

# Improving Problem Solving Skills of Third Year Mathematics Students Taking The Course Numerical Analysis II (Math3152); in Case of Adigrat University

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**Abstract - This study wanted to investigate the poor performance of solving problem skills and to establish the strategies that can be adopted to improve performance in solving problems in Mathematics by third year Mathematics students in case of Adigrat University, Ethiopia. The data were analyzed using quantitative content analysis for target population was 37 respondents which comprised of 3 male and 34 female third year mathematics students. The data for the research was collected by use of questionnaires, interviews and observation. Hence, factors contributing to poor performance in solving problem skills include inadequate learning materials, lack of motivation and poor attitudes by both teachers and students. The findings of this study will give mathematics curriculum developers new insights into emerging issues on performance and influence the Ministry of Education on policy formulation. However, students are also expected to benefit from the findings; because improved mathematics performance will give them opportunities to pursue science related courses in higher institutions of learning. Three major challenges limited the use of problem solving and investigations: curriculum, student-related, and teacher-related issues. The strategies suggested by the students on how to improve achievement in mathematics were grouped into five areas, which comprised of staffing, teaching and learning materials, curriculum, motivation and attitudes, and fees and levies.**

**Keywords - Problem Solving Skills, Numerical Analysis II, Investigations, Mathematics, Curriculum**

## I. INTRODUCTION

### *Background of the Study*

There is a complex relationship between teaching, learning and curriculum. Specifically, the students' learning is affected by the teaching of curriculum. Hence the curriculum plays a major contribution in the teaching methods and direction. The teaching methods and direction are under teachers' control. Nevertheless, the question is "how can a teacher encourage the students' potential in relation to solving mathematical problems? Dealing with the encouragement, interactions between teachers and students are the concerns. The classroom interaction is not only between the teacher and the students, but also between the students and learning contents. Moreover, in the nature of learning which involves reflection of human actions, the human interaction could involve some purposive activities. The activity could generate some logical arguments [1].

Mathematical thinking will support science, technology, economic life and development in an economy. Increasingly, governments are recognizing that economic well-being in a country is underpinned by strong levels of what has come to be called 'mathematical literacy' according to a report by Program for international student assessment(PISA) in the population [2].

The contributions of mathematics to modern life extend beyond its partnerships with the other sciences and engineering. Over the last several decades it has become clear that a mathematically-educated population is a key to economic development [3].

Effectively solving a mathematical word problem is assumed to depend not only on students' ability to perform the required mathematical operations, but also on the extent to which they are able to accurately understand the text of the word problem [4-7].

Being able to use mathematical thinking in solving problems is one of the most fundamental goals of teaching mathematics, but it is also one of its most elusive (difficult to find, describe) goals. It is an ultimate goal of teaching that students will be able to conduct mathematical investigations by themselves, and that they will be able to identify where the mathematics they have learned is applicable in real world situations. A report by Paul Halmos reveals that problem solving is "the heart of mathematics". However, even as teachers around the world have considerable successes with achieving this goal, especially with more able students, there is always a great need for improvement, so that more students get a deeper appreciation of what it means to think mathematically and to use mathematics to help in their daily and working lives [8].

A research showed that "Problem-solving is the process deal with a new situation, formulating connections between given facts, identifying the goal of the problem, and exploring possible strategies for reaching the goal". It requires the problem-solver to coordinate "previous experience, knowledge, and intuition" in order to solve problems where no direct procedures or paths to

the solution have been provided. An important aspect of problem solving is recording the steps towards devising a solution strategy [9, 10].

Another report reveals that a four step process for Problem solving in Mathematics involves getting a problem, understanding it by identifying which quantity the problem is asking one to find or solve; then devising a plan by identifying which skills and techniques one has that can be applied to solve the problem; then carry out the plan; and after getting a solution, looking back to see if the answer one gave, seems reasonable [11].

A research by Burns says “A problem-solving curriculum, however, requires a different role from the teacher. Rather than directing a lesson, the teacher needs to provide time for students to grapple with problems, search for strategies and solutions on their own, and learn to evaluate their own results. Although the teacher needs to be very much present, the primary focus in the class needs to be on the students’ thinking processes [12].

In Ethiopia, many studies revealed that only few students choose to join Department of Mathematics in all Governmental universities compared to other Departments. For example, at Adigrat University students’ enrolment figures showed a low students’ interest to join to the Department of Mathematics because most students believe that mathematics is the most difficult field of study. This can also well confirmed by the long years’ experience and observation of the researchers in teaching Numerical analysis II at Samara and Adigrat Universities. Due to this an action research were conducted on third year Mathematics students to assess their interest, attitude and skill in solving problems in Numerical Analysis II Classes and to enhance their low level of interest, attitude and problem solving skills in the course; in the case of third year Mathematics students at Adigrat University.

## II. OBJECTIVES OF THE STUDY

### *General objective of the study*

The main objective of this study was to improve problem solving skills of third year mathematics students in Numerical Analysis II by finding out and minimizing the existing factors that affect the students’ low level of problem solving skills; in case of Adigrat University.

### *Specific objectives the study*

The specific objectives of this study were:

- To assess students problem solving skills in Numerical Analysis II
- To examine students’ participation in solving Numerical Analysis problems
- To investigate the factors that affect participation of students in solving Numerical Analysis II problem classes
- To improve students problem solving skills in the course Numerical Analysis II

## III. LIMITATION OF THE STUDY

For more relevant and reliable results, it would have been better if it had included representatives of all students at Adigrat University enrolled in Department of Mathematics, but due to shortage of time, budget, over burdens of the researchers in other regular teaching activities and limited resources the study was limited to third year mathematics students.

## IV. SIGNIFICANCE OF THE STUDY

Under taking such kind of research has a great importance and contribution for the University community, and also other responsible body. The result of the study could help Mathematics instructors to identify the challenges of problem solving skills of their students capacity and may initiate them to give due attention to design new methods that help students observe, examine and improve their problem solving skills in Numerical Analysis II. Moreover, it is hoped that it can initiate others to do more and detailed research on this area.

## V. RESEARCH METHODOLOGY

### *Population of the Study*

The target population of this study was third year Mathematics students in case of Adigrat University, Ethiopia. Totally 37 respondents were involved in the final analysis. The respondents were totally taken from the Department of mathematics for it is near to the researchers and due to the prevalence of the problem.

### *Data collection instruments*

As the purpose of the study was to improve problem solving skills in Numerical Analysis II classes of the third year mathematics students at Adigrat University and to take an immediate corrective action, primary data was collected by the researchers using data collection instruments such as questionnaires, interview and observation.

### *Data Analysis and presentation*

#### *Data Analysis*

In the present study, the study data collected through interviews, questionnaires and observation was analyzed using descriptive statistics such as frequency distribution and percentages. In this analysis descriptive statistics frequency was calculated and tabulated.

#### *Data Presentation*

After the data was analyzed, main features of findings were described using frequency distribution, percentages and tables to present the data.

## VI. RESULT AND DISCUSSIONS

This section of the study deals with the analysis and interpretation of the data gathered from study targeted population using interview, questionnaires and observation in the selected third year mathematics classes at Adigrat University. In this part, the most important findings from the study were discussed.

According to table 1, out of the total students, 34 (91.89%) of the respondents were female students and 3 (8.11%) of them were males.

Table 1: Student's gender

Item description	Response	N <sup>o</sup> of respondents	Percentage
Sex	Male	3	16.22
	Female	31	83.78
	Total	37	100

Source: own survey 2018

From Table 2, it can be seen that mathematics was not their first choice when most (83.78%) of the students joined to the department at Adigrat University. This is because majority of them (61.29%) were not interested and 25.80% were assumed that mathematics is the most difficult field of study. And about 12.91% of the students answered that, they had no information about mathematics before they join to the Department of Mathematics.

Table 2: students' response on mathematics choice when they joined Adigrat University

Item description	Response	N <sup>o</sup> of respondents	Percentage
When I joined Adigrat University, mathematics was my first choice	Yes	6	16.22
	No	31	83.78
	Total	37	100
Mathematics was not my first choice, because I was	Not interested	19	61.29
	Assumed that the course is difficult	8	25.80
	Not have prior information	4	12.91
	Total	31	100

Source: own survey 2018

As shown in Table3 below, most (86.49%) of the students believe that they were not actively participating in Numerical Analysis II Classes. Moreover, 89.19% of the students do not believe that learners have positive attitude towards Numerical analysis II classes.

Table 3: students' interest and participation towards Numerical analysis II

Item description	Response	N <sup>o</sup> of respondents	Percentage
Do you believe that you have positive attitude towards Numerical analysis II classes?	Yes	5	13.51
	No	32	86.49
	Total	37	100
In Numerical analysis II classes, all students are actively participating	Agree	0	0
	Not Sure	4	10.81
	Disagree	33	89.19
	Total		

Source: own survey 2018

As indicated in Table 4 only 18.91% of the respondents answered that the time allocated for each Numerical Analysis II syllabus is proportional, where as 27.03% responded that they do not have information about syllabus but majority of the students strongly disagree the proportionality.

Table 4: Numerical Analysis II versus time allocation

Item description	Choice	N <sup>o</sup> of respondents	Percentage
The time allocated with the content covered in Numerical Analysis II syllabus is proportional	Agree	7	18.91
	Not Sure	10	27.03
	Disagree	20	54.06
	Total	37	100

Source: own survey 2018

Table 5 shows that the level of problem solving skills in Numerical analysis II was almost low (81%) except the rest of respondent (18.92) have a medium skills in solving problems in Numerical analysis II classes.

Table 5: The level of problem solving skills in Numerical analysis II

Item	Choice	N <sup>o</sup> of respondents	Percentage
How is your extent of problem solving skill in Numerical analysis II?	High	0	0
	Medium	7	18.92
	Low	30	81.08
	Total	37	100

Source: own survey 2018

From table 6, among the different factors which may contribute for the low problem solving skill of students, the primary ones are inadequacy of classrooms (53.33%), shortage of instructional materials (53.33%), and lack of suitable library (53.33%). Moreover, lack of reference books and lack of regularly arranged tutorial classes have their own effect.

Table 6: Factors to low problem solving skill of students in Numerical analysis II

Item	Choice	N <sup>o</sup> of respondents	Percentage
Inadequacy of classrooms	High	16	53.33
	Medium	12	40.00
	Low	2	6.67
	Total	30	100
Shortage of instructional materials	High	16	53.33
	Medium	12	40.00
	Low	2	6.67
	Total	30	100
Lack of suitable library	High	16	53.33
	Medium	12	40.00
	Low	2	6.67
	Total	30	100
Lack of tutorial class	High	12	40.00
	Medium	12	40.00
	Low	6	20.00
	Total	30	100

Source: own survey 2018

By table 7, all the selected students responded the instructor has key impacts on learners' teaching learning process

Table 7: How much your Numerical analysis II teacher affect the teaching-learning process

Item	Response	N <sup>o</sup> of respondents	Percentage
Do you think that your Numerical analysis II teacher have an actual impact in the teaching-learning process?	Yes	37	100
	No	0	0
	Total	37	100

Source: own survey 2018

As shown in table 8, out of the selected students 64.86% of the students responded that the influence of Numerical analysis II teacher at Adigrat University to develop problem solving skills were low.

Table8: Influence of Numerical analysis II teacher to develop problem solving skills

Item	Response	N <sup>o</sup> of respondents	Percentage
How effective is your teacher in influencing you to develop problem solving skills?	High	3	8.11
	Medium	10	27.03
	Low	24	64.86
	Total	37	100

Source: own survey 2018

As indicated in table 9, most of the respondents agreed (strongly or slightly) that the teachers influence which may contribute for the low problem solving skill of students since they do not provide regular counseling; they do not encourage cooperative learning, and they do not apply active learning methods.

Table 9: Low contribution of Numerical analysis II teacher to develop problem solving skills

Items	Choice	Nº of respondents	Percentage
They do not give us advice	Agree	26	70.77
	Slightly agree	8	21.62
	Disagree	3	8.11
	Total	37	100
They do not motivate us to learn	Agree	11	29.73
	Slightly agree	12	32.43
	Disagree	14	37.84
	Total	37	100
They do not encourage cooperative learning	Agree	12	32.43
	Slightly agree	11	29.73
	Disagree	14	37.84
	Total	37	100
They do not apply active learning	Agree	37	100
	Slightly agree	0	0
	Disagree	0	0
	Total	37	100
They do not come to class prepared	Agree	20	54.05
	Slightly agree	15	40.54
	Disagree	2	5.41
	Total	37	100

Source: own survey 2018

## VII. CONCLSION AND RECOMMENDATION

### Conclusions

This action taken has the opportunity to engage in mathematical problem solving and to develop problem solving skills techniques through reflecting on a set of heuristics (the study of how people use their experience to find answers to questions or to improve performance). We will work both individually and in groups on mathematical problems, drawing out the strategies we used and applying them to the next

Generally, we conclude that problem-solving should focus on problems that stimulate students' imaginations that appeal to their interest, that accord with their knowledge and skills. As well as exercising careful judgment in the selection of problems, the teacher's most important role is to offer just the right amount of support and encouragement, ensuring that a solution is within a student's grasp but not too easily discovered.

Finally, we say that please record your steps and ideas even if they do not lead you to a successful solution, since this might serve as a venue to trace, modify, and possibly reformulate them.

### RECOMMENDATION

- Mathematics Instructors should motivate and support their students how to develop problems solving skills.
- Tutorial classes should be arranged in order to increase participation of female students.
- Mathematics curriculum developers should review mathematics syllabus and the time allocation.
- Encourage students to do and present their work in class, giving enough time to exercise all students.

## VIII. ACKNOWLEDGMENT

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**A questionnaire to be filled by third Year Mathematics Students**

**Title:** Improving problem solving skills of Year III mathematics students taking the course Numerical Analysis II

The purpose of this questionnaire is to collect information about the current status of the problem solving skills of Year III mathematics students taking the course numerical analysis II, in case of Adigrat University. The information gathered through this questionnaire will be used only for Action research purpose and it is assured that your response will be held in strict confidentiality. Therefore, you are kindly requested to fill in the questionnaire frankly and responsibly for it is the chief determinant to the success of the study. The researchers express their thanks to you in eagerness that you would spend extra time and energy to complete this questionnaire.

For each of the statements (questions) below, indicate your response from the given alternatives for each item by putting tick [✓] or encircling the appropriate answer and for open-ended questions write your answer on the space provided.

- I) Student's gender  
 Sex :      A.      Male              B.      Female
- II) Students' interest and attitude towards mathematics
1. When you joined to Adigrat University, was mathematics your first choice?  
 A.      Yes                      B.      No
2. If your response to question №.1 is "B", why?  
 A.      Not interested in mathematics      B.      No prior information about mathematics  
 C.      The course is difficult              D.      Others
3. In Numerical Analysis II class all students are actively participating:  
 A.      Agree    B.      Not Sure    C.      Disagree
4. Do you believe that you have positive attitude towards Numerical Analysis II classes?  
 A.      Yes    B.      No
5. The time allocated with the content covered in Numerical Analysis II syllabus is proportional  
 A.      Agree    B.      Not Sure    C.      Disagree
6. How is your extent of problem solving skill in Numerical Analysis II?  
 A.      High                      B.      Medium                      C.      Low
7. If your response to question №. 6 is "C", judge the extent to which the following factors contribute to it.
- | Response                            | High  | Medium | Low   |
|-------------------------------------|-------|--------|-------|
| Inadequacy of classrooms            | _____ | _____  | _____ |
| Shortage of instructional materials | _____ | _____  | _____ |
| Lack of suitable library            | _____ | _____  | _____ |
| Lack of tutorial class              | _____ | _____  | _____ |

If there are other factors, please list them out:

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- III) Teacher factors on students low participation in solving problems Numerical Analysis II
8. Do you think that your teacher of Numerical Analysis II has an actual impact in teaching-learning process?  
 A.      Yes                      B.      No
9. If your response in question №. 8 is "A", please list down the detailed reasons:
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10. How effective is your teacher in influencing you to develop problem solving skills?  
 A.      High                      B.      Medium                      C.      Low
11. If your response to question 10 is "C", rate the contribution of the following cases:
- | Response                                   | <u>Agree</u> | <u>Slightly Agree</u> | <u>Disagree</u> |
|--|--------------|-----------------------|-----------------|
| They do not give us counseling             | _____        | _____                 | _____           |
| They do not motivate us to learn           | _____        | _____                 | _____           |
| They do not encourage cooperative learning | _____        | _____                 | _____           |
| They do not apply active learning          | _____        | _____                 | _____           |

If any, specify:

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**Thank You!**