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February 2020

A Mathematical Modelling Task on Measles Outbreak in Senior High School

John E. Cordero
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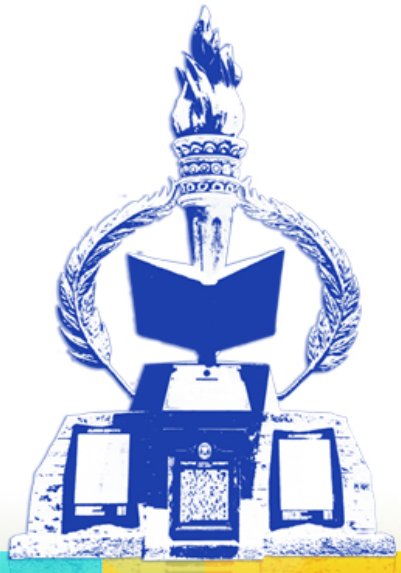

Online Commons Citation

Cordero, J.E. & Conde, R.L. (2020)
A Mathematical Modelling Task on Measles Outbreak in Senior High School
(Special Project, Philippine Normal University)
Retrieved from pnu-onlinecommons.org/omp/index.php/pnu-oc/catalog/book/1363

A Mathematical Modelling Task on Measles Outbreak in Senior High School

A Special Project Presented to
The College of Graduate Studies and
Teacher Education Research

In Partial Fulfillment
Of the Requirements for the Degree of
Master of Education major in Mathematics Education

JOHN E. CORDERO

February 2020

APPROVAL SHEET

This special project entitled "**A MATHEMATICAL MODELLING TASK ON MEASLES OUTBREAK IN SENIOR HIGH SCHOOL**", prepared and submitted by **JOHN E. CORDERO**, in partial fulfillment of the requirements for the degree of **Master of Education major in Mathematics Education**, is hereby recommended for approval and acceptance.

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Approved in partial fulfillment of the requirements for the degree of **Master of Education in Mathematics Education.**

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Officer-in-Charge
Dean, College of Graduate Studies and
Teacher Education Research

DEDICATION

This special project is dedicated to the administration, teaching and non-teaching personnel of Bangkulasi Senior High School, which is the setting of this study that aims of enhancing the mathematical modeling task on measles outbreak in Senior High School.

This work is also dedicated to the researcher's dear father, who is his staunch supporter until its completion; to his beloved mother, who for the past few months had given him encouragement and full attention that made him regain his confidence to accomplish it; and his dear wife Atty. Mary Antoniette C. Calimag –Cordero, who had never failed supporting him until this study was fully finished,

Finally, this work is dedicated to the researcher's to ABM students at Bangkulasi Senior High School who served as respondents in this study.

ACKNOWLEDGMENTS

This special project could not have been accomplished without the help and persistent motivation of concerned individuals who, in one way or another, contributed and unselfishly extended their much–valued assistance in the preparation and completion of this study:

Above anyone else, to our sovereign Maker Jesus Christ, whom the researcher is grateful for his life and blessings;

Dr. Adonis P. David, the Director of Graduate Research Office (GRESO) of Philippine Normal University, Manila, for his patience, understanding, and consideration for the completion of this thesis.;

Dr. Rosie L. Conde, his adviser for generously sharing insights on thesis preparation, organization, and completion;

His wife, Atty. Mary Antoniette Calimag - Cordero, who served as his inspiration to finish his masters' degree;

Dr. Levi E. Elipane, who encouraged and gave him moral support; and

Mr. Carlos M. Oro, Principal II of Bangkulasi Senior High School, for allowing the researcher to conduct this study in his school.

JOHN E. CORDERO

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ABSTRACT

NAME : John E. Cordero

TITLE : A Mathematical Modeling Task on Measles Outbreak in High School Students

KEY CONCEPTS : Mathematical modeling, Mathematical modeling task, Measles outbreak model

DEGREE : Master's in Education

SPECIALIZATION : Mathematics Education

ADVISER : Dr. Rosie L. Conde

As the researcher conduct the study on the Mathematical modeling task on measles outbreak in Senior High School. This study aims to engage students through a mathematical task based on mathematics problem solving approach.

The qualitative research method was used in this study to describe the theory and application of mathematical modeling task on measles outbreak in Senior High School, in the subject General Mathematics, using Microsoft Excel application in order to strengthen their mathematical creativity and critical thinking skills in real life situations. The utilization of technology, such as laptop, smart TV and projector, was so important in conducting the task for it facilitated the students' appreciation and engagement in the said activity. The developed instructional materials integrating mathematical modeling could be used by other mathematics teachers to train the students on mathematical modeling activities

that would apply them in real- life situations. The use of instructional materials on other topics in Mathematics integrating mathematical modeling should be developed, hence, making the classroom conducive for learning wherein students can practically perform mathematical tasks.

CHAPTER I

THE PROBLEM AND LITERATURE REVIEW

Background of the Study

In today's fast changing world, great demands on literacy have made people consider how to be functional and productive not only in local but also in global contexts. These demands have awakened the Filipino senses to aspire more and become better than what the traditional Philippine educational system offers.

To make the system responsive to the changing times, The K to 12 Program covers Kindergarten and 12 years of basic education (six years of primary education, four years of Junior High School, and two years of Senior High School [SHS]) to provide sufficient time for mastery of concepts and skills, develop lifelong learners, and prepare graduates for tertiary education, middle-level skills development, employment, and entrepreneurship.

The extension of the basic education of K- 12 curriculum has total of 12 years, from elementary level spend years of 6 years (Kindergarten to Grade 6), for another level they spend four years to finished the secondary (Grade 7 to 10) and additional two years of Senior High School (Grade 11 to 12).The incoming Grade 7 students of school year 2012-2013 was the first batch to graduate from junior high school in 2016. Those who decided to pursue their studies from thereon finished senior high school in 2018. After finishing junior high school, a student can acquire Certificate of Competency (COC), while the National Certificate (NC) is received by students who finish senior high school in line with Unified Technical Vocational Education and Trading Program Registration and Accreditation System. The Technical Education and Skills

Development Authority (TESDA) is the in-charge agency to promote the technical aspect of the students.

Last school year 2016 -2017, the senior high school was implemented in the Philippines. The students who are enrolled in school year last 2012-2013 for 2nd year, 3rd year and fourth year high school students, they are not included in K-12 program. If they finished fourth year high school, automatically students continue college.

The implementation of SHS under DepEd Order 36, series 2012 relating to Senior High School entitled SHS for research and development guidelines to reconnoiter the SHS Modelling Program. The SHS was fully implemented last 2016-2017, there were 28 model schools are pioneering nationwide for the implementation of Senior High School. Last June 2012, selected models' schools in the Philippines who started SHS for Grade 11 and graduates of the same school year and outside the enrollees.

The SHS Mathematical Modeling task is a classroom strategy that requires innovation and develop their "SHS Mathematical Modelling" is a task and development activity that allows the model schools to try out some designs and strategies in such a way that they will develop the curriculum base on the needs of students for the constraint of local market. They can design their mathematical task and explore and experiment varied teaching –learning strategies suited to their students and learning environment. The inputs and processes to be tried out by these schools will be evaluated and the positive results will be considered in the implementation of SHS Program in School Year 2016-2017.

DepEd asserts that the modelling for SHS is designed to simulate the transition process and provide concrete data for the transition plan. A DepEd primer in the K to 12 programs stressed out

the modelling program could help generate insights on the potential changes in the organizational structures of department as well as other affected agencies like the Commission on Higher Education and TESDA.

One of the challenges of implementation of K to 12, is that there is a difficulty in finding subject in senior high school must be aligned with work or preparation in tertiary education especially in Mathematics.

The Enhanced Basic Education of 2013 or Republic Act No. 10533 expects everyone to embrace the new system. But majority of parents and education are still hesitant about the additional two (2) years in high school. Parents said that the lengthens years of Senior High School years before entering the university. Educators said that SHS is just a replication of general subjects in college. Since these impressions from different sectors have not been founded, a research based SHS implementation is in order to provide insights back up by research data.

According to Houston (2001) that the theory of mathematical modeling is a way of life that everybody will do it and can be applied mathematician as professional. I believe that only few percentages of students become professional mathematician such as scientists or engineers or economists. When they use mathematical modelling as their job. L Now I know that only a very small percentage of students will become professional mathematician, but many more become scientists or engineers, or economists and they make use of mathematical modelling in their work". As we live each day that learning mathematics is a long process, unknowingly, there is mathematics; our daily experiences are expressions of mathematical problems and solutions. Every work entails mathematics, from simple to big task , from simple activities at home like estimation of time travel and cost of expenses, to traffic flow, weather forecasting and nuclear arms race with great impact on all of us, these are just few and all require the application of mathematics skills.

A person should see how mathematics is applied in the real world and observe how it grows from the world around him/her. He should also learn to plan and carry out the collection and organization of data in order to answer questions in everyday life. One should be able to answer questions in his experience and observed the use Mathematics in his every experience to make and/or disprove conjectures and finally draw conclusions. All these things and other competencies like estimation, computation skills, algebraic thinking and geometry should be experienced and learned by everyone to scope with the many changes in the world he /she lives in. According to Arora and Rogeron as stated in the article of Cheng (2001) that the rapid changes of the new technology has a big impact to the classroom setting for the 21st century learners. The availability of computer is an essential need in the classroom for teaching for the expectation of the computational skills of students. This technology is the integral part of the classroom needs that has remarkable impact to the students to support to their computational skills. Cheng (2001) added that mathematical modelling is like having true problems that need a process in order to find mathematical solutions to the problems. Thus, as changing the real-world problems by solving it in mathematical situation.

According to (Ang, 2001) that mathematical modeling is something like a real-life problem that needs a proper solution to everyday basis. In this way, the terms are commonly used to represent, analyze, make predictions, or otherwise provide insight into real world phenomenon, of perceptions in mathematics. Mathematical modeling stresses that the practice of bringing the students into real life situation starts from their everyday life experiences, which can be the foundation of the school development of the new mathematical. However, Blurn and Ferri (20019) stated that the reason why mathematical modeling has a far less permanent role due to the difficulty felt by both students and teachers.

Mathematical Modeling activity also promotes students to be process oriented. Being process oriented has its benefits in the area of motivation. It has been documented that intrinsically motivated, they exhibit task involvement. One-way teachers can encourage the development of involvement is by focusing on concepts rather than on computations (Chua, 2003). These are one of the few skills that are uphold by mathematical modeling. Also, mathematical modeling gives importance to the whole learning process not just in getting the correct answer. It has been strengthened in the classroom by Atienza (2000), where it was found out that the participants strongly and that understanding why the answer works is more important than just getting the answer.

All mathematical activities aim to use the mathematical creativity and the critical thinking of students. The activity breaks away from the traditional way of approaching mathematics for it gives importance to the whole learning and not just simply in getting the correct answer. The fully engagement of the students in mathematical modeling task is important to develop their skills to become creative thinkers. According to Galbraith, P., Renshaw, P., Goos, M., & Geiger, V. (1999). that among the several kinds of creative activity being promoted in contemporary developments, arguably the most empowering for students in mathematical modeling.

The use of model- eliciting activity in problem solving to give a good interpretation to the opportunities flow directly to real life problems in the classroom, improve good representation and good solutions for unexpected interpretation. (Chan, 2008). Mathematics application involves story problem and word problems. Research has found out that the real life problem use in classroom mathematics is important for the developing students in order to enhance skills, expose and explore to the authentic qualitative problem that students encountered (Gkoris , Depaepe, & Verschaffel, 2013).

This study aims to engage students with mathematical tasks based on mathematics problem solving approach. Redefining the problem situations, the mathematical task supports the significant problem to enhance skills in problem solving and creative thinking situation towards problems solution. The study makes it a point to stress out the importance of the learning environment, and its importance in developing the critical thinking and creativity of students. This study focuses on providing students with model-eliciting tasks given in a problem given in a problem-solving approach wherein a given mathematical is characterized. The challenge of this teaching method lies on the cognitive comprehension and creative skills of students, as well as their maturity level and successful activity.

In teaching mathematical modeling task emphasized that, it is important to start from the elementary grades, student will use to solve the real-world situations. So that they will give more time to help and improve their abilities to be more active in the classroom discussion. Also emphasized that Senior High School students' level must be given more attention become more responsible in doing the task, there are a lot of benefits can get if the students can give more effort to do the mathematical task in order to become proficient modelers. Thus, communication skills are important to develop the mathematical understandings to appreciate the mathematical task more deeply and apply it in real life situations.

The elementary teachers simply instruct her/his pupils to do the task for the traditional word problem where the pupils finding the solutions. They believe that to identify the numbers in the problems, they must do some operations. Like example, the conducted story about the elementary level involves telling story, at exactly 9 am in the morning, Mr. Lorenzo drove a car together his colleagues going to Frankfurt for about 360 km kilometers after 30 minutes they rest stop. Teacher ask simply the students, this is just a story, there is no question will be given to the

students responses to the teacher and say “Thank you for the story “. The story is intended for first grade and six graders that combination of number and answer as well. For the second part of the story is for 2nd grader until 6 graders, summary of previous grade level to put together numbers and answer.

There are reversible effects in the students, wherein the critical thinking skills and reasoning skills would practice with real life situations. The mathematical modelling is basic part of elementary level; the first century learners can be more interested and creative in solving real situations. The importance aspect of the students in solving real life problems are finding solutions, making presumptions, and approximations to address the evidences to the problems, or more problems need to be discovered and identified.

The mathematics subject is the core and most focusing subject in the curriculum from Kindergarten to Tertiary education. The Philippines Mathematics Basic Education curriculum had experiences of revising several times over the years. Last 1983, the fully implementation of New Elementary School Curriculum (NESC was fulfilled, to be followed by Secondary Education Development Program or SEDP curriculum last 1983. In 1985, the Department of Education Culture and Sports (DECS) started to review the curriculum now Department of Education (DepEd). lastly, in 2002, the curriculum expert willing to embrace the developed Basic Education Curriculum (RBEC) for the quality education of the Philippines.

The time goes by, the educational system in the Philippines are willing to open changes the curriculum by Department of Education (DepEd). The implementation of K to 12 programs to enhance the basic education, from Kindergarten to grade 12, by adding more two years after completion of Grade 10, which would be 10 years to finish the basic education.

The fastest changes of development in terms of information and technology today have improved the ideas on people for the world of education. The 21st century teachers believe that nurture persons who are capable to solve problem and find solutions effectively in real life situations. In realm of education, they must enjoy mathematics instead don't startled of it; comprehension and understanding are importance to appreciate the power of mathematics.

Measles is the commonly disease in the Philippines. This virus is extremely infectious and rampant throughout the Philippines. This virus disease developed in the early stage of childhood especially during climates changes, seasonal outbreaks, hot season, and dirty surrounding. The disease occurred when you have lack of vitamin and low of immune system in your body. The proper hygiene is important to the person because this is severed communicable disease that causes complication of lower respiratory train and brain, which can cause deaths. In 2018, the world of medicines or scientist finding for a solution and promise to stop and eradicate the disease because this is the most common infectious in the world. Measles is still burdening globally even you are rich or poor. In 2019, the Department of Health closely monitors and imposed the program entitled two-dose vaccination campaign to reach the elimination of measles outbreak in the country.

Vaccination is really needed to prevent the high rates of measles outbreak in the country; Filipinos are at risk of any diseases because of some part of the areas in the Philippines could not reach for medical mission and there is no health center in the barangay, beside there is no medical allocated for measles vaccination. The population of the Philippines has increased every year across rural and urban region. Whereas some of the Filipinos are not aware of modern life. They wanted only the alternative herbal medicines to replace the modern method and other Filipinos immunization is not their top priority especially in the island of Visayas, they just only using herbal medicine to heal the patient for mild disease that they can apply intervention for their children.

Nevertheless, the Filipinos are still resourceful and supple with regards to vaccination outbreak in their respective areas. And there are a lot of logistical factors to be considered in transporting vaccines in the affected areas. They can use Carabao or Horse to transport the medicine, rough road is the common problem in the remote areas, they need more time to travel the medicines to reach the destination. To reduce the long-distance travel, they use vehicles such Habal-Habal or Motor to deliver the vaccine to the affected areas

Thus, education is experiencing changes to continue setting for mathematics education. The development program of education is still growing to support instructions for strategies of teaching and learning program with comprehensive consideration for the student's improvement of critical thinking and problem –solving skills. The application of new strategies and models for the method of teaching is become compulsory to help students to construct knowledge for the dynamic environment and for development of our educational system. To prepare students for knowledge-based workforce that they must be practice in real life situations for keeping capabilities after school.

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Review of Related Literature

This chapter includes all related literature and studies, both foreign and local, about mathematical modeling, its relationship with real life problem. These reviews helped to have a better understanding about the approach, process and importance of mathematical modelling.

What is Mathematical Modelling?

The following are the explanation of many experts about what mathematical is for them.

According to Cheng (2001) that the mathematical modelling is a simplification of task from abstract to complex that would consider finding solutions, converting the real-life situations into mathematical form. Using the new technology, the mathematical task can be used to solve in applying techniques to get a mathematical solution. This answer can be interpreted through behavior of the graph using the application of Microsoft excel.

The K- 12 Curriculum

Education is one of the basic foundations of the Philippines. The quality of education depends on the program given by the Department of Education through the major platform which is the K to 12 curriculums. According to SEOMEO that by extending of additional two years in high school the students can would have a practice skill and ready to work to meet the requirements to the field of work to become world worker for the betterment of their future. Moreover, Senior High School graduates has chance to look up their job after graduation, if they don't want to pursue to College, instead they can apply work for the mean time because there are some companies accepted SHS graduates.

The first batch of Filipino students undergone through Grade 11 will troop to schools in 2016. Many students and parents, though, are still unaware of a few details as regards the new senior high school system. Matters on the country's K-12 program remain unclear. One of them, however, refers to the specific tracks wherein students will choose the best skill for them to master. With the new educational system required by the government, Filipinos have no other choice but to embrace it. In the first place, each one will profit from the new scheme because it follows international standard.

The Mathematics Curriculum Principle

To achieve equity, teachers and schools must assure that mathematics, curriculum is appropriate and meaningful, and this is the Mathematics curriculum principle. Teachers must carefully decide what content, processes, and related classroom experiences would help students grow in their ability to do Math. Teachers must also have a deep understanding of Mathematics in order to assess the quality, coherence, and comprehensiveness of a chosen curriculum. For instance, teachers must know about students' prior experiences and knowledge in order to effectively design a curriculum that continues to build skill and understanding. Teachers must be aware of typical student difficulties and misunderstanding so that they can present content appropriately and avoid misconceptions.

The NCTM highlights three aspects of a comprehensive Mathematics curriculum that can guide teachers' decisions and the planning process. The first two aspects are the actual mathematics content and the mathematical processes that make up the curriculum. The students need to view Mathematics from a broad perspective that demonstrates the interconnectedness of it may branches. A third aspect of a comprehensive curriculum is the balance of conceptual

knowledge and skill development. Students must understand how to use the mathematics they encounter in school and in the world, but they can apply Math better if they have a deeper, conceptual understanding, Current researches suggest that a problem- solving approach to teaching and learning mathematics help students develop both conceptual understanding and skill proficiency (Lester, 1994). A comprehensive curriculum provides opportunities for students to do mathematics and to understand what means to do mathematics. That is, students need to experience mathematics by actively participating in the lesson, though not only doing but also through discussion. Applying Math to real-life experiences enhances learning. The modeling focus of this study shows how a curriculum can provide real-life connections.

Mathematical Modeling

According to Lingefjard (2006) that mathematical modeling is a method of analyzing, observing, assuming, applying, attaining, and interpreting the behavior of the model. Dossey, McCrone and Weir (as cited in Wessels, 2014) also explained that modeling equally a procedure done by application that represent in real life situations with use of calculated time. In the same manner that the students are entailed to apply variety of mathematical concepts and procedures learned in class to analyze, interpret, and solve the given situation through their own created model.

Mathematical modeling entails the 21st learners to emphasize the importance of definition of mathematical theories beyond practice of traditional or note learning. With mathematical modeling, the task should be beginning with real life situations and finding more solutions in previous mathematics as a final judgment back to reality for efficacy and interest of the mathematical modeling for further investigation of the situation.

According to National Council of Teachers says that the application of critical- thinking skills will be determined by the processes or method, this is easy for the teacher to apply their job

and it will more active and participative students in classroom engagement as cited in (Oswalt ,2012).

According to Lesh & Zawojewski (as cited in Chan, 2019) that the most significant goals of mathematical modeling is to support the new directions of problem –solving and with regards to the mathematics education as cited (Chan ,2009). It is also well received in terms of being an innovative way of generating authentic learning and way of thinking (Kang & Noah,2012). This was agreed by Skolverket (as cited in Arleback, 2009) where he stated that the mathematical models are the important aspect of the communication, problem –solving, and the past opinions in the subjects, must be well integrated in all mathematics teaching.

Temurs (2012) also stressed that in order to develop the modeling technique the problem solving must be in place because any procedures begin with a real-life situation. Also, according to Pollak (as cited in Carrejo & Marshall.2007) that the method of modeling defines to characterize the real-life condition with a mathematical development of the students that makes mathematical theories and instrument involves. However, according to Oswalt (2012), a mathematical problem doesn't have to contain real-world applications. Just if the problem engages students to learn and sparks their curiosity, then it is good to be considered as a one.

According to Galbraith, Stillman, & Brown (as cited in Oswalt, 2012), that the implementing the task must integrate properly and useful in the classroom with higher thinking skills that understand the concrete ideas that limit to the development of the students. However, Biembengut & Hein (2013) expressed that mathematical modelling, when used correctly, can change the view about mathematics and treat it as a tool to solve problems and not just a mere transmission of resolution techniques and procedures.

For a successful modeling process, Lesh and Doerr (as cited in Temur, 2012 emphasized these three crucial points:

1) Development of mathematical modeling needs supporting data to understand the situations with the used of clarifications, illustrations, formulation, table to interpret the data and undertaking the investigation. Thus, organizing, sympathetic, and streamlining to support to answer the problem.
2) The concrete details of mathematical modelling are necessary to evaluate the variables in relation to conjecturing, establishing, and investigating the data. Specifically, using a technique and approach in preparing the mathematical model are very significant.
3) The process of interpreting the solution involves proving, reflecting, developing, and applying the solution in the different perspective of the models. The standard system of the building must be in specific requirements to evaluate the solutions. However, in mathematical modelling is not only focused in getting the right answer. According to (English & Fox, 2005) that it is important to recognized and presented the modelling task, learners has capacity to impose and make statement for the appropriate manner. The development of the products the time constraints on the part of the students that might be unnecessary traditions might impose unfortunate constraints on the products they are to develop (English & Fox, 2005) and added that the perspective must he manifested similarly as coordination and unexperienced (Lesh and Doerr as cited in Chan, 2009). In the findings of Atienza (2000), the students believed that it was more important to understand why a mathematical procedure works than just to arrive at the right answer.

Role of Teachers on the Mathematical Task

According to Grootenboer (2009), that the main characteristics of mathematical modelling task consist of the subsequent such as set of task, logical value, classroom engagement, offer for different multiple intelligence ,complete various ideas, avenue for different solutions, and

pathways for various solutions, relation with each other, and realistic situations. Mathematical task is usually in a form of problem-solving question wherein students can able to explain for a certain scenario that established on the given set of data. Students can participate to engage, active, enjoy, informative learning task. It should also allow learners to develop critical thinking skills, creative thinking skills and decision making. depending. These descriptions are befitting the core of mathematical modeling. Oswalt (2012) says that the task of mathematical modelling is involves the critical thinking skills of the students in mathematical aspect, crucial part of the students is unruly that engages students in mathematical thinking, illustrate the prior learning then also recently covered the mathematical ideas with full support with understanding. This idea is shown in the research made by Chan (2008), where a model – eliciting task is one of tool that used for learners to make visible for mathematical thinking. In study, it has been proven that modelling task activities does not that engaging students in mathematical modeling activities is to develop the creative thinkers but does not empowered learners.

In terms of presenting mathematical tasks, Oswalt (2012) advocated that mathematical modeling problems begins with a specific model then eventually develop to the further difficult problems, divert after the simple to a concrete one, there is no definite solution for problem solving questions. Mathematical task can able to involve further activities that lead to difficult questions to the basic model. (Cited in Oswalts ,2012) that the students should know all the basics method of mathematical modelling especially in solving the real-life problems, learners should not be more confidence in solving it. Lastly, any modelling tasks should enable students to provide different varieties of answer based on their own interpretation of the problem.In mathematical modelling used in the classroom discussion, teacher is just facilitator of learning; he/she motivates students to become responsible to come up with technique for presenting the problem in solving it. But not the purpose for giving the right answer instead to assist and facilitate them. But if ineffective and

the students were not able to get the correct answer, the teacher should not spoon-feed the answer since the focus of the mathematical modelling in his study lies how they were able to conceptualize things. In the study of Silver, Mesa, Morris, Star and Benken (2009), it was observed that the teachers used challenging topics of mathematics but not constantly logically to their students. Though the teachers provided their students with manipulation of the new technology for real -life situation, they infrequently provide their learners with interactive task otherwise demonstration of accurate perceptive. Their findings, teachers should apply some of the best practices in teaching, advanced, didactic methods is used analytically to support learner's involvement that would provide task that are cognitively demanding.

Mathematical Modeling in Teaching Mathematics

In Singapore school, the basic objectives in secondary school for their mathematics instruction is that to allow students to develop the critical intellectual methods as essentials to attain the mathematical facts and reasoning skills, thus as their application in real life situation for mathematics teaching. In the article of Cheng (2011) is that the Ministry of Education in Singapore has stated their major focus on Mathematical Problems to design the framework for mathematics program. As their belief that the aim of mathematical modelling in the classroom is to focus on mathematical problems as a topic, as probable to address and apply the program for practical situations and real-life problems.

Cheng (2001) examined possibility in introducing teaching of mathematical modelling in Singapore as well as the benefits of instruction and knowledge and its implications in the mathematical concepts using mathematical modeling approach. In this article, using the examples of illustration and procedure for the mathematical modelling the only basic part of mathematics ideas and notions are obtainable. One of this example lessons was about linear equation and

exponential functions in General Mathematics. He presented it using mathematical modelling activities.

The activities started with situations and real “live “things which are water and sink. Then, he identified the affecting variables through gathering data before deducing the relationship in these variables. The relationship between water and sink was expressed into symbols. He calculated the mathematical symbols using Math concepts of exponential functions and linear equations. to derive the mathematical solution, then interpreted this mathematical solution in the light of real-life situations. These served as the illustration of mathematics education that school mathematics to use in the previous practices in the classroom as the method for mathematical modeling.

Also, in article of Chen (2011), he discussed the concerns that arise about the teaching of mathematical modelling on the classroom as an approach in teaching. All these are considerably important because these are the factors that will affect the learning process and its result. First, the students abilities are required for mathematical modelling and the students for the better position can appreciate the modelled for real life problems in the stronger mathematics background but also the possibility that mathematical modelling can offer better conducive learning situations in a real life or problems to the regular students. Hence, these students should not be deprived by the chance to learn through mathematical modelling.

The mathematical problems can be divided into simpler activities that inspire students for investigation and argumentation. Tasks can be divided and assigned into groups to make used of constructivist approach. Second, as facilitator of the learning process, are teachers ready to make use of mathematical modelling approach? Teachers are responsible to introduce the mathematical modelling in the classroom and need to look back for the ideas in their mathematics lesson. These materials are not accessible for the students as normal learning materials. Frequently, in teaching

mathematical modelling in the classroom, one of the problems is the shortage of learning materials and funds to assist students in the learning process. Teachers had better to combine the problem centered set for educational resources. When preparing the subject matters the teachers need to find a lot of suitable resources and proper learning materials for the lesson. The task is to find the difficulties that can be improved depending on the level of mathematical capacity and ability of the students. Books of resources explained by Burghes, Galbraith, Price and Sherlock (1996).

Separately from resources, both understanding and modelling skills are involved for the fundamentals of teaching methods successfully. An expert mathematician applied the real-world practices to one another. It is not easy to the part of teachers, provided that the similar is needed for the best practices. But both teachers and students working together as likely for learning process. Otherwise, teachers should attend trainings and seminars for additional knowledge and experiences.

There are a lot of brilliant platform for mathematical modeling that provided for educations and researches of interdisciplinary environments. There are complications from other disciplines that may provide the collaboration with both teachers of mathematics and other teachers. With the present importance on interdisciplinary task, curriculum is the significant factors for mathematical modelling.

According to (Giorgano, 1997) that the program recommended for Mathematical Association of Americas Committee on the undergraduate is that students should have chances to accept the “real – life world” in mathematical modelling developments, both independent plans for internship industry and operation research course. This additional statement that a modelling practice would remain involved in the subjects especially in major of mathematical sciences. Additionally, this modelling skills should begin as early as possible, to initiate the modelling skills for students’ job and support the demonstration in the entire period of the study. Also, according

to Giordano et al (1997)," as soon as possible, it is important to involve learners in the process of mathematical task, begin with simple plans, helps their advanced growth and self-confidence in mathematical modelling.

Issues in Mathematical Modelling

In the recent situation, the studies of modelling approaches in the classroom teaching on a worldwide rule and their impact to emphasized on the learning process in mathematics was presented in the international research communities according to Galbraith ,Henn, & Niss, Matos , Blum, Houston, & Carreira as cited in Carrejo & Marshall,2007). Formative arguments for mathematical modelling are now raised because of the curriculum inclusion have been categorized in the following categories, which motivates students to develop the wide-ranging competences and develop good attitudes such as nurturing, investigating, and encourage to solve real -life problem situation to maintain the ability to become open-minded person and increase self-confidence , critical thinking skills , which emphasizes that in mathematics society to make sure that students can be mindful the probable misappropriation ,value dissimilarity , the use of mathematics should be emphases , aim of promoting mathematics learning is to provide the students with the complete picture of mathematics as part of discipline of values and society, mathematical concept of modeling influence the students learning (Blum & Niss as cited in Arleback, 2009).

Though the strategy has a very good potential in improving the academic performance of students, various research and studies proved otherwise. According to a study by Yoon and Thompson (as cited in Chan,2009), p.39), the modeling has been claimed to be uncompromising, trying to fit and complete the traditional method in solving the real-life problem situation. In a

study made by Arleback (2009), stated that working toward the overall attitudes for the illustration of mathematical modelling either the test items were undesirable or not.

Studies about Mathematical Modeling

There are many researches that involved mathematical modelling, some of the foreign studies that involved mathematical modeling activities are stated below.

Pavel (2007) conducted a study on mathematical modeling using technology in elementary school there are two basic purposes in this study, first, mathematical modelling problem shall be observed the procedure on learners worked in mathematics, then second to explore student's relations with the use of Potter's Wheel. This is revolution through solid generating computer software. Each group will be given 40 minutes per meetings on soft drinks bottle for the task. The students are necessary to perform and pattern task for the competition called soft drink bottle.

In the study of Potter's Wheel -Assisted is used to provide the supporting data that learners can able to develop mathematical concepts and construct the required procedure to dynamically involved, solve the rea life problem and mathematical modelling must be completed and expressive. The mathematical development of the students included the construction of models for identifying appropriate bottles, finding and relating variant and invariant measures such as volume and surface giving the material prior instruction in software use. According to Greg (2002) that conducted a collaborative, research-based mathematical modeling laboratory experiment which included a laboratory module for bioprocessing engineering. He was teaching the subject as part of a biotechnology interdisciplinary programmed. The class was split into six groups of three students with the goal of researching a new infiltration mechanism that is currently at the forefront of research international attention. Different aspects of the issue were allocated to each group, and

intergroup contact was required via email to ensure a consistent set of goals for each group and for the class. Berkeley Madonna, the software package, has been used for all calculations. In addition to giving the students an introduction to mathematical modeling and computer programming, this approach has helped to highlight the importance of work in bioprocess engineering. In addition, the project was well embraced by the students, and the discovery of new insights contributed to a degree of excitement. Nonetheless, many students were spent by computer programming's technological demands, and need a complete attention. And they did not think too much about the physical aspects of the system they modelled.

Mathematical modelling covers a wide area of application. The medical world uses the mathematical modelling in resolving conflicts predicting possible results. The next study is an application of mathematical modelling in medical world. Mathematical modelling of cellular processes by Dr. Jana Wolf. Complex diseases are often shown to be characterized by the accumulation of numerous disturbances in rather large and complex cellular networks. Simple logic can hardly examine the effects of these perturbations, such as mutations or over-expression of proteins. Thus, mathematical modeling leads to a deeper understanding of regulatory systems and thus provides a better basis for analyzing high-by-placing data and defining successful targets for drugs.

The research developed and evaluated mathematical models of signaling pathways and gene-regulatory networks in regular and disease-related systems. Tools, such simulations, bifurcation analyses and sensitivity analyses, helped in the investigation processes. These activities gave insights into the dynamical properties of the system.

These are the following characteristics of mathematical modelling:

1. **Realism of models.** we need a numerical demonstrate to be as reasonable as conceivable and to speak to reality as closely as conceivable.
2. **Hierarchy of models**. Numerical modeling isn't a one-shot issue. Models are continuously being developed in order to make them practical. So, we get a hierarchy of models for every case, each more practical than the preceding one and their compliance with observations.
3. **Relative exactness of the models.** Distinctive models change in their exactness and their understanding with perceptions.
4. **Models may contribute to anticipated or erratic figures, or indeed to drivel.** Ordinarily models provide forecasts anticipate on common sense contemplations, but the demonstrate expectations are more quantitative in nature. Some of the time they provide unforeseen expectations and after that they may lead to breakthroughs or profound considering approximately presumptions.
5. **Sticking to one model may prevent insight.** A model helps thinking, but it can also direct thinking in one narrow channel only. Sometimes insight is obtained by breaking with traditional models and designing entirely new ones with new concepts.
6. **Partial modeling for subsystems.** Before making a model for the whole system, it may be convenient to make partial models for subsystems, test their validity and then integrate these partial models into a complete model.
7. **Estimation of Parameters**. Every model contains some parameters, and these have to be estimated. The model itself suggests experiments or observations and the method of

calculation of these observations and the method of calculation of these parameters. Without this explicit specification, the model is incomplete.

8. **Validation by independent data**. Parameters are in some cases calculated with the help of a few prove and the same information is utilized for approving the show. That's illegal. The show ought to be checked with free information.
9. **New models to simply existing complicated models.** We start with simple models, introduce more variables, extra capacities to create the models extra commonsense, more complex and with extra experiences. Complex models ought to be streamlined once more.
10. **Transferability of mathematical model**. A mathematical model for one field may be equally valid for another field but greater care must be exercised in this process. A model which is transfer to several fields is very useful, but no model should be thrust on a field unless, it is applicable there.
11. **Forecast – Validation of iteration**. A scientific show models comes about that are at that point related with perceptions. Ordinarily, there's a few distinctions. To annihilate this vulnerability, we refine the demonstrate, figure once more and look for to approve once more and proceed this prepare until a appropriate show is accomplished.
12. **Models for strategies and tactical thinking**. Models may be constructed for determining guidelines for situations or they may be for determining an overall strategy applicable to a variety of situations.
13. **Constraints of additively and normality**. Models that are linear, additive and in which the distribution of probabilities follows the normal law are relatively simpler, but from these constraints comparatively more practical models must be.

14. **Mathematical modeling and mathematical techniques emphasis in the applied mathematics has very often been on mathematical techniques, but the heart of applied mathematics is mathematical modeling.**

In this study, the research and findings obtained are presented with the respect to the success skills of SHS students in the mathematical modelling task using the stated methods and techniques. Students can easily get the ideas and thought about mathematical modelling when connected to their real-life situation. Consequently, it was found that 25 students took the formative exam, got 65% whereas the summative test score got 80%. In the conducted study, mathematical modeling. It was defined as result, modeling and formula. When considering the answers given to this question by the participants, it can be stated that they have not been able to fully express the definition of mathematical modeling as defined by Berry and Houston (1995) and Moscardini (1989). Mathematical modeling was described in the last discussion with the participants as ' the method of solving daily life problems, ' ' model creation, ' and ' guessing. ' They articulated the concept of mathematical modeling as applicable to the description of "mathematical modeling" expression contained in the literature and discussion. The impacts on the part of the student is that they can able to expand to the problem through giving ideas about the behavior of mathematical modelling during the task. When choosing among models or judging the adequacy of a model, we may find it tempting to rely on the value of the best-fit criterion being used. For the example, it is tempting to choose the model that has the smallest sum of squared deviations for the given data set or conclude that a sum of squared deviations less than a predetermined value indicates a good fit. However, in isolation their indicators may be very misleading for example, consider the data. If the model y =x results in the same deviation. Without the benefits of the graphs. Therefore, we might conclude that in each case the model fits the data

about the same. However, there is a significant variation in each model's ability to capture the trend of the data. A powerful technique for quickly determine where the model is breaking down is to plot the deviations as a function of the independent variable.

Synthesis

The following studies showed the aim and effects of incorporating mathematical modelling into the classroom set-up, the status of the students ' problem-solving skills, and the mathematical challenge. Similarities and variations are noted in the synthesis of the related studies.

The present study is like the research of Oswalt (2012), where the integration of modelling activities was also the focus of the study, However, the goal of the said research is on creating professional development such as trainings and workshops. Helping high school teachers incorporate mathematical modeling in their classroom, which is separate from the purpose of this study. In terms of the students being used as study participants, Chan (2009) was able to do it. His research aimed to integrate modelling as part of the teaching and learning of mathematics, which is also the objective of the present study. He believed that students should be more involved in the whole teaching –learning process and that through modelling, it enabled students to understand the lesson more that than traditional methods of teaching.

The present study referred to some examples indicated in the study of Unida (2011) though it differed in terms of its use in the classroom set- up. In Unida's study modules in mathematical modelling were created to be given to each student while in the present study, mathematical task/activities are integrated within the lesson proper of the class.

In terms of relating mathematical modelling with student's problems solving performance, the present study shares the same purpose with the research made by Temur (2012). The study

revealed that after the exposure of the prospective teachers to mathematical modelling, the concept of problem solving was becoming more similar.

Based from review of literature, mathematical modelling is an approach useful to prepare students to be productive in real life especially outside the school. It is the reason why mathematical modelling is a core course in educational community in some other foreign countries. As stated by Cheng (2001) in his paper, there is no need to revamp the curriculum, but we need to reconsider our approach to the teaching of certain subjects in mathematic. In the present study, the developed instructional materials integrating mathematical modelling activities is just in time with the problem-based approach recommended by Cheng (2001) as a useful approach to learn math concepts through real- life problems.

Research Problems

This research is generally intended to evaluate the mathematical modeling function for measles outbreak in senior high school students that focuses on real life situation. This research has specifically sought to answer the following questions:

1. What is the content of mathematical modeling task?
2. What are the advantages of using mathematical modelling in solving real life situation?
3. What are the difficulties and constraints on the conduct of the Mathematical Modelling activity?

Conceptual Framework

This study is focused on mathematical modeling based on the translation model of Lesh et al. (in Suh, 2007), which notes that students make more meaningful connections while viewing mathematical ideas in multiple modes such as deceptive, images, real-life contexts, verbal symbols and written symbols. This model underlines that translation among different modes of representation makes concepts meaningful to students. Mathematical modeling, apart from the above model, stems from two theories of learning: social construction and metacognition (Bahmaei,2011; Wethal,2011, Oswalt,2012). Perceptively in a Vygoskians, it claims that the learning of an individual is affected by the classroom or the outside world in combination with previous knowledge of the learners (Cobb, as quoted in Wetbal,2011). According to the National Research Council (1999), All new learning includes passing knowledge from previous learning. Although practice is an essential step in establishing successful processes across the brain, direct instruction alone does not typically lead to profound learning. Nevertheless, as students are engaged in problem-solving, such as problems involving mathematical modelling, they have opportunities to link through mathematical areas as well as learning about applications outside the mathematics classroom (National Council of Teachers of Mathematics,2009). This approach positions learning by engagement rather than knowledge-acquisition alone. Participation in these classroom activities is the social context for the mathematical development of students (Bowers & Cobb, as stated in Wetball, 2011).

One of the natures of mathematical modeling is the freedom of letting students formulate their own definition or explanation to a certain formula. During group discussion, mathematical modeling promotes interaction and collaboration between members. When it comes to model-eliciting tasks, these should build on students' previous knowledge and encourage the formation of new ideas and concepts (Breen & O'Shea, 2010).

The structure of grouping activities is a matter to consider in order to fully integrating the concept of mathematical modeling to students, English (in Temur 2011, Oswalt 2012). Stressed that when mathematical. Problems are structured for small group tasks; the process will be simpler if group rules are given age during problem-solving. She also added that the group works with components such as planning, observation, configuration and the use of modeling problems, which give students opportunities that could contribute to the existing experience of the individual in mathematical thinking. In Cohens study (as cited in Wethall, 2011), it was stated that learning task rather than learning to apply the rules, conceptual reasoning should be required.

It was stated that learning task conceptual reasoning rather than learning to apply the rules should be required. One important learning principle that mathematical modeling upholds is John Flavell's Principle of Metacognition, which refers to one person's ability to think about one's own thought, Temur (2011) strongly emphasized that when students are aware of their own or peers ' thinking processes or methods, understanding and modeling will be simpler for them while solving problems. It was also proven in a study of Kramarski & Mevarch (2005) where it showed that students who underwent metacognitive training outperformed others in terms of mathematical reasoning and metacognitive knowledge. Also, cooperative learning combined with metacognitive training was proven to be more effective than individualized learning combined with metacognitive learning.

To succeed in this group activity, each group member should work collectively, manifest an open-minded nature and develop a sense of ownership of the problem. This is evident in the results of Francisco & Maher (2005), where the students gained ownership of the mathematics cycle and the product of the expertise they built together. Taking the different learning hypotheses found in mathematical modeling into account, this research attempted to evaluate the effects of

incorporating mathematical modeling into problem-solving success task on Measles Outbreak using exponential function of Senior High School Students.

Figure 1, shown below is a simplified view of the process of mathematical modeling.

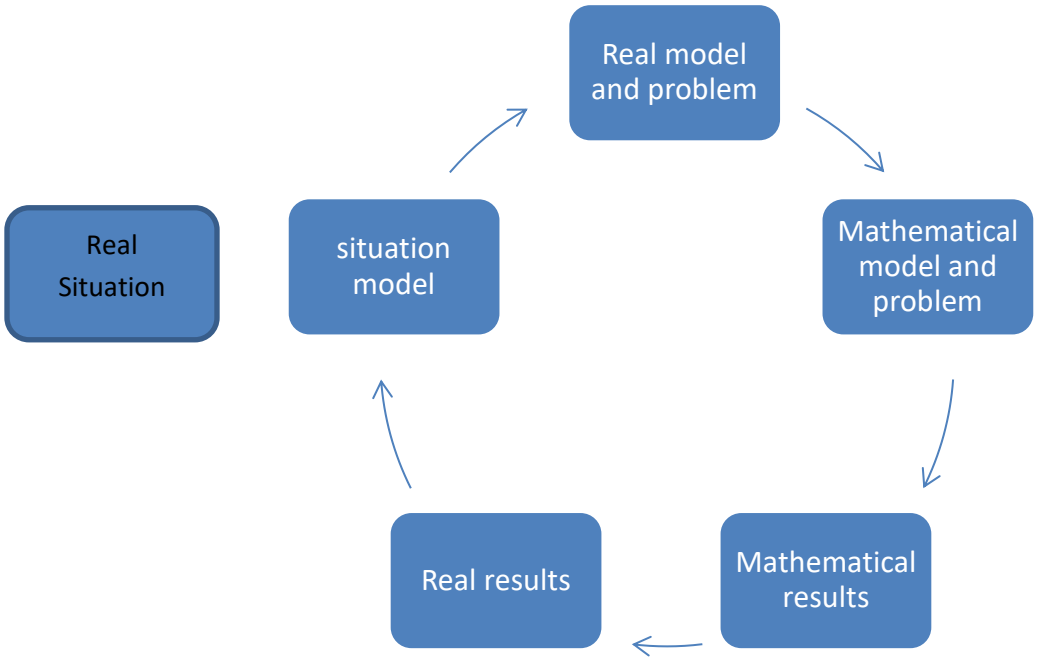


Figure 1. *Simplified Mathematical Modeling Process*

The starting point in mathematical modelling is a real-world problem situation. According to Oswalt (2012), a modeling problem usually uses "real world" application but it is not necessarily having to be so. She also added that if the problem can spark student's interest and curiosity, it can be considered as a modeling problem. Zbiek and Conner (2006) added that modeling problems should not be so narrow that student would already know the answer it should also start from a basic riddle then would progress into a more challenging one as the session progresses (Oswalt, 2012) from the real world data expressed by the modeling problem, the task of the students is to deliberate among their peers how they will form a mathematical model that would serve as their foundation in producing mathematical results. The mathematical results will then be used as a

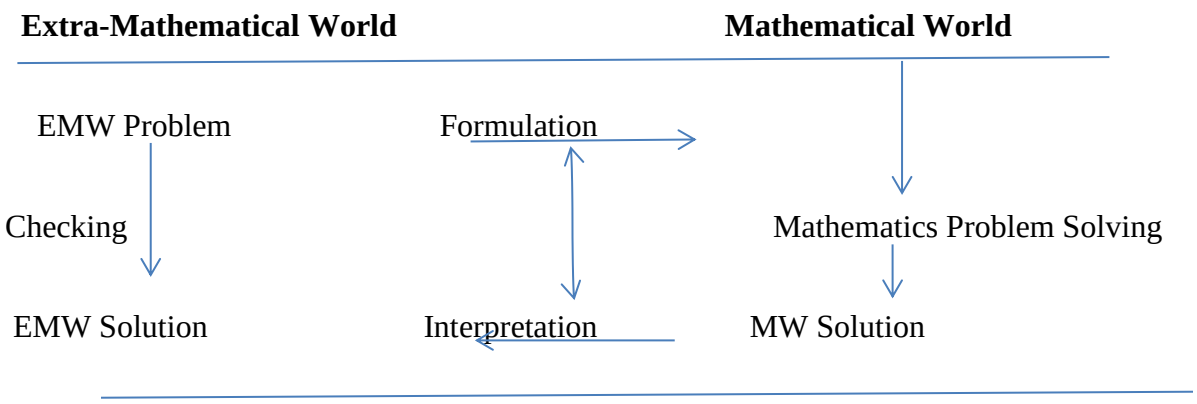
reference for predictions or conclusions that would answer the given modeling problem. A mathematical model, according to Biembengut and Hein (2013), can be formulated using numerical expressions or formulas, diagrams, graphs or geometric expression, algebraic equations, table, etc. As interpretive stages take place within the modeling process, students are given several mathematical definitions within each modeling stage and at times, according To Mooney and Swift (as cited in Oswalt, 2012, students may reinterpret the model until they arrive at a valid solution.

In this study, the focus is how students, through collaboration and group participation, can device their own mathematical model. This is in line with Cheng (2001) who stated that in mathematical modelling, the emphasis is in solving a problem rather than finding an answer that must exist. She added that there are times when the problems are not solved, or the answers are mere approximations to the "exact answer" or are beyond reach.

Mathematical modelling and problem solving have their own distinct characteristics. In problem solving the nature of the problems presented is closed with a given fixed value while in mathematical modelling, it is open ended in nature. Moreover, Mathematics use in problem solving and mathematical modeling will remain an important part of the curriculum as it will always be useful (Cheng, 2011). Though the two strategies have differences, they are related with each other. According to a study made a Parker and Bedford(2001), although the technique required when solving the problem lies within a student's repertoire of mathematical tools , they are still unable to convert the contextual problem into a mathematical representation. Those shortcomings can be complemented by engaging students into mathematical tasks where they will be exposed and trained to construct their own model interpreting situations presented to them in a word problem format. Through the integration of mathematical modelling, students will be able to set up their own model to develop a mathematical problem which until now they have a hard time doing. These

two may have differences, but they are related with each other. To put it simply, problem solving can be considered as the heart of mathematics learning, whereas mathematics modelling in the classroom in mathematics in action (Unida, 2011).

The study integrates mathematical modelling presented in problem solving format, (2001) ascertained that when teaching mathematics through mathematical modelling, it is inevitable to conclude that problem solving is related to it. Figure 2. shows the relationship of problem solving with mathematical model and how it is being integrated in the process of mathematical modelling.



The modeling begins with an issue in the extra-mathematical world (EMW). When we speak of extra-mathematical world, it pertains to real life situations and not just situations that have numbers on it. It usually has no numerical data and is open ended in nature.

Modelling happens when students formulate the EMW problem in mathematical terms. The mathematics problem can be solved by the application of different mathematical concepts and solutions processes. From an EMW, students will find ways on how to relate it or explain it in

mathematical way. Thus, forming a model. When students begin to mathematize the phenomena, it now becomes a mathematics problem solving (MPS) task that needs to be analyzed and computed, then based on the results, students may now interpret and relate it with the EMW and to verify it, apply it to EMW if it works. If it still doesn't work out, students may edit and analyze the data more, Mooney A Swift (as cited in Oswalts ,2012) stated that the answer must be interpreted, and the procedure may need to be repeated before a satisfactory solution is obtained.

Mathematical modelling in this study happens when students are able to relate the extra mathematical world (EMW) to the mathematical world (MW) by producing mathematical results that would explain or answer the given real world problem.

Mathematical Models

Logical modeling is the craftsmanship of deciphering issues from the subject of utility into doable logical definitions, the theoretical and numerical evaluation of which gives bits of information, courses of action and course of action that are important for the preliminary application. Models are conceptual forms utilized to develop, portray, clarify, and/or anticipate the behavior of complex frameworks (English, 2008). Numerical models contrast from other categories of models basically since they center on the auxiliary characteristics of the frameworks they depict (Lesh & Harel, 2003). They are supported by quantitative forms (such as checking, measuring, calculating, graphing, gathering, extrapolating), although they may moreover incorporate subjective strategies (such as depicting and clarifying). Scientific modeling is the method of creating, assessing, adjusting, and applying numerical models. Mathematical displaying is additionally a vital portion of learning in subjects supported by arithmetic, counting all STEM (science, innovation, designing, and science) subjects. Concurring to English (2008), "an appreciation and understanding of the world as comprising interlocked complex frameworks is

basic for all citizens in making viable choices approximately their lives as both people and as community individuals." She proceeds, "Modelling isn't fair restricted to arithmetic and science, be that as it may. Other disciplines counting financial matters, data frameworks, back, medication, and the expressions have too contributed in expansive portion to the capable numerical models we have input for managing with a extend of complex frameworks. Scientific demonstrating gives learning openings that energize ideal advancement of STEM-related abilities. It isn't fair reaching the objective that's vital, but too the elucidation of the objective, the data given, and the conceivable steps to arrangement (English, 2008). Demonstrating permits understudies to create valuable aptitudes such as deciphering, considering, communicating, defending, reexamining, refining, and expanding that can be connected more by and large (Doyle, 2006; English, 2008).

Models depict our convictions approximately how the world capacities. In numerical modeling, we decipher those convictions into the dialect of mathematics. These are the advantages:

1. Arithmetic could be an exceptionally exact dialect. This makes a difference us to define thoughts and distinguish basic presumptions.
2. Mathematics may be a brief dialect, with well-defined rules for controls.
3. All the comes about that mathematicians have demonstrated over hundreds of a long time are at our transfer.
4. Calculations can be rendered using computers.

The Mathematical Modeling Process

The process of mathematical modelling is a loop that starts with a problem (usually grounded in reality) that involves a model to define, illustrate, or predict a system or process

behavior's United States Common Core State Mathematics Standards (CCSSI, 2010) defines six actions required to complete a modeling assignment, as described below**.**

1. **Identifying the factors.** These are the components or highlights pertinent to the circumstance to be demonstrated (English, 2008; Stillman, Brown, & Geiger, 2015). Inquire about and information collection may be fundamental. As a framework can incorporate numerous factors, defining a show can be complex. Decreasing the number of factors by making certain suspicions can rearrange the circumstance without diminishing from the convenience of the demonstrate in clarifying or anticipating the genuine world
2. **Formulate the variable model.** Easier issues can be investigated, and information can be spoken to in other shapes to distinguish relations and designs that can be refined, amplified, generalized, and disconnected back to the initial issue. The generalized circumstance is mathematized into a useable shape, for case, a condition or chart. If mathematical innovation is utilized to help in these forms, the demonstrate may be within the shape of a computer program.
3. **Performing operations utilizing the demonstrate.** This ordinarily requires calculations and/or computer reenactments to deliver numerical yields.
4. **Interpretation of the outcomes.** The comes about created by the demonstrate are related back to the first context. Validating the scientific show: This is often vital since the demonstrating prepare may be a trade-off between effortlessness and exactness. The challenge is to discover a show where the real-world circumstance is disentangled utilizing suspicions that expel complexity, but which in any case yields comes about that surmised reality. Models can be approved by comparing their yields with known values. The effect of any presumption can be tried by analyzing the impact of shifting those suspicions; in a

perfect world, changes to the suspicions make small distinction to the yields. On the off chance that the demonstrate does not surrender reasonable comes about, at that point it is vital to refine the show by looking into and adjusting the factors utilized and presumptions made when initially creating the show; thus, the reference to the displaying cycle.

5. **Conclusions.**

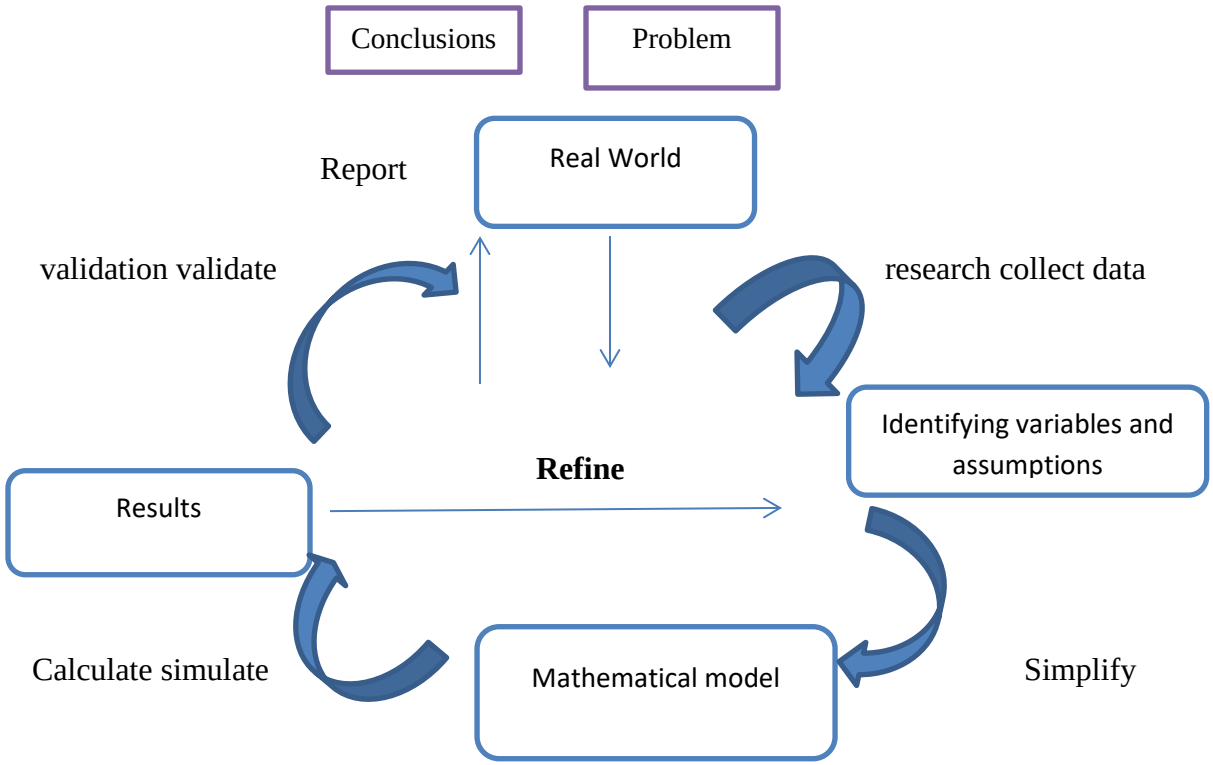


Figure 2. *Mathematical Cycle*

Mathematical modelling using Technology

Mathematical innovation, such as calculators (logical, design, and computer variable based math framework, spreadsheets, and computer-based graphing computer program, has the potential to improve the nature of systematic demonstrating errands that can be utilized within the senior high school classroom, depending on how the teacher chooses to use the innovation. Several

creators have investigated students utilize of innovation, particularly in arithmetic. Galbraith, Renshaw, Goos, and Geiger (1999) recognized four parts for methodical innovation:

a) **Technology as a controller**, in which movement is either restricted to those operations over which the understudy has specialized competence or comes about in accepting acknowledgment of the yield produced, independent of its exactness;
b) **Technology as a helper**, in which the innovation is utilized as a dependable time-saving substitution for repetitive manual computations;
c) **Technology as a partner**, in which the innovation gets to be "a companion to go investigating with, instead of just a maker of results" and where the student gets it that the method is more than fair looking for a required result; and
d) **Technology as extension of self,** in which the innovation gets to be a basic portion of the student's toolkit, at the side scientific information, mental forms and on-paper abilities. The utilize of numerical innovation ought to be respected as an aptitude to bolster higher arrange considering. Both paper box assignments can be improved through the fitting utilize of innovation. They both require the starting collection of information to be recorded in a table and shown as a diffuse plot—a perfect application for spreadsheet or graphing computer program. On the off chance that students are copying on-paper strategies utilizing innovation, maybe with a bigger information set, at that point it is likely that the innovation is being utilized as a worker to do the schedule, time devouring errands. How the students' advance past this organize depends on the instructor and the provoking questions they utilize to coordinate students' modeling exercises. Provoking questions are basic in case the students are to reorganize the assignment and utilize the innovation in ways that empower investigation of the errand past the apparent era of a required response. Usually

the substance of numerical demonstrating. Without appropriate questions (e.g., “What can you see from the graph?”, “What do you think the relationship is?”, “What else do you wish to know?”), there's no necessity to produce a demonstration. In this setting the utilize of innovation complements the method of numerical demonstrating. It gives the devices required disentangling the advancement of a demonstrate (worker part) and the implies to investigate, grow, and refine the show (accomplice and extension-of-self parts). One thing to be maintained a strategic distance from is the ‘black-box’ utilize of innovation (Buchberger, 1989), such as employing a program device to fit a bend to a information set without any understanding of the fundamental relapse prepare. This can be frequently the case when the scientific innovation is respected to an conclusion. Students are given a scripted button-pushing formula or a endorsed set of spreadsheet commands that might create a reasonable demonstrate but will not include to their understanding. Students ought to continuously have a common thought of what the technology is doing, indeed on the off chance that they do not get it the detail of the basic calculation. Small or no understanding of the underlying forms may lead to blunders, especially in selecting the leading scientific show and translating the results of the demonstration.

Differentiation

One advantage of scientific demonstrating as a learning involvement is that understudies can lock in with a displaying errand at a level fitting to their scientific improvement. A few understudies may not be able to advance past collecting information and appearing connections between factors explicitly. Be that as it may, a chart may be enough for them to get comes about and make expectations. Other understudies who are more competent may be able to speak to the show arithmetically and investigate choices for adjusting, generalizing, and applying the

demonstrate, illustrating a more modern understanding of the significant scientific relations. For case, the classic box assignment may be amplified by (a) adjusting the demonstrate to oblige distinctive paper sizes (since the assignment is at first confined to a sheet of paper of a settled measure), and (b) the real-world applications of the demonstrate. Instructors ought to have pre-prepared prompts to amplify and enhance a scientific demonstrating assignment to a level suitable for each understudy.

Scope and Limitations

The study covered application of lesson using mathematical modelling task on measles outbreak using exponential functions on SHS students.

The study limited for senior high school topic of real life problems; linear function and exponential functions with the aid of instructional materials and initial evaluation of Grade 11 Mathematics Curriculum of SHS Modelling Program in terms of goals, substance, guidelines materials directions, prepare appraisal strategy, classroom administration, execution, and regulatory provision. It was conducted involving 25 students from Bangkulasi Senior High School of Grade 11 students' School Year 2018-2019.

Definitions of Terms

The following terms, which are widely used for the purpose of the study, are defined both conceptually and operationally.

Instructional materials - refers to the steps of Mathematical modeling that will be used in the presentation of selected topics in General Mathematics.

Mathematical model - uses mathematical language to describe a system. Mathematical models are utilized not as it were in characteristic sciences and building disciplines such as material science, biology, earth science, meteorology and electrical designing but it is additionally utilized within the social sciences such as financial matters, brain research, human science and political science. Eykhoff (1974) expressed that a numerical demonstrate may be a representation of the basic angles of an existing framework or a framework to be developed which presents information of that framework in usable shape. In this study, math model is the mathematical symbols representing the real-life situation.

Mathematical modeling - refers to a handle of speaking to genuine world issues in scientific terms to discover arrangements to the issues. A scientific demonstrate can be considered as disentanglement or deliberation of a (complex) genuine world issue or circumstance into a scientific shape, subsequently changing over the genuine world issue (Ang Keng Cheng, 2001). In this study, mathematical modeling is the steps of presenting math concept in relation with real life problems.

Problem Solving - is what you do when you do not know what to (Kutz in Villaflor, 1998). Solving a problem means finding a way out of a difficulty, a way out of trouble, a way around of deterrent, accomplishing a point which isn't instantly achievable. It is the accomplishment of insights and insights is the blessing to mankind; it can be regarded as the foremost characteristically human action (Polya in Villaflor, 1998). In conclusion, Problem solving could be a portion of daily life, some of the time making uneasiness disappointments and difficult work in their arrangement but too being a sound of unwinding, fulfillment and mental incitement.

CHAPTER II

PROCEDURES

Qualitative Design and Methodology

This study utilized the senior high school students under the Accountancy Business Management (ABM) strand, enrolled in Business Math, Entrepreneurship, General Math and Statistic and Probability, took part as participants in the study. This study hopes a better understanding and appreciates the mathematical modelling task on measles outbreak in Senior High School. The objective of this inquire about is to explore what scientific demonstrating and developing models contribute to the development of straight relapse substance. This includes making a directions plan and investigate as to how this underpins understudies in their move from their biases to formal scientific thinking. Given these contemplations, the chosen strategy for this ponder is subjective investigate since it compares to family of strategy approaches in which the guidelines plan and investigate is forbid (Cobb & Gravemeijer, 2008). This sort of inquire about comprises in three stage cycles: plan the instructing try and examination (Gravemeijer & Cobb,213).

Glass and Hopkins (1984) define descriptive method research as a method that involves collection of data in order to answer questions concerning the current statue of the subject of study.

Descriptive method of research has three primary purposes which are to portray, clarify and approve portrayal discoveries. Graphic rises taking after imaginative investigation and serves to organize the discoveries in arrange to fit them with clarifications and after that test or approve those clarification (Krathwohl,1993).

Research Site

The research site in this study is Bangkulasi Senior High School in Navotas City, which is an urbanized city of Metro Manila. The city of Navotas is a first-class city that involves a limit strip of arrive along the eastern shores of Manila Bay. Navotas is specifically north of Manila, west of Malabon City, and south of Obando, Bulacan. The city has received awards of good seal governance and Good seal for Good Education.

Named as the "Fish Capital of the Philippines," Navotas is considered to be a really critical angling community, with 70% of its common people inferring job specifically or in a roundabout way from angling and its related businesses, such as angle exchanging, angle net patching, and angle creating, having minimal rate of inter-island angle makers. Navotas involves a shoreline at the west side of Manila Inlet, which could be a vital coastal front, appropriate for all sorts of vessels.

Navotas may be a portion of the casual sub region of Metro Manila called CAMANAVA. This sub region, aside from Navotas, incorporates the cities of Caloocan, Malabon and Valenzuela. Navotas is seen to be inclined to surge particularly amid the blustery season and amid high tide, but the national and local governments are attempting to ease the problem. Pollution and overpopulation are other issues that the government is attempting to unravel. Navotas is celebrated for fish sauce and shrimp glue (patis and bagoong in Tagalog). Navotas celebrates its establishment day each January 16 and it got to be a city after a plebiscite was held on June 24, 2007.

Selection Criteria and Participants

After obtaining the necessary papers to conduct the study, the gathering of pertinent data ensued personality done by the researcher. Each school head, teacher, and student who served as respondents were asked to fill out the questionnaire.

To avoid possible problems in interpreting teachers' behavior listed in TBI, the researcher personally administered the questionnaire to the students –respondents in the schools. The researcher had to translate the statements into the vernacular for better comprehension.

Data Collection

For the purposes of this investigation, in profundity interviews were utilized. In profundity interviews comprise of individual and unstructured questions, which point to distinguish participant's feelings, sentiments, and suppositions with respect to a inquire about subject. The most advantage of personal interviews is that, there's individual and coordinate contact between questioners and interviewees, as well as kill non-response rates, but questioners got to have created the fundamental aptitudes to effectively carry an meet (Fisher, 2005, Wilson, 2003).Further, unstructured interviews offer adaptability in terms of the stream of the meet, subsequently clearing out room for the era of conclusions that were not at first implied to be determined with respect to a inquire about subject. Be that as it may, there's the chance that the meet may go astray from the per-specified inquire about points and goals (Gill & Johnson, 2002). As distant as information collection devices are concerned, the conduct of the investigate included the utilize of semi-structured survey, which was utilized as an meet direct for the analyst. A few certain questions were arranged, so as for the analyst to direct the meet towards the fulfillment of investigate destinations, but extra questions were made experienced amid the interviews.

Role of Researcher

Concurring to Carrejo & Marshall (2007) in arrange to assist understudies, get learning objectives, teachers must be able to form and reinforce joins between more organize, unique scientific concepts and genuine world circumstances where science plays more connected rule. To be able to conserve consistency with the content and strategies, the researcher acted as the teacher with the presence of observers and researchers during the conduct of the class using Lesson Study approach.

In mathematical modelling, the teachers should only set as facilitator in the whole learning process. During the process, Trainers must be seen that when utilizing scientific displaying the understudies ought to not quickly know how to unravel the issue (Oswalt,2012). Various methods and strategies in questioning and scaffolding could be implemented to lead the students to the right path. This is supported by Chan (2009) where he elaborated that the mathematical modelling is eliciting task that. would give the setting for the student's collaboration, the instructor ought to work as a facilitative coach to supply framework at certain, junctures of the modeling handle. Understudies ought to endeavor a assignment some time recently the educator intercedes or makes a difference (Breen & O'Shea, 2010) It suggests that teachers should refrain themselves in providing their students with too much assistance.

In a classroom where numerical modeling is utilized, the educator would ought to set up that understudies are mindful for coming up with strategies for tackling the issues displayed which the educator will help and encourage but not give answers. But if ineffective and the students were not able to get the correct answer, the teacher should not spoon-feed the answer since the focus of the mathematical modeling in this study lies on how they were able to conceptualize things. In this study, as observed by Silver, Mesa, Morris, Star and Benken (2001), the teachers used extend of

arithmetic subjects that are not “consistently learned people “challenging. Through the instructors given their understudies with hands –on works out or real-world settings and advancement, they occasionally deliver their understudies with naturally assignments or appear of numerical considering. Their discoveries recommend that indeed on the off chance that instructors connected a few of the most excellent practices in instructing. Imaginative academic approaches were not efficiently utilized in ways that upheld student’s engagement that would bolster errands that are cognitively requesting.

Methods of Validation

The study is a “basic research”, which utilized qualitative inquire about strategies. Fundamental investigate is carried out to set up a hypothesis or show in a field of ponder, to reinforce or contribute to existing ones, or to test a hypothesis. Basic research thinks about are aiming to form information and hypothetical understanding about fundamental human forms and other normal forms. Within consideration, auxiliary school and high school arithmetic instructive programs created by MNE have been checked on and hypothetical structure of the scientific modeling approach is displayed with illustrations.

Mathematical modeling and Instructional Approaches, according to Boaler, J. (2001). He added that Mathematical modelling theory focuses on the interaction between people and real world that would create a good result for developing knowledge. This situation requires students to explore the technology with diverse homes in school. For this reason, it gets to be imperative to display understudies with circumstances in which they utilize the information and have application openings. Numerical displaying is characterized as the change of any issue circumstance into a numerical demonstration. Be that as it may, this concept begun to be utilized commonly to characterize the method counting all the steps of organizing mathematizing, scientific working and

interpretation/verification. Sometimes the issue circumstance that's given is nothing else than a pre-structured mathematical issue or a scientific issue that's full of genuine life. This is often the classic "word issue" circumstance that by and large happens in schools. Utilizing arithmetic to fathom issues that are experienced in genuine life is called as application of arithmetic. Some of the time the application concept is utilized for a relation that ties genuine life to science. Within the final ten a long time "application and modeling" concepts were utilized to clarify any relations between genuine life and arithmetic.

Hence, the mathematical modelling is one of approaches to develop application and discover the model relations of real-world situation. The aim of mathematical modelling is to enable the students to establish their basic skills in solving real life problem.

Ethical Considerations

The current thought was subjected to certain moral issues. Because it was specified prior, all members detailed their composed acceptance regarding their cooperation within the investigation, marked by the parents' assent and authorization letter from school. The point of both letters was to console members that their cooperation within the inquire about is deliberate which they were free to pull back from it at any point and for any reason. Another to this, members were completely educated with respect to the goals of the ponder, whereas they were consoled that their answers were treated as secret and utilized as it were for scholastic purposes and as it were for the purposes of the specific investigate. The members were not manhandled, both physically and mentally, amid the conduction of the inquire about. In differentiate, the analyst endeavored to form and keep up a climate of consolation.

CHAPTER 3

FINDINGS AND DISCUSSION

On the content of the Mathematical Modelling task

The researcher developed the mathematical modelling task using Microsoft Excel in General Mathematical particularly exponential function. This helped students develop their mathematical skills in solving real-life problems. Students should have a prior knowledge about Microsoft excel experience in answering the problem. In order to understand the task, the researcher discussed thoroughly the process in solving mathematical modelling task by giving three (3) examples of real-life situation. The researcher explained the steps very well the behavior or trend line of the graph using the Microsoft excel. The researcher selected twenty-five (25) students of Grade 11 from Bangkulasi Senior High School. This group was divided into five (5) smaller groups, which consist of has five (5) members each. After the groupings, the researcher presented the mathematical modelling problem to the students through three (3) minutes video about Mathematical modelling task on Measles Outbreak.

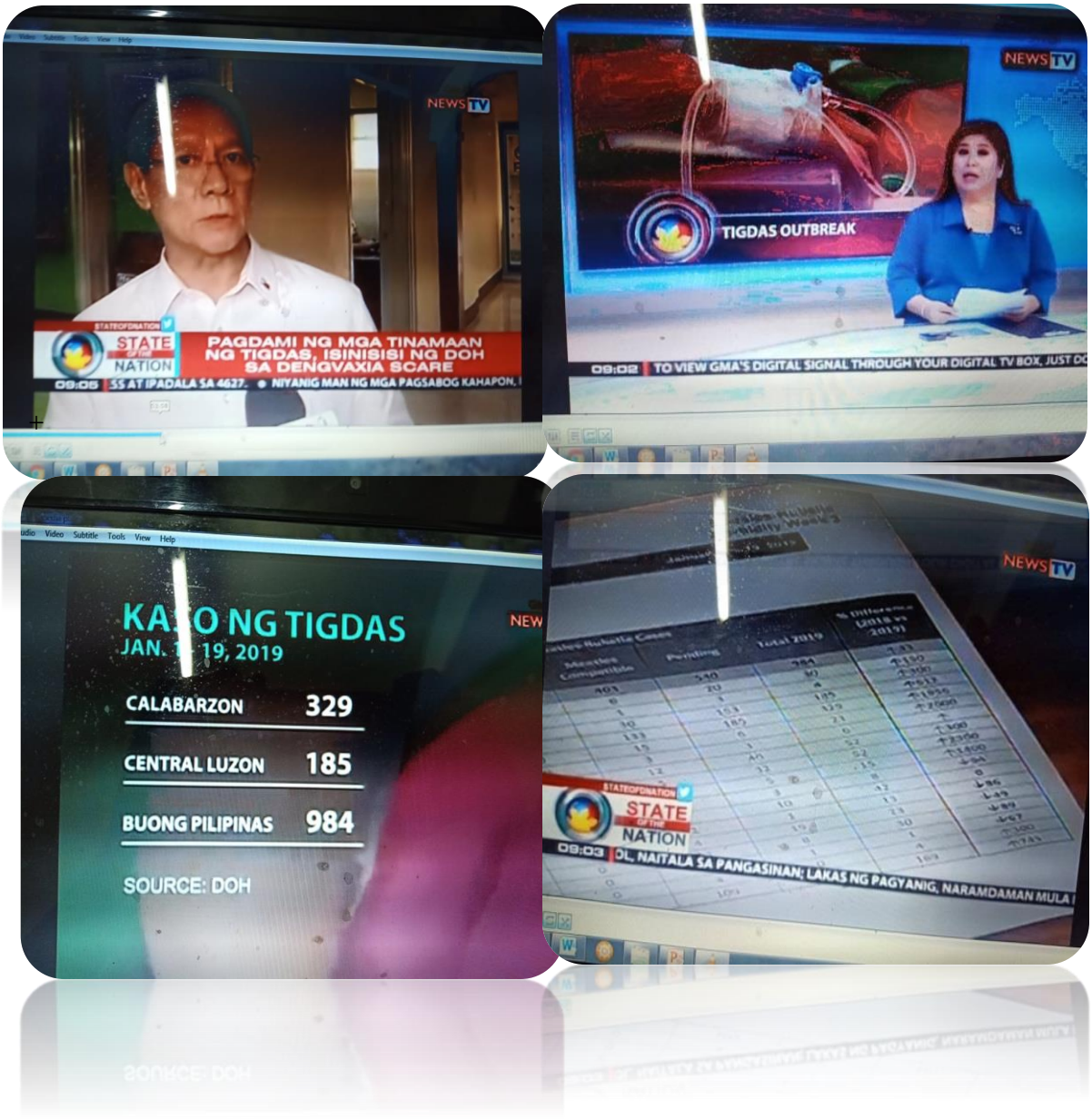


Figure 3. *Print screen of the video shown before the task.*

Below are the group tasks on Mathematical Modelling:

1. Let the students watch the video about Measles Outbreak in 2019, then discuss and construct the scatter plot using regression analysis, polynomial and exponential function in the class.

T	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
X	30	4	185	120	21	6	52	52	15	8	42	13	23	30	1	4	160

2. The table below shows the time spent studying in hours (x) of six grade 11 students and their scores on a test (y). Solve

a. Find the equation of the exponential function.

b. Draw the graph of the model on the scatter plot.

X	1	2	3	4	5	6
Y	5	10	15	15	25	35

3. Listed below are heights in cm and weights in kilograms of eight teachers.

a. find the equation of the linear function

b. Draw the graph of the model on the scatter plot

X	4	2	8	10	12	14	6	16
Y	10	5	25	10	15	20	5	10

The process of performing the mathematical modelling task on measles outbreak in Senior High School students using exponential function was guided by the following ways. First, the video will play using the Smart TV. Second, after watching the video each group will be given twenty (20) minutes to complete the task. Third, each group was required to have a laptop for the activity. Fourth, the group simply identified the variables based on the video presented and input the data using Microsoft Excel. The group created a table for the data and highlighted it using the Microsoft excel data solver and analysis. The exponential equation or formula and graph will display on the screen, and then used it the model of exponential equation preparing for the task.

The Mathematical model task the variable K is multiply by the variables XY, SS and e value of the data. After going through the process, the highlight of the data is the behavior of the graph by connecting the dots and the group will explain the trend line of the scatter plot. Moreover, graph behaviors changes will depend on the data. The trend line graph will move horizontally and vertically. Therefore, the group will conclude the better data that will fits for the exponential function. Learning is initiated by a problem, problems are based on real situation, solve the problem using Microsoft excel, all information required for problem solving is not given initially, and use appropriate resource .The task was then validated by selected Mathematics teachers, who

are graduate school students of the College of Graduate Studies and Teacher Education Research (CGSTER), Philippine Normal University, enrolled in the subject Theories of Learning Mathematics during the Term 3 of SY 2018-2019.

Figure 4. *Photographs showing students working collaboratively with their respective groups participating in the task.*

On the advantages of using Mathematical Modelling

As a learning tool, one of the advantages of mathematical modelling is that students can engage with a modelling task at a level appropriate to their mathematical development. Some may not be able to progress beyond collecting data and showing relationships between variables graphically. Hence, a graph may be enough for them to obtain results and make predictions. Others, who are more capable, may be able to represent the model algebraically and explore options for modifying, generalizing, and applying the model, thus, demonstrating a more sophisticated understanding of the relevant mathematical relations.

It is believed that the mathematical modelling has so many advantages; models exactly represent the real –life problem situation, mathematical modelling help the students to take decision faster and more accurately because they can explore the trend line of the graph, the students can typically offer convenience and cost advantages over the means of obtaining the required information on reality because they will not use the manila paper but instead will use smart TV by presenting their report output, complex problem can be easy to solve by using the data analysis and data solver in Microsoft excel and they can express through the trend line of the graph that fits the data.

Mathematical technology usage, such as calculators and computers (i.e. scientific, graphics, and computer algebra system, spreadsheets, and computer-based graphing software), has the potential to enhance the nature of mathematical modelling tasks that can be used in a SHS classroom but this depends on how the teacher utilizes such technology. The task is intended for students to be exposed to modern technology, especially in the General Mathematics. Accordingly, Galbrath Renshaw, Goos and Geiger (1999) identified four roles for mathematical technology, to wit: (a) technology as master, wherein activity is either limited to those operations over which the

student has technical competence or results in uncritical acceptance of the output generated, irrespective of its accuracy; (b) technology as servant, as such, technology is used as a reliable time-saving replacement for tedious manual computations; (c) technology as partner, where technology becomes "a friend to go exploring with, rather than merely a producer of results" (p. 225) and where the student understands that the process is more than just seeking a required result; and lastly, (d) technology as extension of self, where technology becomes an essential part of the student's tool-kit, alongside mathematical knowledge, mental processes and on-paper skills. The use of mathematical technology should be regarded as a skill to support higher order thinking.

Appropriate use of technology can enhance Mathematical modelling tasks because such tasks require data initially collected to be recorded on a table and displayed as a scatter plot which is an ideal application of spreadsheet or graphing software. When students are duplicating on-paper methods using technology, perhaps with a larger data set, it is likely that technology is being used as a servant to do the routine, time consuming tasks.

According to Schmint & Loyens (2007), mathematical modelling tasks have clear connection to reality. It provides an engaging, kinesthetic approach to learning mathematics. It boosts student creativity and independence but also shows that mathematics is a body of interconnected knowledge rather than a series of discrete topics. It also encourages students to use technology in various roles (servant, partner, and extension of self). It prepares students for ideas that they will encounter in senior mathematics and develops the skills of modelling needed for success in senior mathematics courses.

According to David C. Webb (2007), mathematical modelling is used to promote student engagement. This is in direct contrast to a physical model which could be a construction of a human skeletal system or a cube made out of clay and straws. The purpose of mathematical models

is to help students develop mathematics from a problem context from which they both can make sense of the situation and mathematics at the same time. Informal ideas and representations are developed which eventually lift them into patterns and attempts to generalize the situation to describe what they are seeing. Further, mathematical modelling gives students a sense of what it means to do mathematics.

Mathematical models are openly mentioned in the Algebra Standard of Principles and Standards for School Mathematic as provided by NCTM (1989). Middle school and high school students are expected to learn to use mathematical models to represent and understand quantitative relationships and to develop skills such as: modelling and solving contextualized problems using various representation such as graphs, tables and equations, identifying essential quantitative relationships in a situation and determining the class or classes of functions that might model the relationship, using symbolic expressions which include iterative and recursive forms and representing relationships arising from various contexts. Students draw reasonable conclusions about a situation being modeled (pp. 222 and 297).

According to Coursehero.com, these are advantages of mathematical modelling task:

1. Models can accurately represent reality. If properly formulated, a model can be extremely accurate. A valid model is one that is accurate and correctly represents the problem or system under investigation.
2. Models can help a decision maker formulate problems. In the profit model, for example, a decision maker can determine the important factors or contributors to revenues and expenses, such as sales, returns, selling expenses, production costs, transportation costs, and so on.

3. Models can give us insight and information. For example, using the profit model from the preceding section, we can see what impact changes in revenues and expenses will have on profits. As discussed in the previous section, studying the impact of changes in a model, such as a profit model, is called sensitivity analysis.
4. Models can spare time and cash in choice making and issue understanding. It ordinarily takes less time, exertion, and cost to analyze a show. We are able utilize a benefit show to analyze the effect of a modern showcasing campaign on benefits, incomes, and costs. In most cases, utilizing models is quicker and less costly than really attempting a promoting campaign in a genuine trade setting and watching the comes about.
5. A show may be the as it were way to fathom a few expansive or complex issues in a opportune mold. An expansive company, for case, may create thousands of sizes of nuts, jolts, and clasp. The company may need to form the most elevated benefits conceivable given its fabricating imperatives. A scientific show may be the as it were way to decide the most elevated benefits the company can accomplish beneath these circumstances.
6. A demonstrate can be utilized to communicate issues and arrangements to others. A choice investigator can share his or her work with other choice investigators. Arrangements to a scientific demonstrate can be given to the understudies to assist them make last choices.

On the difficulties and constraints of Mathematical Modelling

The researcher observed that the difficulties and constraints of mathematical modelling during the task was the absence of laptop, the activity was difficult to be completed correctly, the students should have the pre-requisite skills to do the task such as computer skills in Microsoft excel, and exponential functions and some function are already present. They should have already

skills in Math modeling, teamwork, time management and communication are needed; most importantly they should have access of the video.

Difficulties can also arise when students form a mathematical model directly from their problem-text model without developing a problem situation model. Although proficient problem solves may not need to form such a model (at least form problems), less proficient solvers tend to avoid reading problem texts and try to solve word problems by attending solely to the numbers in the problems (Bell et al. 1984,1989; Mulligang 1993). In this case, they would have an incorrect or incomplete problem –text model and hence would likely generate an erroneous mathematical model, such as dividing when an operand is less than one (De Corte et al.,1988).

There has been increasing emphasis over the last decade on the importance of fostering students on higher position considering abilities in all regions of the educational programs (Beyer, 1987 et al.) As Fenneman and Peterson (1985) noted, higher place considering abilities empower a person to memorize more arithmetic, to apply science to other disciplines and to illuminate arithmetic issues all through life.

Students often have anxiety in considering elective focuses of see or in managing with a few sources of data at once (Costa & Lowery,1989), Being Flexible in one's thinking is particularly important in problem solving. By changing their point of view, or by examining a problem from more than one perspective, students can avoid the tunnel vision syndrome and are less likely to get "bogged down" in solving a problem. Flexible thinking is also a necessary component of creative thinking. This includes applying novel and original ideas to the solution of a problem, as well as generating several different solutions to an open-ended problem (English,1986,1990b, 1990c).

Being able to identify, analyze, describe and generalize pattern is fundamental to mathematical problem solving and to mathematics learning in general. As with deduction, it is difficult to imagine a world without patterns. Relating designs in numbers, geometry, and

estimation makes a difference child get it associations among numerical subjects. These associations cultivate the sort of numerical considering that serves as an establishment for more unique numerical thoughts (National Council of Teachers of Mathematics, 1989).

Greeno (1992) maintained that several important features of mathematical or scientific thinking are evident in student's ability to participate in mathematical or scientific discourse. Such discourse involves ways of formulating conjectures, claims, and counterclaims, and ways of supporting conclusions. Learning to participate in the discourse of a discipline is considered a major aspect of learning in that discipline (Pea & Greeno). Students can be involved in conversations where they offer their understanding of a question or idea, discuss each other's views and identify the assumptions that underlie alternative opinions and work to resolve conflicts opinion.

Developing a classroom "community of inquiry" (Sharp,1987; Splitter ,1988) can foster the development of mathematical communication. Here, students identify, discover, and invent questions and problem and in so doing, engage in self-corrective inquiry through explicit metacognitive behavior. Engaging in higher order thinking with other a help student realize that they have "the ability, the permission, and even obligation "to be critical in their thinking, to not always accept a given problem formulation, and to challenge accepted position (Resnick ,1987b. 41.). The dialogue or connected talking among students and the teacher can become the primary tool for constructing mathematical and scientific ideas through opinions (Splitter, 1988p.45).

As a result of instruction, many students develop erroneous beliefs about the nature of mathematics that can have a strong negative effect on their mathematical behavior (Schoenfeld, 1987). A commonly held view is that ordinary students cannot expect to understand mathematics and must therefore resort to memorization techniques and mechanized procedures in solving mathematics problems (Lampert,1990). Mathematics is perceived as a closed subject. I where there

is only one right answer and only one way of getting it, and divergent thinking is unnecessary (Carpenter, Linquist, Mathews, & Silver,1983 et. al). Belief about one's self also have a significant impact on student's mathematical performance These beliefs are related to the metacognitive components of self-regulation and self-awareness that addressed earlier. Results from the National Assessment data (Dossey, Mullis Linquist, & Chambers,1988) revealed decline student's levels of confidence in mathematics as they progress through school. Schoenfeld (1992). Famous that numerous writings contain "problem –solving segments in which understudies are given penetrate and hone exercises on basic forms of the procedures they were instructed. When methodologies are instructed in this way, they are now not heuristics in Polya's sense, that's, they ended up unimportant calculations. As we stressed at the beginning of this chapter, problem solving involves grappling with a novel's situation in the absence of an expert solution strategy drilled procedures and simply apply these to a given problem, they no longer engage in the mathematical thinking that novel situations encourage.

Students need to acquire a repertoire of general heuristics and should know not only how to apply them appropriately but also when to apply them. The research of Novick and Francis (1993) has highlighted the difficulties problem solvers experience in discriminating situations for which various representations, such as a matrix or a tree diagram, would be most appropriate, applying heuristic can help students represent the explicit relations in a problem and subsequently recognize the implied relationships. Students need to appreciate how an appropriately used heuristics can help them refine their mental model of a problem.

CHAPTER 4

SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter presents the summary, conclusions, and recommendations of the study,

Summary of the study

The descriptive – developmental research used for this study. Researcher developed the task materials on some, selected topic in General Mathematics presented in real-life situations and solved it using the mathematics concepts. This task on materials hopes to help the students to solve real-life problems using mathematical modelling activities.

Specifically, this study did the following:

1. Developed task on selected topics in General Mathematics integrating mathematical modelling.
2. Validated the content of the task materials.
3. Tried – out the developed instructional material on mathematical modelling task materials.

Based from the review of literature, mathematical modelling task is an approach useful to prepare students to be productive in real life especially outside the school. It is for this reason why mathematical modelling is a core course in educational community in some other foreign countries.

In the review of literature, one of the concerns arising from the use of mathematical modelling in teaching mathematics is the lack of ready to use books or materials. Correspondingly, the developed instruction materials integrating mathematical modelling directly address this concern.

In arithmetic classroom is still centered on a part of drills and hone on the strategies of understanding numerical issues. Whereas these may be critical abilities to give on the science understudy, the require for schedule manual calculations may reduce with time. Besides, with the nearness of high speed, high execution, and computers the accentuation in calculations may not be such drudgery. After all, mathematics is more than close to math, it is around issue of understanding. And so, learning general mathematics would go beyond deeply into real life situations.

Summary of Findings

These are the finding of the study:

Mathematics experts rate the mathematical modelling task it was good enough because the task went through by validation.

1. The students were able to do the task effectively with it comes to the use of technology and learners are very active and cooperative. The students can relate the real-life situation problem.
2. Some of the students were not able to submit their output on time because of difficulty of understanding of the problem and due to the absence of the laptop. They need pre-requisite skills for Microsoft excel, lack of time management, lack of communication and lack of confidence in reporting the output.
3. The students perceived the material as organize and useful in applying math concepts in real life situation with the use of laptop for reference activity in learning math concepts.

Limitations

The study covered application of lesson on Mathematical Modelling task on Measles Outbreak in Senior High Students approached on exponential functions to General Mathematics for Grade 11 level.

The study is limited in teaching the following lessons with some has specific title of real-life problem for exponential and linear functions. Because "mathematical models" covers such a wide range of techniques, the only known limits on their use in the physical and biological sciences are the limits on present technology, the limits given by physical laws, limits given by complexity and finally the limits of computation. Within the social sciences, the limits are given by the need of adequately exact speculations as well as information, so the limits are set by the rules of measurements.

Summary and Conclusion

This research investigated an implementation of a researcher made mathematical modeling task on Measles Outbreak in Bangkulasi Senior High School.

1. The researcher therefore concludes that the students must have proper training in computer literacy so that they are able to perform the task properly. The use of computer laboratory is a proper venue for mathematical modelling activity so that students can participate in the activity in order to develop their critical thinking skills. Therefore, emphasize the importance of mathematical modelling in real life situation.
2. The researcher therefore concludes that the engagements of the students are very important in mathematical modelling task. The use of projector is suitable in the performance of the

mathematical modelling task. It is easy to graph the trendline when they have proper knowledge and memorize the procedure when they are doing the mathematical task.

3. The researcher therefore concludes that mathematical modelling task should be discussed thoroughly and to give additional examples in order for them to perform the given task.

Recommendations

Based on the findings of this study, the following are hereby recommended:

1. The teacher should use computer laboratory for classroom discussion so that students can use computer for the given task.
2. Classroom should have graphical board suited for mathematical modelling to be used during class discussions.
3. Students should have pre-requisite knowledge of Microsoft excel, so that they can perform the task in solving the real –life situation problems.
4. The classroom should be conducive for learning and well –ventilated environment.
5. The teacher should develop the materials to integrate mathematical modelling for the Mathematics curriculum for grade 11 students.
6. The developed instructional materials integrating mathematical modelling could be used by mathematics teachers to train the students on mathematical modelling activities and to expose them in the use of mathematics theory in real- life situations.
7. Instructional materials on other topics in mathematics integrating mathematical modelling should be developed.
8. A descriptive study should be conducted to determine the effect of mathematical modelling task on measles outbreak using exponential function in Senior High Students.

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Appendices

Teacher's Profile

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DATE OF BIRTH: AUGUST 5,1976

PLACE OF BIRTH : HIMAMAYLAN, NEGROS OCCIDENTAL

EDUCATION

PHILIPPINE NORMAL UNIVESRSITY, MANILA
M.A – MATHEMATICS EDUCATION **2019-2020**

ST. MARY'S COLLEGE, TAGUM CITY
BSED- MAJOR IN MATHEMATICS **1997-1998**

MABANTAO NATIONAL HGH SCHOOL
MABANTAO, KAPALONG, DAVAO DEL NORTE **1993-1994**

WORKING EXPERIENCE

BANGKULASI SENIOR HIGH SCHOOL **2017- Present**
TEACHER II-STATISTIC & RESEARCH

ST. JAMES ACADEMY OF MALABON **2016-2017**
TEACHER – STATISTICS & MATH 8

DATAMEX COLLEGE OF ST. ADELAINE **2015-2016**
COLLEGE INSTRUCTOR

SAUDI WATERPROOFING COMPANY **2007-2013**
SALES SUPERVISOR /PURCHASE COORDINATOR

TRAINING & SEMINARS ATTENDED

:

- **Brainery – Integrating Tech Tools in Teaching Mathematics**
  December 9,2019 at American Center, Manila

- **School Based In- Service Training for Teachers (INSET)**
  October 23,2019, BSHS, Navotas City

- **2019 MTAP – DepEd – NCR Annual Convention and Seminar Workshop**
  Sept. 28-29,2019 at Araullo High School, City of Manila

- **Seminars –Workshop for the School Facilities Coordinators**
  August 1-2,2019- SDO Navotas

- **Seminar on The Basics of Asset Management**

  Jan. 10-11,2019 -St. Agatha and Country Club, Inc. Guiguinto, Bulacan

- **School Improvement Planning (SIP) Process Retooling and School Monitoring & Evaluation and Plan Adjustment Seminar**

  December 11,2018, SDO Navotas

- **Regional Training on Senior High School Competency – Based Learning**
  September 18-22,2018, Great Eastern Hotel, Quezon City

- **1st SIMP -AAG -STEMHUB Multidisciplinary Research Festival**
  August 18,2018, UST Angelicum College, Quezon City, Philippines

- **Mass Training of Senior High School (SHS) Teachers on Academic and Technical – Vocational Track for STEM Mathematics**
  January 18-Feb. 4,2018, Atrium Hotel, Pasay City

- **Mass Training of Teachers and Career Advocates for the Implementation of Grade 12 Career Guidance Program**

  April 25-26,2018, San Rafael Vocational School, Navotas City

- **SHS Mass Training Workshop on Common General Topics**

  July 8, 2017 –Eurotel Hotel, Quezon City

- **2016 Training for Senior High School (SHS) Teachers in Private Schools**

  April 21-23, 2016, De La Salle University, Lipa, Batangas