

Difficulties in teaching senior high school General Mathematics: Basis for training design

Craig N. Refugio*, College of Education, Graduate School, Math Department & College of Engineering & Architecture, Negros Oriental State University, Dumaguete City 6200, Philippines. <https://orcid.org/0000-0003-1374-6103>

Maria Ilona Elsa A. Bulado, Mathematics Department & Graduate School, Negros Oriental State University, Dumaguete City 6200, Philippines.

Patrick G. Galleto, College of Education & Graduate School, Jose Rizal Memorial State University, Dapitan City 7101, Zamboanga del Norte, Philippines. <https://orcid.org/0000-0001-7534-6581>

Charles Y. Dimalig, Siquijor Province Schools Division, Siquijor 6225, Philippines.

Dundee G. Colina, College of Arts & Sciences, Foundation University, Dumaguete City 6200, Philippines. Email:

Hermie V. Inoferio, College of Education, Jose Rizal Memorial State University, Katipunan Campus, Katipunan 7109, Zamboanga del Norte, Philippines.

Mary Lou R. Nocete, Mathematics Department, Negros Oriental State University, Dumaguete City 6200, Philippines.

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Abstract

The study investigated the difficulties encountered by Grade 11 teachers in teaching Senior High School General Mathematics, the reasons for the problems, and the strategies employed by teachers in overcoming the challenges with an end view of developing training design. The sequential explanatory mixed methods design was used in the study with the aid of a questionnaire checklist and an interview to validate the answers generated by the questionnaires. The study revealed that the challenges in teaching emerged due to time constraints and mastery issues of contents. Though teachers were pedagogically and technologically equipped to teach the course, however, some have poor time management and link to peers to share the best strategies to cope with the problems. Hence, training, as well as seminars and workshops for the unmastered competencies/contents and the competencies with no strategies applied to deal with the difficulties in teaching, are to be provided to Grade 11 General Mathematics teachers by implementing the training design developed by the researchers.

Keywords: Difficulties, reasons, strategies, training design

* ADDRESS FOR CORRESPONDENCE: Craig N. Refugio , Associate Professor 5, College of Education, Graduate School, Math Department & College of Engineering & Architecture, Negros Oriental State University, Dumaguete City 6200, Philippines

E-mail address: craig.refugio@gmail.com

1. Introduction

The implementation of the K-12 program in the Philippine Basic Education Curriculum is one of the major reforms and is considered the key to the nation's development. Though the government faces many problems as it implements the program for several years, it is a necessary improvement since increasing the quality of education is critical to a nation's success. It has been seven years since the Philippines shifted to a new basic education system. But this reform program, which added two more years to the old basic education system, has since its planning stage met with so much public opposition. Today, critics continue to insist that the country is not yet prepared for the transition. Many problems and difficulties have been faced by school administrators and teachers in the different learning areas across grade levels, specifically in the areas of Mathematics and Science. Thus, being Mathematics teachers, the researchers looked into the problems and difficulties in Mathematics education, specifically the General Mathematics in the senior high school curriculum.

Interestingly, Mathematics education researchers globally examined a wide range of issues and practices in Mathematics classrooms from various angles. The findings suggested ways for improving teaching Mathematics at the secondary level. However, research studies conducted in secondary level Mathematics classrooms worldwide predominantly focused on performance and achievement and relating them to some personal and psychological variables around a wide range of subject matter in Mathematics.

Similarly, researches in international context assessed student's problems and difficulties in a range of topics in secondary Mathematics. These studies were random variables and probability distributions (Davulcu, & Tezer, 2020; Ho, Wong & Chan, 2014; Kachapova & Kachapov, 2012; Hernández, Albert Huerta & Batanero, 2006); normal distributions (Galleto & Ponggan, 2018; Onyancha, 2017; Limpert & Stahel, 2011); numbers and number sense (Johnny & Mohamed, 2011; Yea-Ling Tsao & Lin, 2011; Mohamed & Johnny, 2010); patterns and algebra (Julius, Abdullah & Suhairom, 2018; Nurhayati, Herman & Suhendra, 2017; Jupri, Drijvers & van den Heuvel-Panhuizen, 2014); measurement (Dincer & Osmanoglu, 2018). The results revealed several issues and challenges that served as barriers to learning secondary Mathematics. In a similar vein, some studies also disclosed the origins of the problems or difficulties, including the processes used to address them by Mathematics teachers (Skaalvik, 2018; Liljedahl, Santos-Trigo, Malaspina, & Bruder, 2016; Tambychika & MohdMeerahb, 2010; Khiat, 2013).

However, researches that focused on topics in the General Mathematics curriculum of the Senior High School (SHS) in the Philippines have not been studied in-depth. Hence, this study was set up in the school year 2017-2018 to investigate the difficulties encountered by the grade 11 teachers in teaching senior high school General Mathematics in the Schools Division of Siquijor along with functions, rational functions, inverse functions, exponential functions, logarithmic functions, simple interest, compound interest, simple annuities, general annuities, stocks and bonds, business and consumer loans, propositional logic, syllogism, fallacies, and proof and disproof. Further, the study explored the reasons for the challenges met by the teachers and their strategies used in coping with the issues. Significant findings served as a basis for developing a training design that works best in the division under investigation and instrumental to other divisions in the country.

1.1. Theoretical Framework

This study is anchored on "Gibb's Reflective Cycle," which advocates by helping people learn from experience (Gibb, 1988). Reflecting on experiences can help people deal with them better in the

future. Many people find that they learn best from experience. However, if they do not reflect on their knowledge, and if they do not consciously think about how they could do better next time, it is hard for them to learn anything at all. Hence, Gibb's Reflective Cycle is useful to help people make sense of situations at work so that they can understand doing well and what they could do better in the future. Gibb's Reflective Cycle is shown in Figure 1.

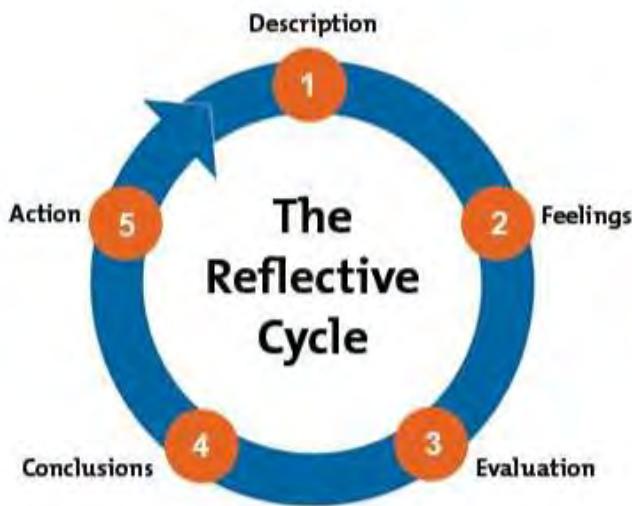


Figure 1. Gibb's Reflective Cycle

The model consists of five (5) stages, namely: description, feelings, evaluation, which combines analysis in the original model, conclusions, and action. The cycle commences at the description and moves clockwise to feelings, evaluation, conclusions, and ends at an action plan to complete the cycle.

In the description stage, the situation, event, or activity is described in detail. For example, the competencies, course description, and the objectives in the General Mathematics curriculum are presented. However, at this stage, conclusions are not drawn whether General Mathematics is challenging to teach. Important details should not be left out. All information that is the key to better understanding the teaching of General Mathematics is ensured relevant.

The feeling stage, on the other hand, describes someone's ideas generated in stage 1. It does not present and discuss someone's feelings in detail or even makes comments on it directly. Making someone aware of is an essential point in this phase rather than evaluating or judging one's emotions.

The good or bad experiences of the event in stage 1 are captured in the evaluation stage. At this stage, someone leaned from the situation, event, or activity. The experiences then guide what to do in similar. Favorable and unfavorable scenarios or experiences are noted, assessed, and analyzed individually. For example, it is at this stage that difficulties, problems, issues, and challenges in teaching General Mathematics are identified.

In conclusion stage, someone takes a step back and looks at himself from a distance and asks what else should be done in the situation. The gathered information during the evaluation stage is precious to come with a right and useful decision. For example, a research study is needed to determine the difficulties, problems, issues, and challenges encountered by teachers in teaching General Mathematics.

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In the final stage, actions are developed for use to address the barriers identified in stage 5. For example, the difficulties, problems, issues, and challenges encountered by teachers in teaching General Mathematics can be possibly solved by crafting a training design to address the barriers.

Hence, Gibb's Reflective Cycle supports the processing and achieving the intentions of the study by finding the difficulties encountered by the grade 11 teachers in teaching senior high school General Mathematics. Significant results served as a basis for developing a training design that works best in the division of Siquijor and instrumental to other divisions in the country.

2. Methods

2.1. Research design

The researchers used the sequential explanatory mixed methods design. The design was a two-phase process where data collection begins with quantitative information, followed by the gathering of qualitative facts (Creswell & Creswell, 2018). Further, Creswell and Creswell suggest that the research in question is intended to explain, rather than merely to describe the phenomena being studied. Moreover, the study was used to describe various aspects of the parameter variables being investigated (Creswell & Creswell, 2018). In its popular format, it was used to describe the characteristics and/or behavior of the sample or population.

2.2. Research respondents

The fifteen teachers teaching General Mathematics of the school year 2017-2018 from the fifteen Senior High Schools in the Division of Siquijor, Province of Siquijor, Philippines, were the respondents in this study.

2.3. Research environment

The research was conducted in the Schools Division of Siquijor, Province of Siquijor, Philippines. All secondary schools of the division offering SHS were included in the study.

2.4. Research instrument

The researchers employed a questionnaire checklist comprising three parts in data gathering. Part one asked on the level of teachers' difficulties encountered in teaching functions, rational functions, inverse functions, exponential functions, logarithmic functions, simple interest, compound interest, simple annuities, general annuities, stocks, bonds, business and consumer loans, propositional logic, syllogism, fallacies, and proof and disproof. Part two was an interview guide asking about the reasons for the difficulties. Part three was also an interview guide asking about the strategies utilized by teachers in overcoming the problems. The instrument was presented to the Mathematics Supervisor of Siquijor Province and three master teacher-experts handling SHS General Mathematics in the Dumaguete City Schools Division for content validation. Suggestions of the experts were incorporated, and the final form of the instrument was made. It was pilot tested to selected SHS General Mathematics teachers of the Division of Dumaguete City. The instrument obtained Cronbach's Alpha of 0.72, a coefficient that indicates that the research tool was reliable, according to Aiken and Susane

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(2001); Tan, Refugio, & Bernaldez (2015); Refugio, (2018); Macias Jr, & Refugio (2018); Refugio, Macias Jr. & Inoferio, (2018); Refugio (2019); and Refugio, Galleto, & Torres (2019).

2.5. Data-gathering procedures

The researchers sought a letter of approval to undergo the study in the Siquijor Province from the Schools Division Superintendent. Informed consent was also sought from the respondents. Permission to record the interview proceedings was further requested. All respondents were informed that participation in the study is voluntary, and they can withdraw their participation anytime. Upon approval of the Superintendent and permission granted by the respondents, each of the researchers proceeded to assigned respondents and personally administered part one of the instrument. After the respondents answered part one, one-on-one interview followed to generate responses for parts two and three of the tool. During the meeting, the researcher-interviewer did note-taking of responses and recording of the interview proceedings. The researchers then considered a transcription of the interview results.

2.6 Statistical treatment of the data

Frequency counting, percentage, weighted mean, standard deviation, and ranking were used to answer the problems posed in this study. All data were processed through Statistical Package for the Social Sciences (SPSS version 17.0), Data Analysis of Microsoft Excel, and MegaStat softwares. Weighted mean indices were described as follows:

Weighted Means	Verbal Descriptions
1.00 – 1.79	Not Difficult to Teach (NDT)
1.80 – 2.59	Slightly Difficult to Teach (SDT)
2.60 – 3.39	Moderately Difficult to Teach (MDT)
3.40 – 4.19	Difficult to Teach (DT)
4.20 – 5.00	Very Difficult to Teach (VDT)

The standard deviations were described as follows:

Standard Deviations	Verbal Descriptions
sd ≤ 3.00	Homogeneous
sd > 3.00	Heterogeneous

3. Results and Discussions

Table 1. Summary of the difficulties encountered by the teacher-respondents

Key Concepts of Functions	Weighted Mean	Standard Deviation	Verbal Description	Rank
A. Functions	1.42	0.64	NDT, Homogeneous	9
B. Rational Functions	1.61	0.85	NDT, Homogeneous	4
C. Inverse Functions	1.57	0.76	NDT, Homogeneous	6
D. Exponential Functions	1.65	0.80	NDT, Homogeneous	3

E. Logarithmic Functions	1.58	0.75	NDT, Homogeneous	5
F. Simple Interest & Compound Interest	1.28	0.65	NDT, Homogeneous	10
G. Simple and General Annuities	1.55	0.77	NDT, Homogeneous	7
H. Stocks and Bonds	1.57	0.74	NDT, Homogeneous	6
I. Business and Consumer Loan	1.50	0.79	NDT, Homogeneous	8
J. Propositional Logic, Syllogism, Fallacies	1.74	0.89	NDT, Homogeneous	2
K. Proof & Disproof	2.34	1.11	SDT, Homogeneous	1
OVERALL	1.56	0.77	NDT, Homogeneous	

Table 1 shows that the first ten key concepts were Not Difficult to Teach (NDT). On the contrary, proof and disproof were found Slightly Difficult to Teach (SDT). Standard deviations in all content standards were less than 3.00, which disclosed that all teacher-respondents were homogeneous in their responses.

Interview supported that the teachers tended to slow down upon reaching the last part of each essential concept, which is the problem-solving. Problem-solving is critical as it enhances the Higher Order Thinking Skills (HOTS) of the students. It also cites a real-life phenomenon wherein a particular mathematical concept can be applied, thus concretizing abstract ideas. Hoffer, Venkataraman, Hedberg, and Shagle (2007) asserted that solving a word problem is considered by teachers as the students' most impoverished area of preparation. The difficulty lies in the weak link between situations, concepts, and representations (Pape & Tchoshanov, 2001). Students fall short in connection is a teacher's challenge in teaching word problems. As an effect, teachers need to slow down. They need to put extra time and sessions in dealing with word problems. With this, the budgeted time indicated in the curriculum guide has deviated, and frequently, the last parts of the curriculum guide are compromised.

Table 2. Learning competencies not covered/not being taught

Learning Competencies	Frequency	Rank
1. illustrate simple and general annuities	1	8
2. distinguish between simple and general annuities	1	8
3. find the future value and present value of both simple annuities and general annuities	1	8
4. calculate the fair market value of the cash flow stream that includes an annuity	4	7
5. calculate the present value and period of deferral of a deferred annuity	4	7
6. illustrate stocks and bonds	6	6
7. distinguish between stocks and bonds	6	6
8. describe the different markets of stocks and bonds	6	6
9. analyze the different market indices for stocks and bonds	7	5
10. interpret the theory of efficient market	9	4
11. illustrate business and consumer loans	9	4
12. distinguish between business and consumer loans	9	4
13. solve problems involving business and consumer loans	9	4
14. illustrate a proposition	9	4
15. symbolize proposition	9	4
16. distinguish between simple and compound proposition	10	3
17. perform the different types of operations on propositions	10	3
18. determine the truth values of propositions	10	3
19. illustrate the different forms of conditional propositions	10	3
20. illustrate different types of tautologies and fallacies	12	2
21. determine the validity of a categorical syllogism	14	1

22. establish the validity and falsity of real-life arguments using logical propositions	14	1
23. illustrate the different methods of proof (direct and indirect) and disproof (indirect and by counterexample)	14	1
24. justify mathematical and real-life statements using the different methods proof and disproof	14	1

Table 2 presents that out of 15 Grade 11 General Mathematics teachers in the Division of Siquijor, more than 60 percent of them failed to teach 15 of the competencies. Alarmingly, 93 percent was unable to cover the last four skills in the curriculum. It means that the budgeted time to explain all the competencies for one semester was not followed. In the interview, teachers said that they tended to extend more sessions on problem-solving because it is in this competency wherein students have difficulty in acquiring the skill.

O'Meara and Prendergast (2018) disclosed a link between teachers' levels of satisfaction with the time allocated to mathematics and the provision of double periods. Teachers felt that double periods allowed for new teaching, and teaching for understanding was also more feasible. Further, it was found that double periods influenced the mathematical experience of post-primary students as well as the teaching approaches employed.

Table 3. Reasons for the difficulties encountered in teaching solving problems involving functions

Competency	Reasons for Difficulties	Frequency	Rank
Solving problems involving functions	<p>Teachers' Difficulty</p> <ul style="list-style-type: none"> • The teachers were not able to cope with the time allotment in delivering the lesson; activities took time to finish, review to activate prior knowledge also took time, grouping activities were time-consuming • Budgeted time of this competency as stipulated in CG was too short or not enough <p>Students' Difficulty</p> <ul style="list-style-type: none"> • Poor in vocabulary • Comprehension level of students was low, and students found it hard to translate the English language into vernacular, to translate verbal phrases into symbols, to formulate an equation out of the problem, to understand the problem leading to failure in formulating equation. • Poor in analysis • Interpretation skill is poor 	2 2 15 1 1	2 2 1 3 3

Table 3 divulges that teachers found challenging to teach solving problems involving functions due to low comprehension level of students and their poor ability to translate the English language into vernacular. To translate verbal phrases into symbols, to formulate an equation out of the problem, to understand the problem leading to failure in formulating equations were also students' issues that were accounted for by the teachers. Hoffer, Venkataraman, Hedberg, & Shagle (2007) confirmed that solving word problems was the students' most impoverished area of preparation, but does not reveal more on the nature of student difficulties. Moreover, Pape and Tchoshanov (2001)

unveiled that the source of trouble may be the difficulty of connecting between situations, concepts, and their representations.

Table 4. Reasons for difficulties in teaching the competencies under the key concepts of rational functions

Competency	Reasons for Difficulties	Frequency	Rank
Graphing rational functions	Teachers' Difficulty In the preparation stage, the teachers needed more time to study and review first before they can teach the competency Students' Difficulty Students had difficulty identifying the direction of the graph and were confused on vertical and horizontal asymptotes This lesson was confusing on the part of the students, time-consuming teaching, students had no calculator, numerator and denominator contributed difficulty	1 3 3 4	5 3 3 2
Solving problems involving rational functions, equations and inequalities	Teachers' Difficulty The teacher needed more practice or experience First time in handling the subject Too long and complicated process plus limited time Students' Difficulty It takes time because interpreting the word problem is difficult Students are confused on less than and greater than phrases	2 1 1 7 2	4 5 5 1 4

Table 4 presents that the reasons for difficulties encountered in teaching graphing rational functions were not alarming since only less than 30 percent of the teachers considered the competency challenging to teach. However, about 50 percent found solving problems involving rational functions, equations, and inequalities challenging to deliver. In the interview, the difficulty was met due to some teachers were new in the service. Others admitted to having limited knowledge about the competencies. Problem solving also took time to teach because interpreting a word problem was tricky.

Table 5. Reasons for difficulties in teaching the competencies under the key concepts of inverse functions

Competency	Reasons for Difficulties	Frequency	Rank
Graph Inverse Functions	Teachers' Difficulty The teacher admitted that this competency is difficult for her to teach because she is first-timer. Students' Difficulty Students had difficulty in plotting points Students had difficulty in generating a table of values out from inverse function Determining y - values was difficult for students	1 1 4 2	4 4 2 3
Solving problems involving inverse functions	Teachers' Difficulty Budgeted time as prescribed in CG was not enough/Limited time to tackle the lesson	2	3

The teacher usually proceeded to the next competency even if students did not yet master the current competency	1	4
Students' Difficulty		
Low comprehension/difficulty to formulate equation from the problem/Lack of skill to analyze the problem /Difficulty in interpreting the problem /Low vocabulary	15	1
Lack of prior knowledge that can be used in dealing with inverse function	1	4
Students were easily intimidated when it comes to problem-solving	1	4

Table 5 reveals that teachers indicated graphing inverse functions challenging to teach because students were unable to generate a table of values out from inverse functions. The teaching experience of the teacher was also the reason for the difficulty in teaching the competencies. On the other hand, all teachers displayed that solving problems involving inverse function was challenging to explain because of students' poor comprehension, inability to formulate equations out from the problem, lack of skill to analyze, difficulty to interpret the problem, and poor vocabulary. On the other hand, one teacher averred that students easily intimidated to do problem-solving due to a lack of prior knowledge in dealing with inverse functions.

Table 6. Reasons for difficulties in teaching the competencies under the key concepts of exponential functions

Competency	Reasons for Difficulties	Frequency	Rank
Graph exponential functions	Teachers' Difficulty Teachers admitted that they always skip this competency because they found it challenging to teach, challenging to elaborate further Students' Difficulty Graphing exponential function was difficult to do because plotting points was confusing for students.	2 3	3 2
Solving problems involving exponential functions, equations, and inequalities	Teachers' Difficulty Limited time allotment Students' Difficulty Inability to formulate equation out from the problem, difficulty to translate, analyze, and deficient in comprehension	1 1	4 4
		7	1

Table 6 discloses 20 percent of the teachers claiming that graphing exponential functions were difficult to teach due to students' inability to plot points and time constraints. A proportion of teachers also admitted that they usually skipped the competency because they found it difficult to elaborate further. On the other hand, solving problems in this competency was also identified challenging to deliver for the same reasons: students' inability to formulate equations out of the problem, difficulty in translating and analyzing, and deficient in comprehension. On the other hand, each interviewed teacher indicated that there is limited time allotment for this topic, and inequalities are a complicated lesson.

Table 7. Reasons for difficulties in teaching the competencies under the key concepts of logarithmic functions

Competency	Reasons for Difficulties	Frequency	Rank
Graph logarithmic functions	Teachers' Difficulty Teachers admitted that they need more training about graphing logarithmic functions Teachers needed more time to review thoroughly Teacher possessed limited content knowledge Teacher skipped the topic	3 2 2 4	3 4 4 2
Solving problems involving logarithmic functions, equations and inequalities	Teachers' Difficulty The teacher has limited content knowledge The topic was intentionally omitted Mastery was sacrificed Students' Difficulty Inability to formulate and translate equation out from the problem, difficulty to analyze, and deficient in comprehension Difficulty in acquiring the problem-solving skill	1 2 1 7 1	5 4 5 1 5

Table 7 reflects that a considerable number of teachers found graphing logarithmic function and solving problems involving logarithmic functions, equations, and inequalities challenging to teach. In terms of graphing, teachers admitted that they need more training to be equipped more about the competencies, to possess a mastery of the concepts, and to be always ready to teach the skills. In terms of problem-solving, teachers indicated that the difficulty emerged due to limited knowledge in formulating verbal phrases or sentences into symbols or equations.

Table 8. Reasons for difficulties in teaching the competencies under the key concepts of simple and general annuities

Competency	Reasons for Difficulties	Frequency	Rank
Calculate the present value and period of deferral of a deferred annuity	Teachers' Difficulty Teachers were not able to teach this topic due to lack of time, or they intentionally skip the lesson Teacher needed more studying time or training about this competency Students' Difficulty Confusing on what formula is to be used Students have difficulty in calculating because of they easily confused	4 2 2 2 2	1 2 2 2

Table 8 shows that teachers considered the competency, calculating the present value and period of deferral of a deferred annuity, as challenging to teach because of lack of time, which eventually resulted in skipping the lesson. In a similar vein, teachers indicated that the competency was challenging to explain because they were confused about what formula to use led to difficulty in calculating. Teachers further averred that they need more study time and training about the competency. It is imperative to stress that the time-frame for each activity of any day should be planned and appropriately structured with much emphasis on the performance standard-based learning competencies in the form of the time-table. Additionally, inadequate training of the concept can result in the inability of teachers to complete the lesson and prepare students for the next level. It is, therefore, relevant that teachers get working descriptions of the subjects and structure of work.

Table 9. Reasons for difficulties in teaching the competencies under the key concepts of propositional logic; syllogism, and fallacies

Competency	Reasons for Difficulties	Frequency	Rank
Illustrate different types of tautologies and fallacies	Teachers' Difficulty Needs more training and practice because teachers admitted that he/she is not so knowledgeable on this The teacher did not master the content because most of the time they were not able to take up this topic	12	2
Determine the validity of a categorical syllogism	Teachers' Difficulty Needs more training and practice because teachers admitted that he/she is not so knowledgeable on this The teacher did not master the content because most of the time they were not able to take up this topic	14	1
Establish the validity and falsity of real-life arguments using logical propositions	Teachers' Difficulty The teacher did not master the content because most of the time they were not able to take up this topic	14	1
		14	1

Table 9 presents the difficulties encountered in teaching illustrating different types of tautologies and fallacies, determining the validity of categorical syllogism, and establishing the validity or falsity of real-life arguments using logical propositions. The difficulty was encountered due to teachers' lack of knowledge and mastery of the content making the reasons to skip the topics.

Table 10. Reasons for difficulties in teaching the competencies under the key concepts of proof & disproof

Competency	Reasons for Difficulties	Frequency	Rank
Illustrate the different methods of proof and disproof	Teachers' Difficulty Needs more training and practice because teachers admitted that he/she is not so knowledgeable on this because most of the time, they were not able to reach this topic during the first semester.	14	1
Justify mathematical and real-life statements using the proof and disproof of the different method	Teachers' Difficulty Needs more training and practice because teachers admitted that they are not so knowledgeable on this because most of the time, they were not able to reach this topic during the first semester.	14	1

Table 10 shows that the competencies were difficult to teach due to teachers' lack of training, knowledge, and mastery, resulting in their failure to take up these competencies. It is important to note that mathematics instruction must provide many opportunities for concept building, relevant challenging questions, problem-solving, reasoning, and connections within the curriculum and real-world situations. Likewise, quality teachers are vital in ensuring successful learning. With this, teachers need to sharpen their skills in teaching content and strategies through professional development.

Table 11. Strategies employed to overcome difficulties in teaching the competencies under the key concepts of functions

Competency	Strategies Applied to Overcome Difficulties	Frequency	Rank
Solving	Art of questioning was enhanced	2	3

problems involving functions	The teacher was the one translated the problem into an equation, and students solved the equation of the problem	4	1
	A similar problem was given for exercises, the same situation but different given.	1	4
	More examples were given in group work and discussion activity	1	4
	The teacher translated English to students' dialect	3	2
	Phrase by phrase translation (English to Cebuano)	1	4
	Used leading questions	3	2
	Exposed students to more problems	2	3
	Searched problems that have available solutions and explanations	1	4
	Peer tutoring method was used	2	3
	Most of the time discussion method was used	2	3

Table 11 discloses how teachers in their day to day teaching helped students to overcome the difficulties they encountered in solving problems involving functions. Dominantly, on the process, teachers closely worked with their students for the benefit of learning. The teachers showed their best in knowing the curriculum despite weaknesses, fostered students' mathematical knowledge, and managed classrooms where students explored their ideas. Indeed, students cannot experiment and express their views if teachers are the ones to translate word problems into equations just to speed up the time phasing of the session. However, it is the teachers' task to fill in the nothingness of the students. Eventually, students will realize to discuss solved problem structures and solutions to make connections among strategies and reasoning at their own pace.

Table 12. Strategies employed to overcome difficulties in teaching the competencies under the key concepts of rational functions

Competency	Strategies Applied to Overcome Difficulties	Frequency	Rank
Graphing rational functions	Assigned students to practice graphing during the vacant time with the guidance of a classmate	1	4
	Allowed students to use the calculator	2	3
	Allowed the use of graphing Apps (Mathways)	2	3
	In grouping, there must be at least one member with android CP	1	4
Solving problems involving rational functions, equations and inequalities	Used peer tutoring, think pair share, and collaborative work activity	4	1
	Used similar and straightforward problems and repeat words that are commonly used	3	2
	Extended more time in taking up the topic (Beyond the budgeted time)	1	4
	Prepared all the solutions of exercises before presenting the subject matter to save time.	1	4
	Reviewed rational, laws of inequalities, and equations before presenting worded problems	2	3
	Thorough discussion to find out patterns, phrase by phrase translation, and used grouping activity	2	3
	Reviewed and drilled methods first, then encouraged constant practice, remedial classes, and then giving rewards	2	3
	Picked up examples in the LM that are easy for the students	1	4

Table 12 shows that in graphing rational functions, the teacher allowed students to use calculators and graphing Apps to make the lesson easier. Moreover, the use of peer tutoring, think pair share, and collaborative work activity were popularly used by teachers to overcome the difficulties in teaching solving problems involving rational functions, equations, and inequalities. Meanwhile, teachers extended time allotment and prepared solutions of exercises before presenting the subject matter to save time. It means that the teachers were equipped with the pedagogical skills to deliver the competencies.

Table 13. Strategies employed to overcome difficulties in teaching the competencies under the key concepts of inverse functions

Competency	Strategies Applied to Overcome Difficulties	Frequency	Rank
Graph inverse functions	Used grouping activity and tutorial approach	2	2
	Exposed students to more exercises	2	2
	Just provided simple and easy to solve/graph inverse function	1	3
	Always activated prior knowledge that can be used as a tool in learning a new lesson	3	1
	Encouraged to check their work/solutions always	2	2
Solving problems involving inverse functions	One teacher admitted that he intentionally skipped the competency and proceeded to the next topic	1	3
	Developmentally arranged the problem from easy to difficult	2	2
	Served the exact wording of the problem taken from the previously solved problem but twisted a little bit the given	1	3
	Exposed them first to the easy problem, searched through the internet the questions with available solution and explanation	2	2
	Gave more assignment to be done by groups	2	2
	Helped or guided students in formulating equations from a worded problem	2	2

Table 13 divulges that as a tool in learning a new lesson, teachers used activating prior knowledge always before the start of the experience graphing inverse functions and giving simple and easy to solve and graph inverse functions. Moreover, in teaching solving problems involving inverse functions, teachers were using developmentally issues arranged from easy to challenging, guided students in formulating equations, and used the strategy of giving exact wordings of word problems from the previous example but with a little bit twisted given numbers. It means that teachers are resourceful and artistically equipped to deliver the competencies to students. It implies that if teachers are professionally advanced, they could give more benefits to their students.

Table 14. Strategies employed to overcome difficulties in teaching the competencies under the key concepts of inverse functions

Competency	Strategies Applied to Overcome Difficulties	Frequency	Rank
Graph exponential functions	Constant practice through peer tutoring and grouping	1	3
	Using a review, group work, and drill	3	1
	Spoon feeding approach first, then apply group work activity soon after.	2	2
	Extend budgeted time for this topic	1	3
Solving problems involving exponential	Gave fundamental and straightforward questions about exponential function so that students appreciate it instead of hating it.	2	2
	For lower section, avoid giving difficult problems	1	3

functions, equations, and inequalities	Give problems that are similar to previously solved sample problem Using cooperative learning approach Giving more time in taking up inequalities	3 3 1	1 1 3
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Table 14 displays that in teaching graphing exponential functions, using review, drill, constant practice strategy through peer tutoring, and group work activity were popularly used by teachers. Also, giving problems that were similar to previously solved sample problems and cooperative learning approach were widely used by teachers and avoided giving difficult issues.

Table 15. Strategies employed to overcome difficulties in teaching the competencies under the key concepts of logarithmic functions

Competency	Strategies Applied to Overcome Difficulties	Frequency	Rank
Graph logarithmic functions	Letting students search videos about dealing logarithmic equations and inequality and let them report to the class and then elaborated further through teacher-guided discussion Peer tutoring, practice graphing during the vacant time, and then group practicum right after next meeting Allowing the use of the graphing app	3 4 4	2 1 1
Solving problems involving logarithmic functions, equations and inequalities	Used cooperative learning Rephrased the question into simple and easy to understand Used teacher-guided discussion/activity after collaborative learning.	4 3 3	1 2 2

Table 15 discloses the teachers' strategies employed to overcome difficulties in teaching the competencies under the key concepts of logarithmic functions. It follows that teachers are pedagogically and technologically inclined. Unfortunately, however, it was found out that the teachers were content problematic and required further training.

Table 16. Strategies employed to overcome difficulties in teaching the competencies under the key concepts of simple and general annuities

Competency	Strategies Applied to Overcome Difficulties	Frequency	Rank
Calculate the present value and period of deferral of a deferred annuity.	Intentionally skipped the lesson	2	1

The last recourse that teachers offer when a lesson is not familiar is to skip the lesson (Table 16). However, it is not the best solution. Instead, teachers should do peer mentoring. Teachers should not be only proficient in knowing the curriculum but also capable of fostering students' mathematical learning and able to manage classrooms where students can experiment with their mathematical ideas. Students could not experiment with their mathematical ideas about calculating the present value and period of deferral of a deferred annuity if the teachers omitted the topic.

Table 17. Strategies employed to overcome difficulties in teaching the competencies under the key concepts of propositional logic, syllogism, and fallacies

Competency	Strategies Applied to Overcome Difficulties	Frequency	Rank
Illustrate different types of tautologies and fallacies	Due to constraint of time and limited knowledge about this, only the overview of the lesson was introduced and then proceeded to next competency just to cope up with what is required in the curriculum guide	7	2
	No strategy applied and not able to reach this competency.	5	3
Determine the validity of a categorical syllogism	Due to constraint of time and limited knowledge about this, only the overview of the lesson was introduced and then proceeded to next competency just to cope up with what is required in the curriculum guide	4	4
	No strategy applied and not able to reach this competency	10	1
Establish the validity and falsity of real-life arguments using logical propositions	Due to constraint of time and limited knowledge about this, only the overview of the lesson was introduced and then proceeded to next competency just to cope up with what is required in the curriculum guide	4	4
	No strategy applied and not able to reach this competency	10	1

Table 17 reveals that teachers applied no strategy to overcome difficulties in teaching because they were not able to reach this competency due to lack of time. Instead, they only introduced an overview of the lesson. They were not able to elaborate and discuss further. It means that teachers failed to manage the time in teaching all the competencies of General Mathematics. Thus, they were unable to reach the last part of the course.

Table 18. Strategies employed to overcome difficulties in teaching the competencies under the key concepts of proof and disproof

Competency	Strategies Applied to Overcome Difficulties	Frequency	Rank
Illustrate the different methods of proof (direct and indirect) and disproof (indirect and by counterexample)	No strategy applied. They were not able to take up this competency because the first semester has ended.	14	1
Justify mathematical and real-life statements using the different methods of proof and disproof	No strategy applied. They were not able to take up this competency because the first semester has ended.	14	1

Table 18 shows that teachers failed to take up and discuss these two competencies because the semester was over. Thus, they admitted that no strategy was enforced to overcome the difficulty. In education, time is essential. It is so relevant and useful that each school activity is regulated by time. Teachers should carefully manage time so that all of the competencies in Grade 11 General Mathematics will be covered.

4. Conclusions

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The Grade 11 General Mathematics teachers are pedagogically and technologically equipped to teach the course. However, some have poor time management and do not have the mastery of some contents of the course. The teacher-respondents overcome their difficulties in different ways, including the students' perspectives with varying strategies to address the issues and challenges. Yet, no evidence shows that these strategies work for the better.

5. Recommendations

Training as well as seminars and workshops for the unmastered competencies and contents and the competencies with no strategies applied to cope with their difficulties in teaching, are to be provided to Grade 11 General Mathematics teachers by implementing the training design developed by the researchers. In the end, the slightly tricky to teach competencies can be elevated to a simple one. Doing so will further sustain or even further develop the knowledge, mastery, and skills of teachers. Replication of this study may be conducted to determine other strategies in coping with the challenges and validating the veracity of the findings further.

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