



Stairway to Mastery Approach: Improving Grade 11 Learners Skills in Problem Solving Related to Compound Interest

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Abstract: The primary objective of this study is to improve learners' "skills in solving problems on compound interest through stairway to mastery approach". Corollary to the objective in investigating the performance of students in problem solving involving compound interest in mathematics of grade 11 learners, the researcher adapted a rubric to evaluate the learners relative to the different issues in mathematics such as recognition, calculation, representation, application and comprehension. To collect the necessary data of the study, there were six identified students who participated in stairway to mastery tasks. The data was then evaluated from pre- and post-test assessments. The result of their pre-test indicated a remark that there was a need for improvement and post-test where it shows a satisfactory remark. Descriptively, the students have improved their skills after being exposed to stairway to mastery approach in solving problems that involved compound interest. During the in-depth interviews and thematic analysis, the finding came out that unfamiliar terms, incorrect calculation and lack of focus in studying were some of the challenging reasons why learners were not able to solve problems in mathematics. Ideally, after the importation of the stairway to mastery approach the learners' working relationship, constructive feed backing, and gaining confidence have helped wired their skills in solving fundamentals in mathematics. Thus, the study revealed that the learners' skills in solving problems on compound interest in mathematics can be developed using stairway to mastery approach

Keywords: compound interest, problem solving, stairway to mastery approach

1. CONTEXT AND RATIONALE

As a teacher, it is a dissatisfying experience to encounter students having difficulty in solving problems involving compound interest (M11GM-11a-b-1). In fact, problem solving in mathematics has been identified as a challenging part considering that students needs comprehension for them to achieve a correct answer. According to Rosario (2021), Trends in International Mathematics and Science Study 2019 (TIMSS), it is revealed that Filipino children performed poorly with the lowest Average Scale Scores among 58 countries in terms of Math and Science among grade 4 learners. Moreover, the 2018 Programme for International Student Assessment (PISA) result published by the Organization for Economic Co-operation and Development (OECD), the Philippines placed lowest in reading and second to the last in both reading and mathematics among the 79 participating nations or economies.

Being a teacher in General Mathematics subject, it is an unrewarding experience as earlier discussed that your students cannot independently solve mathematical problems and they need my assistance frequently in trying to solve the problems assigned or given to them. As educator in math, I want my learners to excel in this context since it is fulfilling on my part if they can appreciate the beauty of problem solving rather than being embarrassed and humiliated. Moreover, it is my desire to see that my learners are interested in the topics given to them and claim their grades with joy because of their hard work and perseverance. On the other hand, I am most certain that every teacher would undergo misery and pain in knowing fact that certain student(s) may not be able to pass to the next level due to such deficiency. The various reasons in the students' failure to solve problems involved difficulty in basic operations, parenthesis and exponents, comprehending the given problems involving compound interest, and the confusions on what has been asked in the problem, among others. Among the

different reasons mentioned, the most pressing for me concerns on solving problems that involve compound interest.

Confronted with the above milieu, I feel the need and the urgency of addressing the said problem in order for the students to proceed to the next level and even being prepared in their further education. Moreover, the issue needs quick intervention to lessen students' difficulty in problem solving involving compound interest. In fact, the Covid-19 period have also affected the students' learning habits and some of them got discouraged to pursue their learning or to be better. As a teacher, it is my happiness and desire to help the deprived learners or even learners that needed intervention to learn. Though I did my best and had even assisted them in answering the problems, I believe that those identified learners needed another approach to make them feel that in problem solving there is always a solution to the hard part of it. I do not want to encounter the same experience in the future that my students failed to face the challenge confronted or given to them.

Recognizing the importance of helping them, I am hopeful that the effect of my proposed intervention or study, i.e., stairway to mastery with monitoring and communication would help them cope up their problem in solving topics or questions involving compound interest.

2. INNOVATION, INTERVENTION, STRATEGY

Stairway to mastery approach is a paradigm that will guide the learners since it is a simplified approach of answering compound interest problems. This concept, in fact, can be applied to any issue that involves problem solving. The uniqueness of this technique is that learner's confusions and difficulties are recognized since they cannot continue going to the next level if evaluated with misunderstandings. As a result, students have a path to follow in order to correctly arrive the required answer. With that, learners have the path in order for them to arrive the needed answer correctly. Persistent monitoring of the learners by giving them tasks to answer. These responsibilities should be assigned in such a way that each of them can complete their assigned tasks independently. Specific task would include, following the steps or model with correct answer or representation as being asked, to be able to meet the last step of the model with correct interpretation of the answer.

As shown below is the Stairway to Mastery Model Explanation

- 1.) **ASK:** In the first step of the Stairway to Mastery Model, you "ASK" or identify the key information or data that is given in the problem. In the context of this model, we have the following variables:

A (Ask) = Represents the information or data that needs to be asked or obtained to solve the problem.

P (Problem) = The question or problem statement that needs to be answered or solved.

R (Relationship) = The relationship or formula that connects the given variables.

T(YEAR) = The variable representing the specific year or time at which the problem is referring to.

N (Unknown) = The unknown or variable that we need to find or solve for.

- 2.) **GIVEN:** In this step, you list down the given values for each variable in the problem.

A = The information or data that needs to be obtained through the process of asking or research.

P = The specific question or problem statement.

R = The formula or relationship that connects the given variables.

T(YEAR) = The specific year or time mentioned in the problem.

N = The unknown or variable that needs to be determined.

- 3.) **FORMULA:** This step involves identifying and using the appropriate formula or relationship that connects the given variables to solve for the unknown.

- 4.) **PEMDAS:** PEMDAS stands for "Parentheses, Exponents, Multiplication, Division, Addition, and Subtraction." It is an acronym used to remember the order of operations in mathematics.

The order of operations dictates the sequence in which calculations should be performed when solving an expression or equation.

Show your answer with SOLUTION: In this step, you perform the necessary calculations using the given formula and the values of the variables to find the solution for the unknown.

- 5.) Final answer: This represents the ultimate solution or answer to the problem after following all the steps of the Stairway to Mastery Model and performing the required calculations.

Therefore, to conclude, the Stairway to Mastery Model is a systematic approach to problem-solving that involves identifying the key information (ASK), listing the given values (GIVEN), using the appropriate formula (FORMULA), following the order of operations (PEMDAS), and showing the final answer (SOLUTION) to arrive at the solution for the problem (Final answer).

In this process, the teacher must really be patient and mindful that a part of their time should be allotted for social relationship with their others to feel comfortable and valuable. Moreover, partnership with the parent and adviser is also appreciated that will unite with our goal which is to help by being improved and excelled. In this study, I will let my six learners undergo five days remedial sessions utilizing the stairway to mastery model. On the first and second day, I introduced the model and explained to them each step and provide examples. Third to fourth day, I give the learners chance to apply the introduced model step by step and individually monitored their outputs. The fifth day of our session, I give them a post-test specifically to assess their mastery of the specific competency being develop to them.

Arifin et al. (2020) emphasized in their study that, learners who are unable to perform their assignments independently are provided scaffolding and really help learners solve problem. Although, Problem solving in mathematics is described as a complex process that requires a wide range of skills and numerous processes in order to determine the relationship between previous experiences or schemes and the current challenges. In fact, students must use not only existing mathematics knowledge, but also high-level thinking skills. Scaffolding can also have an impact on learners' cognitive growth in the future. The study of Bunagan (2019) corroborates that intervention approach is meant to re-teach the concepts and skills wherein it is given to learners to help them master the competency-based skills they were not able to develop during a regular classroom teaching.

Consequently Guzman Gurat (2018) highlighted that problem-solving cognitive methods such as rehearsal, elaboration, and organization have been shown to be helpful. Furthermore, metacognitive strategies are used in problem-solving, where critical thinking and self-regulation, as well as other methods, are required for planning, monitoring, and evaluation. It may also assist students in solving arithmetic issues due to their prior knowledge and skills in strategy. The highlighted tactics could also be considered when creating problem sets for students to help them improve.

True enough, as a classroom teacher, we are responsible for preparing our students. We need to prepare them to be responsible in doing task for them to appreciate its value and significance in their future endeavor. Especially that my identified learners need further monitoring in their task since they need assistance and guidance. It is my desire that they learn problem solving involving compound interest since it is relevant in our lives.

3. ACTION RESEARCH QUESTION

This action research envisioned to find out the impact of Stairway to Mastery approach to the difficulty of students in Problem Solving involving Compound interest. Specifically, this study intends to answer the research question: How can I improve my grade 11 learners' understanding in problem solving specifically compound interest topic?

Action Research Methods

- A. Participants, other sources of Data and Information

The participants of this study are the Grade 11 students enrolled in one of the schools in Davao City for the School Year 2022-2023. In the selection of the participant, I utilized purposive sampling

technique which is also known as judgmental sampling. The total of six participants were selected who considered as frustration level or developing. The data gathered in this study are based on their assessment result.

B. Data Gathering Methods

It is important to note that the ethical guidelines were considered in the conduct of the study. I made sure that the honesty, privacy, fairness and confidentiality are served to give due respect to the participant of the study.

The participant of this study is a Grade 11 learner enrolled in one of the schools in Davao city. In the selection of the participant of my study, I utilized the purposive sampling technique or also known as judgmental sampling. The participant was selected after the conduct of the assessment in my mentioned competency.

C. Data Analysis Plan

Action research design was employed in my study, specifically students identified low scores during the assessment of our lesson about compound interest. Data gathered through the adapted rubric for evaluation of each student. Evaluation result were compared and observed that after the applied intervention there is an improvement of scores. This implies that the integration and utilization of stairway to mastery model in teaching problem solving is important for the students to be guided.

Moreover, interview was utilized in the data collection and factual reasons behind difficulties of students.



4. RESULTS AND DISCUSSION

Table1. *FIRST ROUND-Learners' Performance in Problem-Solving involving compound interest*

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Participant	Recognition (able to identify relevant information necessary to solve the problem)	Calculation (Steps and strategies a student presents as his/her work)	Representation (present/relate information in multiple forms; mathematically, graphically, in words, pictures)	Application (apply correct concept/principle necessary to solve problems)	Comprehension (can recognize whether the answer is reasonable for the given problem)		
Participant	First Round	First Round	First Round	First Round	First Round	First Round (Average)	Remarks
A	2	1	1	2	1	1.4	Needs Improvement
B	2	1	1	1	1	1.2	Needs Improvement
C	1	1	1	1	1	1	Needs Improvement
D	2	1	1	1	1	1.2	Needs Improvement
E	1	1	1	1	1	1	Needs Improvement
F	2	1	1	1	1	1.2	Needs Improvement

First Round- Problem Solving Involving Compound interest of the learners. It can be seen in Table 1 that learners performance in problem solving involving compound interest when they were not able to identify relevant information necessary to solve the problem; confused about steps and strategies on the work that he/she presented; were not able to present/relate information in multiple forms; mathematically, graphically, in words or pictures; misconceptions about how to apply correct concept/principle necessary to solve the problem; cannot recognize whether the answer is reasonable for the given problem. Therefore, the given evaluation above shows that each student need improvement and further intervention.

Table2. FINAL ROUND-Learners' Performance in Problem-Solving involving compound interest

Participant	Recognition (able to identify relevant information necessary to solve the problem)	Calculation (Steps and strategies a student presents as his/her work)	Representation (present/relate information in multiple forms; mathematically, graphically, in words, pictures)	Application (apply correct concept/principle necessary to solve problems)	Comprehension (can recognize whether the answer is reasonable for the given problem)		
Participant	Final Round	Final Round	Final Round	Final Round	Final Round	Final Round	Remarks
A	4	3	2	3	2	2.8	Satisfactory
B	4	3	3	2	2	2.8	Satisfactory
C	3	3	3	2	2	2.6	Satisfactory
D	3	3	3	2	2	2.6	Satisfactory
E	2	3	3	3	2	2.6	Satisfactory
F	4	3	2	2	3	2.8	Satisfactory

As shown in Table 2, the **Final round- Solving Fundamental Operations in Mathematics skills of the learners.** After intervention, the learners' performance in problem solving involving compound interest, when they are able to identify relevant information necessary to solve the problem, follow steps and strategies a student presents as his/her work, able to present/relate information in multiple forms; mathematically, graphically, in words, pictures, able to apply correct concept/principle necessary to solve problems, can recognize whether the answer is reasonable for the given problem. Therefore, the given evaluation above shows that each student improved their performance in problem solving involving compound interest using stairway to mastery approach.

Table3. COMPARISON OF THE FIRST ROUND AND FINAL ROUND- Learners' Performance in Problem-Solving involving compound interest

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Participant	Recognition (able to identify relevant information necessary to solve the problem)		Calculation (Steps and strategies a student presents as his/her work)		Representation (present/relate information in multiple forms; mathematically, graphically, in words, pictures)		Application (apply correct concept/principle necessary to solve problems)		Comprehension (can recognize whether the answer is reasonable for the given problem)					
	First Round	Final Round	First Round	Final Round	First Round	Final Round	First Round	Final Round	First Round	Final Round	First Round (Average)	Remarks (Needs Improvement)	Final Round (Average)	Remarks (Satisfactory)
A	2	4	1	3	1	2	2	3	1	2	1.4	Needs Improvement	2.8	Satisfactory
B	2	4	1	3	1	3	1	2	1	2	1.2	Needs Improvement	2.8	Satisfactory
C	1	3	1	3	1	3	1	2	1	2	1	Needs Improvement	2.6	Satisfactory
D	2	3	1	3	1	3	1	2	1	2	1.2	Needs Improvement	2.6	Satisfactory
E	1	2	1	3	1	3	1	3	1	2	1	Needs Improvement	2.6	Satisfactory
F	2	4	1	3	1	2	1	2	1	3	1.2	Needs Improvement	2.8	Satisfactory

Table 3 compares the outcomes from the selected learners' first and last rounds. Each participant's performance on average significantly improved, going from needing improvement to being recognized as satisfactory learners. The stairways to mastery approach thus offer a model for expanding learners' comprehension of problem-solving involving compound interest. It makes sense that if learners are not motivated or interested, they will not perform well academically, and the desired learning outcomes will not be achieved. In fact, the result is in line with Gbollie and Keamu's (2017) to which the nature of motivation and the use of learning strategies is vital to improving student learning outcomes.

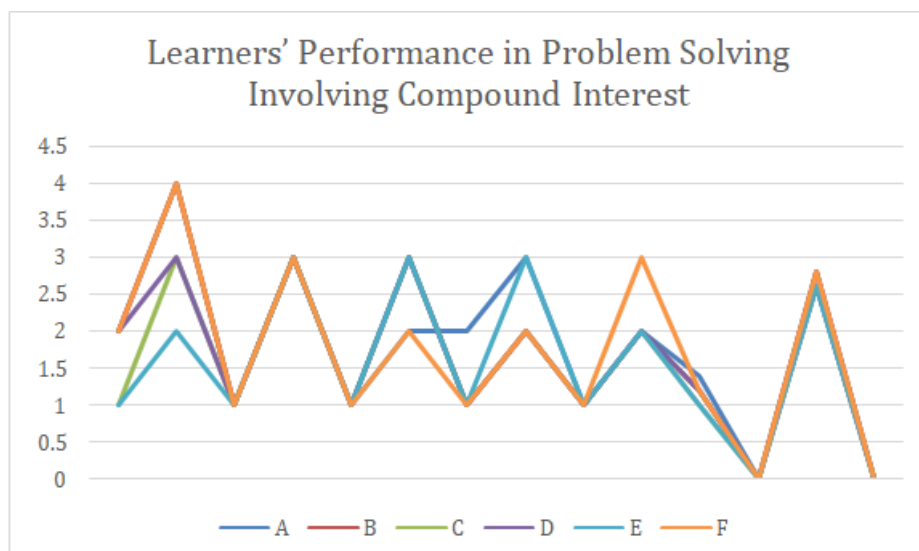


Figure 1. Graphical Representation of the results

Figure 1 above shows the graphical results of each learner in problem solving involving compound interest. Apparently, there is an improvement of the results and really improved their understanding in solving fundamental operations in mathematics after the implementation of the intervention. Aside from the improvement and strengthened understanding in solving, each learner showed positive improvement in terms of his/her social skill, confidence and enthusiasm in learning.

Students Interview Insights

The whole duration of the face-to-face interview was supposed to be supported in video but most of the respondents in this study opted to have answers recorded while they are expressing their feelings. Each participant was asked to fill out the Informed Consent prior to the interview.

The responses of the identified learners below based on their results after answering the problem-solving involving compound interest.

Participants Summary of response:

1) Recognition (able to identify relevant information necessary to solve the problem)

A : Human nakonabasa anggihatagna problem solving about compound interest maam, naglisud ko ug sabot unsaakoabuhaton.

After reading the task regarding problem solving, I am having difficulty comprehending the specific actions or steps that need to be taken.

B. Pagkakitapalangnakosa problem solving ma'am naglibog ko kay wala ko kasabot.

Upon reading the problem, I found myself perplexed and confused due to a lack of comprehension.

C: Wala ko kasabotmangudsalahi-lahina words ma'am nawala ko kaila.

I did not understand the different terminologies used which are unfamiliar to me.

2) Calculation (Steps and strategies a student presents as his/her work)

Naglisud ko maam unsay unahonpag answer kay naamanguddivision,taposnaapud ay exponent unyanaapud plus ug minus.

I find it difficult about what to do first because of the different operations involved like division, addition, subtraction and with exponent.

3) Representation (present/relate information in multiple forms; mathematically, graphically, in words, pictures)

Dili ko kabalomaamasaibutang ang numbers na given basisa formula gud ma'am sa compound interest.

I did not know about where to substitute the numbers based on the given formula.

4) Application (apply correct concept/principle necessary to solve problems)

Pag answer nakomaam kay dli diaymao ang value naakoanabutanglike annually,semi-annually,compounded monthly.

When I was answering, I made a mistake about the represented value for annually. Semi-annually,compounded monthly.

5) Comprehension (can recognize whether the answer is reasonable for the given problem)

Maglisudgyud ko ug sabot maambasta problem solving nahisgutan.

I find it difficult when the topic is all about problem solving

Moreover, their responses were done after they took the pre-assessment test for me to assess their feelings and realization after the test. After I heard their feedback, I was worried and motivated me to work hard and pursue my goal in helping them in learning problem solving involving compound interest. Thematic analysis of the interviewed respondents' responses about problem solving involving compound interest can help identify the patterns and insights that can inform the development of effective strategies and resources for learning. Gladly, after the proposed interventions and strategies, learners are interested and boost their confidence to ask when they have concerns. Moreover, the integration of stairway to mastery approach considered as a path to connect their minds that mathematics is manageable if patience, determination and hard work were combined. After the given post-assessment, their feedback was, gladly I can solve the problem solving. Another learner added that problem solving involving compound interest are like the key to make future topics in mathematics easier with matching good comprehension.

5. REFLECTION

As a secondary mathematics teacher having meet diverse learners, with different characteristics and personalities, such a situation was really challenging considering their intellectual, spiritual and behavioral aspects. I find it problematic and challenging where the students were solving the problems

given to them, involving compound interest, I noticed that they were just ignoring their weaknesses and they were dependent on their gadgets when answering or solving the problems. The intervention ignited students' interest in learning and showed concrete evidence about how students improve their comprehension and ability to answer problem solving.

Integrating stairway to mastery approach during remediation class is very important. In fact, learners are guided through each step of their outputs and any difficulties are automatically highlighted. This means that an effective and alive technique will motivate the learners to learn. Learners can interact, enjoy, and appreciate the lesson in this manner, which leads to meaningful and endless comprehension. As a result, learners' understanding and confidence in addressing problem solving using compound interest gradually improves, resulting in increased class participation and activity engagement.

Giving attention to students in need and positive reinforcement in class showed a great impact towards students' confidence in learning mathematics. In addition, the integration stairway to mastery approach can also be utilized in other learning area which enhanced learners' motivation. I always recognized the participation done by learners instructing them to do it repeatedly and constantly. In fact, I consciously made it certain to have updates with regards to their score in class through color coding.

Surprisingly, there are great improvements in my students' performance like they can now solve independently and improve their performance during the post-assessment. Another is that learners have the confidence to answer during board work and even oral recitation. Furthermore, I observed that learners have excitement in their faces about what they achieved.

More so, as a teacher, I must collaborate with my co- teacher about this issue to quickly resolve it. I must share how learners' performance improved after utilizing the stairway to mastery approach during remediation class. In addition, the strict implementation of the program must be monitored to have effective results and lessen learners identified as frustration level in mathematics. The strategy mentioned is not just applicable during remediation class but for regular class in all learning areas.

I believe that the Philippine government as well as the local government of Davao City have implemented various initiatives to improve math education such as training and professional development for teachers, introducing new teaching methodologies, and enhancing the curriculum.

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NANCY NAMOC NAMUAG, a public secondary mathematics teacher 3 with five years of experience at Magtuod National High School in Davao City, Philippines; holds a Master of Arts in Education Teaching Mathematics from the University of Mindanao, Davao City, Philippines and currently pursuing Doctor of Philosophy in Mathematics. The inspiration behind her study lies in a genuine concern and commitment to addressing the needs of learners who require assistance and attention in mathematical-related problems. This reflects a deep understanding of the challenges that some students face in grasping mathematical concepts and the importance of providing support to enhance their learning experiences. This study is dedicated to all the teachers and students who are continuously searching for related knowledge.

Citation: Nancy Namoc Namuag. "Stairway to Mastery Approach: Improving Grade 11 Learners Skills in Problem Solving Related to Compound Interest" *International Journal of Humanities Social Sciences and Education (IJHSSE)*, vol 10, no. 11, 2023, pp. 42-50. DOI: <https://doi.org/10.20431/2349-0381.1011005>.

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