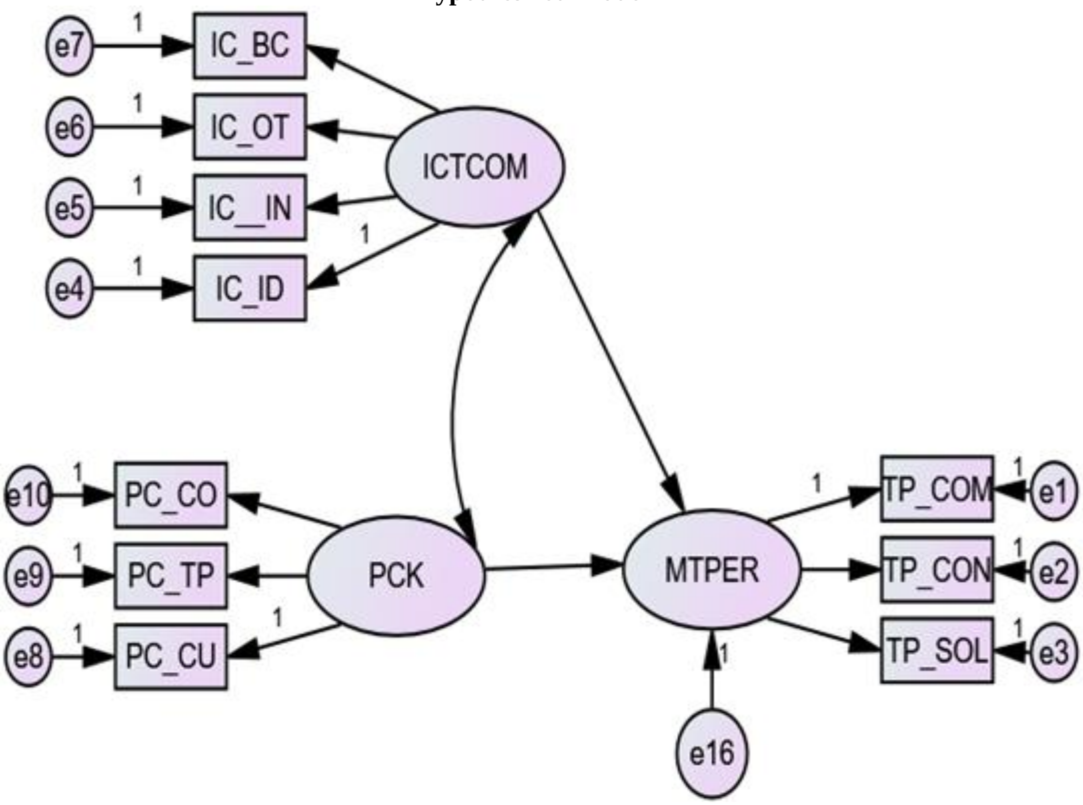

Figure 4: Hypothesized structural model 4 on Mathematics teachers' performance on word problem

Legend:

MTPER= Mathematics Teachers' Word Problem Performance TP_COM= Comprehension and Extraction	PC_CU= Knowledge of the Curriculum ICTCOM= Information and Communications Technology Competency
TP_CON= Construction of Equations	ICT_BC= Basic Computer Operations
TP_SOL= Solving Equation	ICT_OT= Office and Technology Productivity Tools
PCK= Pedagogical Content Knowledge	ICT_IN= Internet and Network Applications and Resources
PC_CO= Knowledge of Content	ICT_ID= Information and Data Management
PC_TP=Knowledge of Teaching Strategies	

Hypothesized Model 5

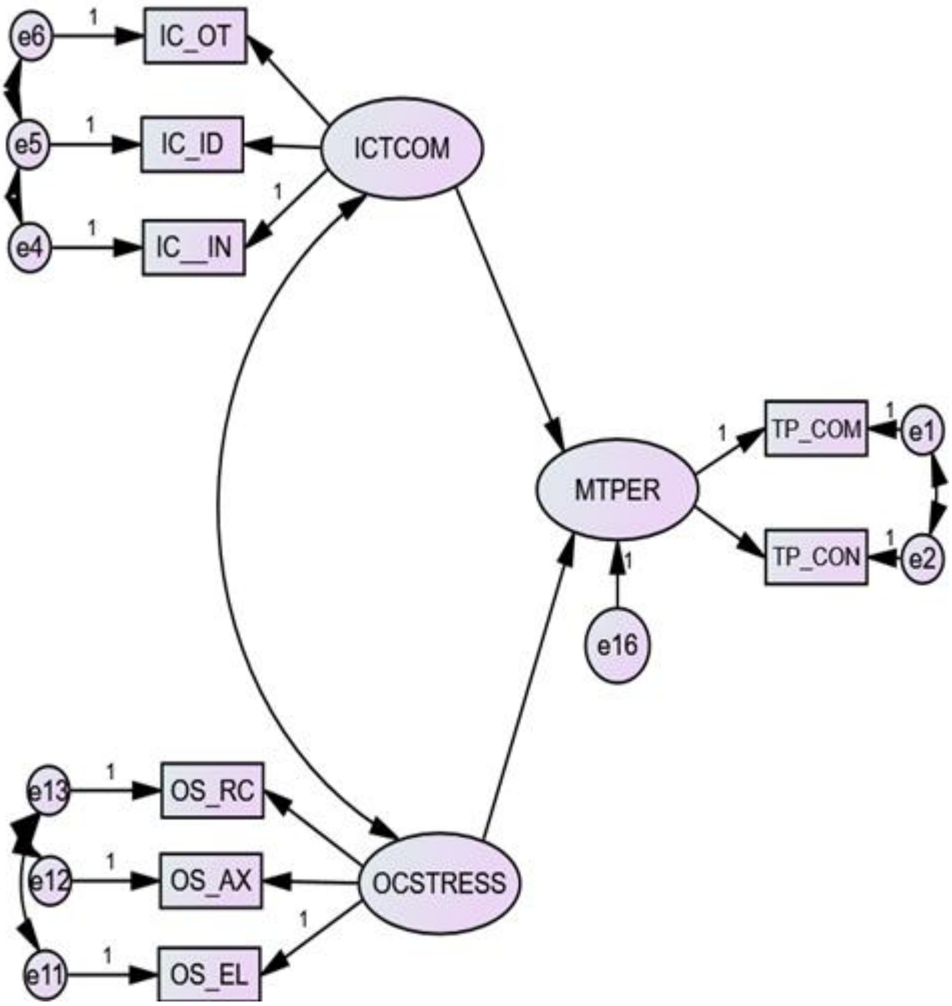

Figure 5: Hypothesized structural model 5 on Mathematics teachers' performance on word problem

Legend:

MTPER= Mathematics Teachers' Word Problem Performance	ICT_ID= Information and Data Management OCSTRESS= Occupational Stress
TP_COM= Comprehension and Extraction	OS_JE= Job Exhaustion/ Demands
TP_CON= Construction of Equations	OS_TP= Time/Pressure Management
ICTCOM= Information and Communications Technology Competency	OS_AX= Anxiety OS_RC= Role Conflict
ICT_BC= Basic Computer Operations	OS_EL= Extra Load Handled
ICT_OT= Office and Teaching Productivity Tools	
ICT_IN= Internet and Network Applications and Resources	

Hypothesis of the Study

For guidance in the analysis of findings and interpretation of the study, the following hypothesis were tested:

Ho_1: There is no significant relationship between Mathematics teachers' word problem solving performance and pedagogical content knowledge, ICT competency, and occupational stress.

Ho_2: There are no variables, singly or in combination, best predict Mathematics teachers' word problem solving performance.

Ho_3: None of the structural models best fits Mathematics teachers' word problem solving performance.

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3. Methodology

This chapter presents the research design, locale of the study, research instruments and its validation process, data gathering procedure and statistical treatment.

Research Design

This study employed descriptive-correlational and causal comparative research design. A model was used as the basis for improving the mathematics teachers' word problem solving performance in fractions that includes pedagogical content knowledge, ICT literacy and occupational stress.

Correlational research was used in the study since it attempted to explore the degree of relationships that existed between the level of mathematics teachers' word problem solving performance, pedagogical content knowledge, ICT competency and occupational stress.

The study had three phases: first, the researcher presents the status of the mathematics teachers pedagogical content knowledge, ICT competency and occupational stress; thus, a descriptive-correlation design; secondly, a structural equation model (SEM) was used on mathematics teachers word problem solving performance as influenced by the pedagogical content knowledge in mathematics, ICT competency and occupational stress making use of causal-comparative research design. Thirdly, an observation of a mathematics teacher teaching word problem solving in fraction was observed to shed an enriching discussion of a teacher's knowledge on content and pedagogy in the actual teaching episode.

Locale of the Study

The study was conducted in Region X, the Northern Mindanao region particularly in the five (5) provincial schools division, namely: Bukidnon, Camiguin, Lanao del Norte, Misamis Occidental and Misamis Oriental.

Bukidnon is composed of three (3) school divisions namely; Division of Bukidnon, Division of Malaybalay City, and Division of Valencia City. Misamis Oriental province has 4 school divisions, Division of Misamis Oriental, Division of Cagayan De Oro City and Division of El Salvador City and Gingoog City.. The Division of Camiguin is a lone division of the island. The Misamis Occiental has 5 school divisions which include the Misamis Occidental Division, Division of Tangub City, Division of Ozamis, Division of Oroquieta and Division of Ozamis City. Lanao del Norte has 2 school divisions namely; Division of Lanao del Norte and Iligan City Division.

Bukidnon, a place endowed with very rich agricultural resources, is composed of 3 school divisions, namely: The Malaybalay City Division; the Valencia City Division and the Division of Bukidnon. The province borders, clockwise starting from the north, Misamis Oriental, Agusan del Sur, Davao del Norte, Cotabato, Lanao del Sur, and Lanao del Norte.

Malaybalay City, the capital city of Bukidnon, is in the focal part of the territory. It is limited in the east by the region of Cabanglasan and the Pantaron range, which isolates Bukidnon from the areas of Agusan del Sur and Davao del Norte; on the west by the district of Lantapan and Mount Kitanglad; on the north by the region of Impasugong; and on the south by the Valencia City and the region of San Fernando. The entire eastern and southerneastern outskirt bordering Agusan del Sur and Davalo del Norte is raised and thickly forested mountains, which is one of only a handful few staying woodland squares of Mindanao. The closest seaports and airplane terminals are in Cagayan de Oro City, which is 91 kilometers away.

The Misamis Oriental being part of the Region X is also composed of 4 school division, namely; division of Misamis Oriental, Cagayan de Oro City Schools Division, Division of El Salvador and Gingoog City Division.

Metropolitan Cagayan de Oro also known as Metro Cagayan de Oro, is the fourth largest metropolitan area in the Philippines. It is located on the northern coast of Mindanao, and comprises the two chartered cities of Cagayan de Oro and El Salvador.

El Salvador is a city in the province of Misamis Oriental on the Mindanao island, southern part of the Philippines. The city serves as a pilgrimage site for the Divine Mercy devotees, that is why it is also famous as "The City of Mercy" or direct translation of El Salvador-City of the "Savior". El Salvador was a barrio of the municipality of Cagayan de Oro. On June 15, 1948, Republic Act 268 created El Salvador as a municipality and functioned officially on August 2, 1948. Then, on June 27, 2007, by virtue of Republic Act 9435, otherwise known as the Charter of the City of El Salvador converted the municipality into a component city of the province of Misamis Oriental. From the original 7 barangays, it is now comprised of 15 barangays of which 8 are urban/urbanizing and 7 are rural. The fight on the legal aspect of becoming a city was extended and very challenging. After almost 4 years of heartrending court battle, the finality of the cityhood was entered in the book of judgment on June 26, 2011.

Camiguin is an island province in the Philippines in the Bohol Sea, about 10 kilometers (6.2 mi) of the northern coast of Mindanao. It is politically part of the Northern Mindanao Region of the country and formerly a part of Misamis Oriental province. Camiguin is the second-smallest province in the country in both area and population. The province is famous for its sweetest lanzones to which its annual Lanzones festival is dedicated, the picturesque Sunken Cemetery of Camiguin and its interior forest reserves, collectively known as the Mount Hibok-Hibok Protected Landscape, which has been declared by all Southeast Asian nations as an ASEAN Heritage park. Figure 6 is provided indicating the locale of the study.

Misamis Occidental with its capital Oroquieta City is bordered by Zamboanga del Norte and Zamboanga del Sur to the west and separated from Lanao del Norte by Pangil Bay to the South and Iligan Bay to the East. Its component cities include Oroquieta, Ozamis and Tangub. Misamis Occiental school divisions include the Misamis Occidental Division, Division of Tangub City, Division of Ozamis, Division of Oroquieta and Division of Ozamis City.

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The province of Lanao del Norte is bordered by Lanao del Sur to the Southeast, Zamboanga del Sur to the West, Illana Bay to the southwest, Iligan City to the northeast and Misamis Occidental by Pangil Bay to the northwest. Its capital town is Tubod. It has 2 divisions, including the independent city of Iligan. The city of Iligan is the first class highly urbanized city of Northern Mindanao.

In summary, Region X is composed of 14 school divisions, as captured in Figure 6.

Figure 6: Map of Northern Mindanao

Participants of the Study

Simple random sampling through lottery was employed to determine the number of samples of teachers considered as participants of this study.

They composed the 790 elementary school mathematics teachers of the fourteen (14) different divisions in Region X as shown below:

Table 2: Respondents of the study from different divisions of Northern Mindanao Region

Division Administrators	Number of School
1. Division of Bukidnon	158
2. Division of Malaybalay City	40
3. Division of Valencia City	39
4. Cagayan de Oro City Division	79
5. El Salvador City Division	20
1. Division of Misamis Oriental	79
2. Gingoog City Division	40
3. Division of Camiguin	39
4. Lanao Del Norte	40
5. Iligan City Division	40
6. Division of Lanao del Norte	39
7. Division of Misamis Occidental	79
8. Oroquieta City Division	39
9. Tangub City Division	40
10. Division of Ozamis City	20
Total	790

Research Instruments

A structured questionnaire for the participants to answer and elicit useful information for the study was the main data gathering tool that was used by the researcher.

Although the questionnaires were made and used by previous researchers conducting studies relevant to the present study, pilot testing of the said instruments was done at Lanao del Sur Division since it was important in establishing constant validity and in improving the question and scale using Cronbach Alpha Reliability Test (Creswell, 2005).

The reliability result of pedagogical content knowledge questionnaire was 0.929 and one item was deleted with a reliability of 0.174. On information and communications technology. Cronbach alpha was 0.922 with 2 items being deleted. Occupational stress had a cronbach alpha of 0.956.

A Likert scale instrument composed of statements for the pedagogical content knowledge, ICT competency, and occupational stress was used. The respondents selected their extent of agreement by checking the item which corresponds to their desired responses to the given statements. For the word problem solving performance of teachers in fraction, 5 word problems were given for them to answer following the 3 major steps in problem solving, namely; comprehension and extraction; constructing of equations; and solving of equations.

Each of the variables had distinct instrument. The pedagogical content knowledge of the Mathematics teachers questionnaire was adapted from the questionnaires of the Australian Council for Educational Research and DOST-SEI Observation Checklist which was modified to fit into the present study. It consisted of three (3) domains, namely; knowledge of content, knowledge of teaching strategies and knowledge of the curriculum. It had a total of 26 items which was measured in numerical scale, the range, and qualitative interpretation as shown below.

Pedagogical content knowledge

Scale range, qualitative description and interpretation of the Mathematics teacher's pedagogical content knowledge

Scale	Range	Descriptive Rating	Qualitative Interpretation
5	4.51-5.00	Very Good	Exceptionally Knowledgeable
4	3.51-4.50	Good	Highly Knowledgeable
3	2.51-3.50	Fair	Moderately Knowledgeable
2	1.51-2.50	Poor	Less Knowledgeable
1	1.00-1.50	Very Poor	Not Knowledgeable

ICT Competency

The questionnaire on the ICT competency level of Mathematics teachers was adopted from National ICT Competency Standard for Teachers which consist of four (4) domains, namely; basic computer operations, office and teaching productivity tools, internet and network applications and resources, and information and data management. It has 35 items which was measured in numerical scale, the range, descriptive rating, and qualitative meaning as shown below.

ICT Competency

Scale range, qualitative description and interpretation of the Mathematics teacher's ICT competency

Scale	Range	Descriptive Rating	Qualitative Interpretation
5	4.51-5.00	Strongly Agree	Very Highly Competent
4	3.51-4.50	Agree	Highly Competent
3	2.51-3.50	Moderately Agree	Moderately Competent
2	1.51-2.50	Disagree	Least Competent
1	1.00-1.50	Strongly Disagree	Not Competent At All

Occupational Stress

The occupational stress of Mathematics teachers was measured using the instrument adapted from Lamban (2014) which was modified to suit into the occupational stress applicable to teachers. It consisted of 5 domains enumerated as follows: job exhaustion and demands, time/pressure management, anxiety, role conflict, and extra load handled. Each domain consisted 5 items with specific scale, range, descriptive rating and qualitative interpretations as shown below:

Domain A- Job Exhaustion/ Demands

Scale range, qualitative description and interpretation of the mathematics teacher's job exhaustion/demands

Scale	Range	Descriptive Rating	Qualitative Interpretation
5	4.51-5.00	Strongly Agree	Very Highly Exhausted
4	3.51-4.50	Agree	Highly Exhausted
3	2.51-3.50	Moderately Agree	Moderately Exhausted
2	1.51-2.50	Disagree	Less Exhausted
1	1.00-1.50	Strongly Disagree	Not Exhausted at all

Domain B- Time Pressure Management

Scale range, qualitative description and interpretation of the mathematics teacher's time pressure management.

Scale	Range	Descriptive Rating	Qualitative Interpretation
5	4.51- 5.00	Strongly Agree	Very Highly Pressured
4	3.51-4.50	Agree	Highly Pressured
3	2.51-3.50	Moderately Agree	Moderately Pressured
2	1.51-2.50	Disagree	Least Pressured
1	1.00-1.50	Strongly Disagree	Not Pressured

Domain C- Anxiety

Scale range, qualitative description and interpretation of the mathematics teacher's anxiety.

Scale	Range	Descriptive Rating	Qualitative Interpretation
5	4.51- 5.00	Strongly Agree	Very Highly Anxious
4	3.51-4.50	Agree	Highly Anxious
3	2.51-3.50	Moderately Agree	Moderately Anxious
2	1.51-2.50	Disagree	Least Anxious
1	1.00-1.50	Strongly Disagree	Not Anxious

Domain D- Role Conflict

Table 6: Scale range, qualitative description and interpretation of the mathematics teacher's role conflict

Scale	Range	Descriptive Rating	Qualitative Interpretation
5	4.51- 5.00	Strongly Agree	Very Highly Stressed
4	3.51-4.50	Agree	Highly Stressed
3	2.51-3.50	Moderately Agree	Moderately Stressed
2	1.51-2.50	Disagree	Slightly Stressed
1	1.00-1.50	Strongly Disagree	Not Stressed

Domain E. Extra Load Handled

Scale range, qualitative description and interpretation of the mathematics teacher's extra load handled.

Scale	Range	Descriptive Rating	Qualitative Interpretation
5	4.51- 5.00	Strongly Agree	Very Highly Stressed
4	3.51-4.50	Agree	Highly Stressed
3	2.51-3.50	Moderately Agree	Moderately Stressed
2	1.51-2.50	Disagree	Slightly Stressed
1	1.00-1.50	Strongly Disagree	Not Stressed

Fractional Word Problem Test

This instrument was used to measure the performance of elementary Mathematics teachers in solving word problems involving fractions. This instrument was adapted from Lelis

(2013) which was based from the NCTM (2000) Number and Operation Standard Expectation which allowed the inclusion of five different fractional word problems which demanded teachers' understanding of the different interpretations and their fluency in performing operations with fractions. Items 1 and 4 required the teachers' understanding of operator concept and proficiency in addition and subtraction with fractions. Item 2 entails their understanding of measure and ratio concepts and fluency in addition, multiplication and division. Item 3 requires the profound knowledge on operator and quotient concepts and mastery in dealing with multiplication and division procedure. Moreover, item 5 demands their deep understanding on operator and ratio concepts together with fluency in performing addition, multiplication and division of fractions. The teachers were requested to respond to the word problems following three steps/phases, namely: the comprehension and extraction phase; construction of equations; and the solving equations phase.

The responses of the teachers on the problem solving test was credited on the merit of how they arrived at the correct answer and not on the final answer alone.

In the scoring of the word problem solving test, three scorers with expertise in the field of mathematics occupying three different positions in the DepEd helped in the scoring process. One was a Teacher I teaching high school Mathematics for more than 10 years with a BS Math baccalaureate preparation and is currently taking masteral units in Mathematics. The second scorer was a Master Teacher I teaching elementary mathematics with a concentration in Mathematics in his baccalaureate degree. He's been teaching for 12 years. The third and last scorer was a district supervisor with her baccalaureate and master's degrees specializing in Mathematics.

The multiple count-scoring scheme of Schoenfeld (1982), modified by Leongson and Limjap (2003) to measure performance in word problem solving was adopted as follows:

Score	Description
0	Made no attempt to supply the information/answer required.
1	Made little attempt in the form of sketches; jotting down needed relationships; or overtly explaining how to answer the question or solve the problem
2	Showed understanding of the question/problem by the representations made and early attempts to answer the required information or solve the problem; information was given/problem solved about halfway
3	Made a great progress in answering the information required or the solution; information is almost perfectly supplied or problem is nearly solved; information/solution is correct but minor errors are committed
4	Information is fully supplied or problem is correctly solved

The mean percentage score was computed to determine the level of mathematical word problem solving performance of teachers in each level.

The performance of teachers in each of the 3 measures in word problem solving test, namely; comprehension and extraction, construction of equations, and solving equations was the average of the scores in each measure.

Performance was determined using Schoenfield's (1982) scale below with modifications.

Mean percentage score and qualitative description on word problem solving performance of teachers

Mean Percentage Score	Qualitative Description
81-100	Outstanding
61-80	Very Satisfactory
41-60	Satisfactory
21-40	Fair
0-20	Poor

Classroom Observation

A class observation to a 2 Mathematics teacher was conducted by the researcher while teaching Mathematics in their classes was done for the sole purpose of providing an enriching discussion of the results that was generated from the quantitative survey instrument on teachers pedagogical content knowledge. The observation assessed how teachers presented their lessons in order to assist learners in comprehending the topic; how the teachers assessed their learners' after the lessons; the teaching strategies that they employed; and how the teachers dealt with misconceptions and learner difficulty during lesson presentation. The observation protocol depicted in Table 9 adapted from Bukova-Guzel (2010) was used by the observer as shown below:

Lesson Observation Protocol

PCK to be observed	Evident when the teacher …	Observed practice displayed
Knowledge of the Content	1) Exhibits deep and thorough conceptual understanding of identified aspects of functions. 2) Identifies critical mathematical components within the concept of functions that are fundamental for understanding and applying that concept. 3) Displays skills for solving problems in the area of functions.	
Knowledge of Teaching Strategies	1) Uses appropriate activities in Instruction 2) Uses real-life examples and analogies in instruction 3) Utilizes different instructional strategies in presentations.	
Knowledge of the Curriculum	1) Addresses learners' misconceptions 2) Displays expectations of possible difficulties learners may face during learning and address such. 3) Discusses learners' ways of thinking about a concept. 4) Shows an awareness of the instruments to measure student learning and how to use them	

Data Gathering Procedure

The process of gathering the data started with the hiring of a research assistant who hand carried the letter to the Regional

Director asking permission to conduct the study in Region X. After such permission was obtained, the approval of the division superintendents in the 14 school divisions and the district supervisors and principals were also obtained. After which the research assistants fielded the questionnaires to the Grade 4-6 mathematics teachers in different schools throughout Region X.

There were 1200 questionnaires being distributed to concerned teachers. However, only 790 questionnaires were retrieved which means that there was only 52% retrieval rate.

Survey questionnaire was used to gather the responses of the participants since it is time and cost-efficient, practical, highly objective and had high generalizability of results.

After gathering answered questionnaires from the participants responses were tallied and subjected for statistical treatment of the data for proper analysis and interpretation.

On the classroom observation, the researcher sought for consent of the teachers being observed and they were assured of anonymity and strict confidentiality. All data and information gathered were used for purposes of professional discussions only. Of the three teachers who consented on the observation, only 2 teachers were actually observed because of time constraint.

Statistical Treatment of Data

The data that were gathered from the questionnaire were calculated and analyzed using the following statistical methods.

Descriptive statistics were used to determine the levels of pedagogical content knowledge, ICT competency, occupational stress and mathematical word problem solving performance in fractions of elementary mathematics teachers in Region X.

The Pearson product-moment correlation (Pearson r) was used to establish the relationship of the following variables: pedagogical content knowledge which were measured by knowledge of content, knowledge of teaching strategies and knowledge of the curriculum; ICT competency which were measured by basic computer operations, office and teaching productivity tools, internet and network applications and resources, and information and data management; and occupational stress which were measured in terms of job exhaustion/demands, time pressure management, anxiety, role conflict, and extra load handled towards word problem solving performance in fractions of mathematics teachers

Stepwise multiple linear regression analysis was utilized to ascertain which of the variables best predict teachers' performance in word problem solving of fractions.

Finally, structural equation modelling (SEM) was used to determine the best fit model for the school administrator's performance. In finding the best fit model the following indices were considered: the Comparative Fit Index (CFI), Normed Fit Index (NFI) and the Tucker Lewis Index (TLI) must be greater than or equal to 0.95; RMSEA or the Root Mean Square Error of Approximation must no less than or equal to 0.05; Chi square/degrees of freedom (CMIN/DF) must be less than 2 and a p-value must be greater than 0.05.

4. Summary, Conclusions, and Recommendations

This chapter presents the summary, conclusions and recommendations drawn from the results of the study.

4.1 Summary

This study tried to find the best fitting model from the interrelationship of pedagogical content knowledge, information and communications technology competency, occupational stress and teachers' mathematical word problem solving performance. This study was conducted in the 4 provinces of Region X, namely; Bukidnon, Misamis Oriental, Misamis Occidental and Lanao del Norte which comprised a total of 14 school divisions.

The data gathered were subjected to analysis using appropriate statistical tools. In describing Mathematics teachers' level of pedagogical content knowledge, information and communications technology competency, occupational stress and mathematical word problem solving performance, the mean was used. In determining the relationship between Mathematics teachers' pedagogical content knowledge, information and communications technology competency, occupational stress and their mathematical word problem solving performance, Pearson product-moment correlation was used and test of significance was established at 1% and 5% level. A stepwise multiple-linear regression was used in finding the best predictors of mathematical word problem performance. A structural equation modeling, specifically maximum likelihood method, was used to examine the best fitting model on performance. Indices such as scaled X^2, Goodness of Fit Index (GFI), Normal Fit Index (NFI), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), and Root Mean Square Error and Approximation (RMSEA) were used to examine the model's goodness of fit.

Based on the analyzed and interpreted data, mathematics teachers are highly knowledgeable in terms of pedagogical content knowledge with an overall mean score of 3.67. Teachers rated themselves high in knowledge of the curriculum (3.83), and knowledge of teaching strategies (3.70). They claim they are highly knowledgeable in these aspects. The knowledge of content had a mean score of 3.49 described as fair rating. Teachers are moderately knowledgeable in terms of mathematics content.

In like manner, information and communications technology competency was also regarded as high among mathematics teachers with an overall mean score of 3.56. Out of the four components of ICT competency, 2 described the teachers to be highly competent with. These are basic basic computer operations (3.95) and office and teaching productivity tools (3.57). The other two, namely; internet and network applications (3.2), and information and data management (3.44) described the teachers as moderately competent.

The teachers' occupational stress with an overall mean score of 3.86 and with all components consistently rated high described the teachers to be highly stressed. These stress components are job exhaustion demands (4.10), extra load handled (3.89), anxiety (3.83), role conflict (3.80), and time pressure management (3.68).

Teachers had the following performance in mathematical word problem solving: 122 (15.4%) were outstanding, 105 (13, 29%) were very satisfactory, 400 (50.63%) were satisfactory, 135 (17.09%) were fair, and 28 or 3.54% were poor. Of the three steps in problem solving comprehension and extraction had the highest mean (3.03) followed by construction of equations (2.19) and solving equations (1.73).

Teachers' mathematical word problem solving performance had significant correlation with pedagogical content knowledge with r= 0.274 at (p>0.05). The measured variable of teachers' pedagogical content knowledge which is knowledge of content had significant correlation with r=.406 at p<0.01. The information and communications technology competency with r=0.206 at p<0.01 had significant correlation. The other variables which had significant correlations are internet and network application having r=0.165, at p<0.01, occupational stress with r=0.029 at p<0.05 and extra load handled with r=0.033 at p<0.01.

The mathematical word problem solving performance of teachers were influenced by knowledge of content ß = .265, t (6.136), p<0.01, knowledge of the curriculumß = -0.104, t (2.567), p<0.01, extra load handled ß =-.134, t (-3.385), p<0.05, and anxiety ß = -.088, t (-2.054), p<0.01. The R^2, the measure of total variation of the dependent variables is 6 % which reflects the amount of variance explained by knowledge of content, knowledge of the curriculum, extra load handled, and anxiety. The remaining 94 % of the variance can be attributed to other factor variables not included in the regression model.

The test for goodness-of-fit of Structural Model 5 is found to satisfy all the necessary fit indices. The chi-square (CMIN/DF) test which is 1.671, along with its corresponding p value of 0.60 are within the range to satisfy a good-fit data. In the same manner, NFI=0.992, TLI= 0.993, CFI= 0.997, GFI=0.993, and RMSEA= 0.029 demonstrates acceptable measure enough to fit the data. The teachers' mathematical word problem solving performance is a blend of information and communications technology competency and occupational stress.

4.2 Conclusions

The findings of the study led to the following conclusions

Mathematics teachers demonstrate high pedagogical content knowledge which means that they possess the appropriate content knowledge, teaching practices and curriculum knowledge necessary for successful teaching-learning process.

Their information and communications technology competency is also adequate to make them capable of learning things which they lack expertise of, like, solving unfamiliar problems, availing of appropriate teaching tools and strategies, and in managing other teaching and non-teaching related responsibilities.

Teachers' occupational stress level prove to be high which affected their performance in word problem solving. There is an indication that when occupational stress is reduced then there is corresponding increase in teachers' mathematical word problem solving performance.

In mathematical word problem solving performance, teachers show a satisfactory performance in all phases of problem solving. The MPS also reveal that majority of the teachers has satisfactory and only few are outstanding. This indicates that teachers need to do their homework of equipping themselves with the necessary competence in order to perform better in mathematics and be able to teach the subject more effectively.

Teachers' performance in mathematical word problem solving is significantly correlated with pedagogical content knowledge, ICT competency and occupational stress causing the rejection of the null hypothesis. Enhancing the pedagogical content knowledge, increasing the ICT competency and reducing the occupational stress among teachers will lead to a significant improvement in the performance of teachers in mathematical word problem solving.

In the regression analysis, knowledge of content, knowledge of the curriculum and extra load handled are predictors of teachers' performance in mathematical word problem. This means that these measured variables influence teachers' mathematical word problem solving performance.

Information and communications technology and occupational stress best capture teachers' word problem solving performance. Once issues of competence on office and technology productivity tools, information and data management, internet and network applications and resources, role conflict, anxiety, and extra load handled are addressed, there is an improved performance among Mathematics teachers in word problem solving.

4.3 Recommendations

The following recommendations are drawn from this study:

The Department of Education may ensure that teachers are given intensive content-specific trainings in Mathematics that focus on contextual, and specialized procedural knowledge acquisition so that teachers even those who are out-of-fields will gain mastery and expertise on the mathematics competencies making them better able to teach the subject.

Information and communications technology infrastructure computers and internet connectivity may be in place to give teachers' an avenue to explore what they need to learn with technology and help them with their work without taxing them financially with the cost of internet connectivity. Training may also be provided to teachers and preferably shall not only focus on basic computer operations but also on accessing and creating teaching tools, and on ways to integrate effectively the available technology in the teaching-learning processes.

It is also recommended that schools may hire non-teaching personnel to attend to paper works and other non-teaching related tasks so that these added works to teachers be reduced giving them enough time to prepare them for their teaching tasks, be able to gain full understanding of the competencies they teach to children and be able to enjoy a better quality of life with their families after work hours.

High end trainings on non-routine word problem solving in fractions may be participated by teachers and must be cascaded to teachers without short-cuts. Different ways to solve various problems shall be included and explained to teachers. This will give opportunity for teachers to clarify misconceptions and gain deeper understanding of fractions.

It is also encouraged to lay down concrete and realistic professional development plan for every school that is responsive to the training needs of teachers on content and pedagogy, use of ICT and stress management to improve their performance. Non-teaching personnel may be hired in every school to deload teachers from reports in order for them to concentrate in teaching activities and raise the bar of academic standards.

DepEd may also require textbook writers to include various non-routine problems with step by step solution to the problem in different orientations.

Finally, future researchers are encouraged to conduct related studies focusing on the other factors that impacts word problem solving performance of teachers in the critical content areas of Mathematics.

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