

HIGH MATHEMATICS ANXIETY STUDENTS AND MATHEMATICAL PROBLEM SOLVING

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As part of a larger study on Mathematics Anxiety and Mathematical Problem Solving this paper examines only one aspect related to it, namely high mathematics anxiety students and their choice of problems to solve. Students were asked to rank the order in which they would choose to solve three given problems. They also had to state the reasons and describe their feelings that guided their ranking. Significant differences in feelings were noted with regards to the rank order of the problems they chose to solve.

INTRODUCTION

There is an increasing focus on the use of students' journal writing to reinforce mathematics instruction. Scheibelhut (1994) and Buschman (1995) believe that through journal writing each student is actively involved in reflecting on what he or she has been doing in mathematics classrooms. For problems related to the affected domain, the students must be aware that the focus is on how they actually feel and not to jot down expressions just to please the teacher (Yazilah & Fan, 2002). The objective of this study was to explore high mathematics-anxiety students' reasons and feelings with regard to choices of problems.

MATHEMATICAL PROBLEM SOLVING AND MATHEMATICS ANXIETY

Subjects

As part of a study on mathematical problem solving and mathematics anxiety of secondary two students in Singapore, 112 high mathematics-anxiety students were administered the paper and pencil instrument "Choice of Problems."

Instrument

The paper and pencil instrument, "Choices of Problems" consisted of six reflective questions based on the three problems. The three problems were assembled from various sources. The Time problem, was adapted from Baroody (1993). The Cat and Rabbit problem was adapted from Stacey and Southwell (1996) and Number problem was adapted from Fong (1994).

The Three Problems

Time Problem

Miss Lee arrived at the concert hall 15 minutes before a concert began. However, due to some technical problems, the concert started 10 minutes later. The whole concert lasted for 2 hours 25 minutes. It was 10.30 pm when Miss Lee left the concert hall. At what time did Miss Lee arrive at the concert hall? Show all your working and explain it.

Cat and Rabbit Problem

A cat is chasing a rabbit. They are 160 metres apart. For every nine metres that the cat runs, the rabbit jumps seven metres. How much further must the cat run in order to overtake the rabbit? Show all your working and explain it.

Number Problem

The sum of two numbers is 36 and their difference is 12. Find the two numbers. Show all your working and explain it.

The Six Reflective Questions

You do not have to solve the problems now. Just read the three problems and say which one would you like to solve first, if you had to solve them some other time.

1. Which problem would you choose first?
2. Why is that so? (Give at least three reasons.)
3. Describe how do you feel about solving this type of problem that you have chosen to solve it first?

You do not have to solve the problem now. Just read the three problems and say which one would you like to solve last, if you had to solve them some other time.

4. Which problem would you leave till last?
5. Why is that so? (Give at least three reasons.)
6. Describe how do you feel about solving this type of problem that you have chosen to leave it till the last?

Procedure

The instrument "Choice of Problems" was administered under the examination conditions. Students were asked to rank the order in which they would choose to solve three given problems. They also had to state the reasons and describe their feelings that guided their ranking. They were given sufficient time to complete the instrument.

Data

The reasons given and feelings manifested by 112 high mathematics-anxiety students when choosing a problem to solve are presented and categorized. Although three problems were used in the study, in this paper the detailed categorisation for only the Time problem will be presented and discussed.

Detailed categorisation of the individual responses of 112 the high mathematics-anxiety students' choice of solving the Time problem first is found in Table 1. High mathematics-anxiety students' choice of solving the Time problem last is shown in Table 2. The feelings manifested by 112 high mathematics-anxiety students when choosing the Time problem to solve first and last are presented in Table 3 and Table 4 respectively.

Time Problem

Table 1 shows the reasons, frequency and percentage of high mathematics-anxiety students in choosing to solve the Time problem first.

Table 1
Reasons for Choosing Time Problem as the First Problem to Solve

Reasons	N=39 %	Samples of Responses
Easiest problem	37 (94.87%)	"It looks easier than the rest." "It is straightforward of the three." "It's the one which I understand the most clearly."
Understand the problem	16 (41.03%)	"It is easy to understand and I can get a picture of the problem immediately."
Familiar problem	14 (35.90%)	"I am more familiar with time." "I am most familiar with this type of question."
Minimum working required	10 (25.64%)	"Do not need a lot of workings." "It needs the least working."
Minimum time required	7 (17.95%)	"It is faster than the two other questions." "Not be time consuming."
Difficulty of the problem	6 (15.38%)	"It is difficult to solve." "Basically, it is the hardest one as there is a lot of addition."
Confidence	4 (10.26%)	"I am able to do." I mean, there's more confidence in doing it as I know a little of what to do." "I have confidence to do this question correctly."
Liking	3 (7.69%)	"I like this type of problem." "This is the kind of question I like to work on."
Order of the problem	2 (5.13%)	"Problem 1 is the first problem. I will go according to the order of the problems unless I do not know how to solve them."

Note: More than one reason was provided by each student

Out of 112 high mathematics-anxiety students, 39 (34.82%) of these students chose to solve the Time problem first. All 39 students have more than one reason for choosing to solve the Time problem first. "Easiest problem" had been the popular choice for 37 students (or 94.87% of the sample) who chose to solve the Time problem first. Other reasons quoted are as follows:

"Easier than problem 2 and problem 3", and

"It is easier than the other two."

"Understanding the problem" including the type of topic and clues were reasons offered by more than 40% of students (n=16 or 41.03%) to explain their first choice:

"The topic on time is much easier to understand."

"First of all it is very simple to understand. We do not have to really find a lot of things because all the clues are there."

Familiarity of the problem was excited by 14 high mathematics anxiety students as one of the reasons in choosing to solve the problem first:

"I am more familiar with the steps regarding the first question."

"This question seems familiar as I have come across this question before."

Ten students felt that solving the problem that required less working is also necessary as it would minimise the mistakes in their working. These were some reasons given by them:

"It can be solved by simple subtraction and addition, more direct and less steps involved."

"Problem 1 requires less steps to complete, thus there are less chances of making careless mistakes."

Seven high mathematics anxiety students spent less time solving the Time problem first as they perceived that "it is faster than the two other questions" and it would "not be time consuming." Some students mentioned that they "won't use much time solving it thus

saving more time" for other problems. Only six high mathematics anxiety students perceived difficulty with the problem when they chose to solve the Time problem as their first choice. These students felt that tedious computations would cause the problem to be difficult as "there is a lot of addition." Five students indicated they were confident in solving the Time problem as it would result in the correct solution while three students like to solve problems involving time. Only two students felt that since the Time problem appeared at the start of the question paper, they would solve it first.

Table 2 summarises the reasons provided by the 16 high mathematics-anxiety students who would chose to solve the Time problem last. In Table 2, all the 16 students provided three reasons as to why they chose to do the Time problem last. Three quarters (12 or 75%) of the high mathematics-anxiety students expressed that the difficulty of the Time problem caused them to solve the problem last. They strongly stated that:

"It is the most complicating."

"It looks the hardest."

Ten of these students lamented that "it involves quite a lot of steps" and "many working is required in this questions." Half of the students expressed that they solved the Time problem last "because more time is needed to understand the problem." Moreover, they also need "to take a longer time to think and get the answer." The Time problem appears to be a longer problem for six of the students. They perceived:

"The question itself is already so long."

"I think that the question is long-winded."

"The paragraph is too long and confusing."

A lower proportion of students chose to solve the Time problem last for the following reasons: problem involving time, easiest to solve, problem confusing, lack of confidence, and more thinking required.

Table 2
Reasons for Choosing Time Problem as the Last Problem to Solve

Reasons	N=16 (%)	Samples of Responses
Difficulty of Problem	12 (75.00%)	"It is difficult to explain the problem." "It is the most complicating." "It looks the hardest."
Multiple steps required	10 (62.50%)	"It involves quite a lot of steps." "Many working is required in this question." "It is the longest."
More time required	8 (50.00%)	"It takes more time to analyse." "It is time-consuming." "I may take a long time to comprehend."
Length of the Problem	6 (37.50%)	"It is also a very long question." "It is the longest."
Problem involving time	3 (18.75%)	"It has something to do with time and I might be careless again when I try to subtract or add it." "I often get these kind of questions wrong."
Easiest Problem	3 (18.75%)	"The easiest, in my view, to solve." "It is easier to do and looks simpler with less working."
Confusion posed	3 (18.75%)	"Question is using too much information to confuse student." "It makes confusion though it's easy."
Lack of confidence	2 (12.50%)	"I am not very confident in getting the correct answer for the question." "I am not very confident in getting a perfect score for this question."
Higher order thinking required	1 (6.25%)	"I have to read the given information more carefully and give it more thought." "It requires a lot of thinking."

Note: All of 16 students provided three reasons.

Feelings Toward the First Choice Time Problem

Table 3
*Summary of High Mathematics Anxiety Students' Feelings
 Towards the Time Problem Which They had Chosen to Solve First*

Feeling	(N=39)	
	No.	%
Confident	18	46.15
Comfortable/Relaxed/Calm	17	43.59
Happy	7	17.95
Feel Successful/Satisfied	5	12.82
Excited	3	7.69
Anxious/Stressed/Tensed	1	2.56
Confused	1	2.56
Interested	1	2.56
Irritated/Frustrated/Angry	1	2.56

Note: Some students indicated more than one feeling.

Table 3 shows the frequencies and percentages for the nine feelings indicated by these 39 high mathematics-anxiety students for the Time Problem. In Table 3, it appears that a majority of the high mathematics-anxiety students expressed positive feelings towards the problem which they chose to solve first. Confident and comfortable/relaxed/calm were the top two feelings expressed by the students when they chose to solve the problem first.

Thirty nine out of 112 students had decided to solve the Time Problem first. A large proportion (90%) of the students felt that they were confident and comfortable/relaxed/calm towards the Time Problem. Some students (18%) were happy to encounter such problems. To feel successful/satisfied in the problem, five students reported that they would solve the Time Problem first. Within this problem, three high mathematics anxiety students were excited

when confronted with such problems. Despite the positive feelings towards the Time Problem, anxious/stressed/tensed, confused, irritated/frustrated/angry and fearful towards the Time Problem were expressed by another student.

Feelings Toward the Last Choice Time Problem

Table 4 shows the frequencies and percentages for the seven, feelings indicated by the 16 high mathematics anxiety students for the Time Problem.

Table 4
Summary of High Mathematics Anxiety Students' Feeling Towards the Time Problem Which They had Chosen to Solve Last

Feeling	(N=16)	
	No.	%
Anxious/Stressed/Tensed	11	68.75
Irritated/Frustrated/Angry	3	18.75
Bewildered	1	6.25
Confused	4	25
Relaxed	1	6.25
Bored	1	6.25
Confused	1	6.25

Note: Some students indicated more than one feeling.

From Table 4, it also appears that a majority of the high mathematics-anxiety students were anxious and had mixed feelings towards the problem which they chose to solve last. Anxious/stressed/tensed and irritated/frustrated/angry were the top two feelings expressed by the students when they chose to solve the Time Problem last.

Sixteen out of 112 students decided to solve the Time Problem last. A proportion (14 out of 16) of students felt that they would be anxious/stressed/ tensed and irritated/frustrated/angry when they approached the Time Problem. Four students were confused when they met with such a problem. Another four students' feelings were bewildered, relaxed bored and confident towards the Time Problem.

FINDINGS

From the analysis it was found that the reasons given by high mathematics-anxiety students when choosing a problem to solve first were: "easiest problem", "familiar problem", "minimum working required", and "understand the problem." The main reasons for choosing to solve a particular problem last were: "difficulty of problem", "multiple steps required", "more time required" and lack of understanding."

It can also be concluded that the feeling manifested by high mathematics-anxiety student when choosing a problem to solve first were more positive. It appears that high mathematics-anxiety students felt confident, comfortable, and calm as well as happy when they solved a particular problem first. However, for a particular problem that they chose to solve last, they felt anxious, stressed, tensed, irritated, frustrated, angry fearful and bewildered.

CONCLUSIONS

The study shows that given the opportunities, students in our schools can express their inner thoughts and feelings in writing to their teachers. Students also demonstrate metacognition when they express feelings and attitudes to the cognitive activities they are involved. It is another form of two-way interaction between teacher and students where more affective and metacognitive questions are asked.

For mathematics teachers to help their students to develop problem-solving ability, it is critical that they know the choice of their problems. As this study has shown, journal writing can give detailed knowledge of a student's preferences in choosing the type of problems to solve. The journal writing responses are relevant and useful in that they assist the teachers in setting the right kind of problems during instructional process.

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