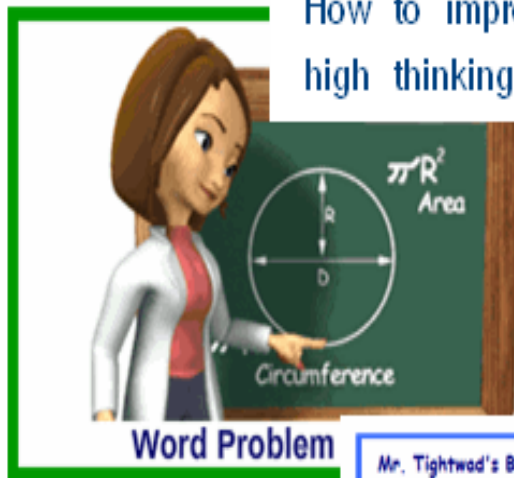


## How to improve the skill of solving high thinking problems



### Mr. Tightwad's Barbecue

#### Important Information

60 people altogether.  
Everyone can have 2 hot dogs, 2 rolls and 1 can of soda.  
Hot dogs are sold in packages of 8.  
Rolls are sold in packages of 10.  
Soda is sold in packs of 12.



$$\begin{aligned}
 60 \times 2 &= 120 \text{ hot dogs} \div 8 = 15 \text{ packages} \\
 &= 120 \text{ rolls} \div 10 = 12 \text{ packages} \\
 &= 60 \text{ cans} \div 12 = 5 \text{ packages}
 \end{aligned}$$

1 package of h.d. = \$2.75  
 buy 4 get 1 free

$$\begin{array}{r}
 \$2.75 \\
 \times 4 \\
 \hline
 \$11.00 \text{ (5)}
 \end{array}$$

5 = \$11.00  
 15 = \$33.00

**Question 4A**

In the accompanying figure, point P is the center of each circle. The circumference of the larger circle exceeds that of the

(A)  2  
(B)  3  
(C)  6  
(D)  8  
(E)  12

Figure 4A

$C_L - C_S = 12\pi$   
 $C = 2\pi r$   
 $2\pi(r+w) - 2\pi r = 12\pi$   
 $2\pi r + 2\pi w - 2\pi r = 12\pi$   
 $2\pi w = 12\pi$

SAT Math Pro  
Circles  
Practice Set 1

Hide Figure

Done by:

Hala Reyadh

Abeer Rasras

Feryal Shabeeb

**Action Research Study  
Submitted to the Education Institute's  
Action Research Database**

**Author(s)**

Hala Reyadh Ibrahim, Abeer Momamed Rasras, Feryal Sabry Shabeeb

**Title of the Study:**

**How to improve the skill of solving high thinking problems**

**Location or Institution (optional)**

Ruqayya preparatory ( Al Bayan Complex)

**Abstract** (maximum of 150 words)

Obviously, most of the students can not make connection between what did they learn in Math and the real life problems they face. So our project is planning to:

\*Improve the skill of solving the real life problems.

\*Develop the critical thinking through learning many of Math strategies.

So we decided to focus on improving the high thinking skill, improve the performance in math and enhance their knowledge. And this will be during five weeks, two times per week, 45 minutes each time through a prepared course.

- Make a diagnostic test to state the students' level before we carry out the project.
- Collect the continuous evaluation results during the project and analyze them to determine the progress in the level of the students' performance.
- Write weekly reports about the goals we achieved and to find out what we have to do to continue in effective way.
- By the end of the project we will make a questionnaire about the students' opinions and the benefits they gained from our project.

By The End:

\* From this experience, we are sure that teachers must focus on how to teach not only what to teach.

\* More strategies you teach more creative solution you get.

\* Videos, math programs, workshops, challenge questions and tasks... even your encouragement, affirmations, and confirmations are very important to let the students trust their selves and try to solve what they thought it is hard.

\* the way you think with can change according to the way you learn with.....

**Grade Level:** primary preparatory secondary

**Data Collection Methods:** (for example – questionnaire, interview, observation, photos, examinations, interview, journals)

**Opened discussion**

**Subject/Topic:** English Science Mathematics

Arabic Social Studies Islamic Studies Music PE

Administration Other \_\_\_\_\_

## **Introduction:**

During our work as teachers, we noticed that most of the students can solve the direct math questions or the questions that their solutions depend on rules or specific steps. But compound questions or the problems that connect with our life it is not understandable for them. And this is not only for the weak students; it is also for clever students. So it was necessary to find out the reasons and how to over come this problem.

For this year the Math Club decided to deal with this problem and try to find answers for many questions like:

- Why even clever students can not solve the problems that connect with real life?
- How can we help students to over come this problem?
- Is really the training course that we are going to provide our students with will be helpful?
- What are we (teachers and students) going to gain from this project?

## **Working with the project:**

### **The sample:**

For the weak students it was so hard to choose our sample from them because they need special classes to improve their basic skills, so we decided to choose the sample from the clever students and the students who have the ability to solve at least 80% of the ordinary math problems.

### **The project plan:**

It is clear that most of students do not like math, they think it is a hard subject and no way to deal with but the problem is: they do not know how to think about a problem, how they can arrange the information, how to use data and make connections or make deductions to find a solution .and the big problem they can not apply what did they learn in math to their real lives.

So we decided to focus on improving the high thinking skill, improve the performance in math and enhance their knowledge. And this will be during five weeks, two times per week, 45 minutes each time through a prepared course.

## Starting the project:

Step by step and during five weeks we tried hard to achieve our goals and carry out the project plan as follow:

### Week 1:

- Record the participants' names
- Discuss about the project, what are going to do and why we have to?
- Give the diagnostic test & record the results.
- Provide the students with a work sheet of high thinking questions to solve them and make their own tries.
- Discuss some of the high thinking problems.

### Week 2 and Week 3:

- Give a work shop of problem solving strategies like:
  - 1) Look for a pattern
  - 2) make a table or an organized list
  - 3) Working backwards
  - 4) Guess and check
  - 5) Draw a picture
  - 6) Write a number sentence
  - 7) Using logic
  - 8) using laws of math
- Solve different and enough questions for each strategy
- Give evaluation test and record the results.

### Week 4 and Week 5:

- Give the students video lessons to enhance their math knowledge (<http://www.math-videos-online.com/geometry-videos.html>)
- Give the evaluation test (2&3).
- Give the students the questionnaire
- Make a discussion about the benefits they gained from the training and Ask about their suggestions to improve the course for the next year.

The lectures were full of teaching, discussions, reactions, recording every progress, trying to deal with many difficulties like:

- When we gave the diagnostic test it was hard for them to feel that they are failures, they disappointed. So it was important for us to encourage them and discuss about our project and how it will help them to improve and increase their ability and their skills to solve these types of problems.
- We put in our consideration that, not all of them have the same ability of learning .so it was important to show the new strategies with enough examples and represent it with different ways.

- Using the strategies and discovering a solution or even a part of it .it was necessary to increase their self esteem and trust their selves. (affirmations are important to increase the ability of learning).

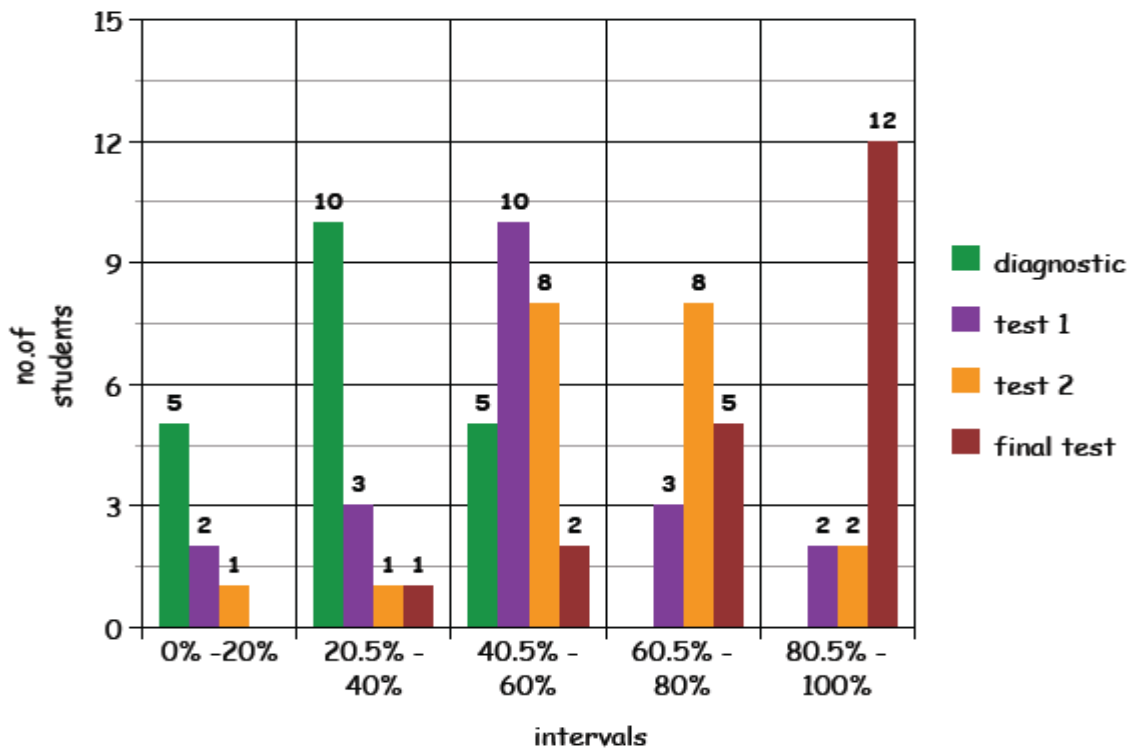
## Graphs and data analysis:

The following tables and the bar chart show the results of the tests of the high thinking problems.

No.	Names	Grade	Diagnostic test (50)	%	test 1 (10)	%	test2 (15)	%	final test (100)	%	The average marks
1	دعاء وليد	8K	2	4%	7	70%	13	87%	80	80%	60%
2	صفاء أسامة	8K	0	0%	2	20%	8	53%	71	71%	36%
3	استبريق عبد العزيز	8G	5	10%	3	30%	8	53%	83	83%	44%
4	ياسمين نبيل	8C	12	24%	6	60%	14	93%	93	93%	68%
5	داليا الأشقر	8A	25	50%	7	70%	7	47%	88	88%	64%
6	اية أشرف	8A	15	30%	5	50%	12	80%	77	77%	60%
7	سعاد محمد	8K	15	30%	5	50%	11	73%	97	97%	62.5%
8	شادن يوسف	8L	20	40%	5	50%	10	67%	98	98%	64%
9	هديل ماجد	8L	16	32%	6	60%	8	53%	94	94%	60%
10	خلود مولوي	8F	20	40%	8	80%	9	60%	96	96%	69%
11	يسرى رحمة	8A	25	50%	10	100%	10	67%	91	91%	77%
12	أمل الكلوت	8L	15	30%	5	50%	11	73%	78	78%	58%
13	هبة محمد	8L	5	10%	4	40%	9	60%	63	63%	43%
14	غنى مصطفى	9D	19	38%	6	60%	12	80%	90	90%	67%
15	بشرى لصوي	8I	10	20%	6	60%	10	67%	93	93%	60%
16	ريم سعيد	9B	15	30%	5	50%	9	60%	82	82%	55.5%
17	ريم جمال	9D	10	20%	5	50%	10	67%	63	63%	50%
18	صفاء مبارك	8I	12	24%	2	20%	3	20%	56	56%	30%
19	نورة الجردى	9B	25	50%	9	90%	8	53%	89	89%	70.5%
20	غرور عبد الواحد	9E	5	10%	4	40%	5	33%	45	45%	32%
<b>Average marks</b>			13.55	27.1%	5.5	55%	7	62.3%	81	81%	56%

Tests progress				
Interval	diagnostic	Test 1	Test 2	Final test
0% - 20%	5	2	1	0
20% - 40%	10	3	1	1
40% - 60%	5	10	8	2
60% - 80%	0	3	8	5
80% - 100%	0	2	2	12

The result of the evaluation tests



### The description:

\*from the previous tables we can notice that :  
the percentage of the students performance in the tests increased from 27.1% to 81%.and this is a big progress ,( to be honest we didn't expect it, but it happened)

\*the graph show the gradually progress for their performance and this was because of :

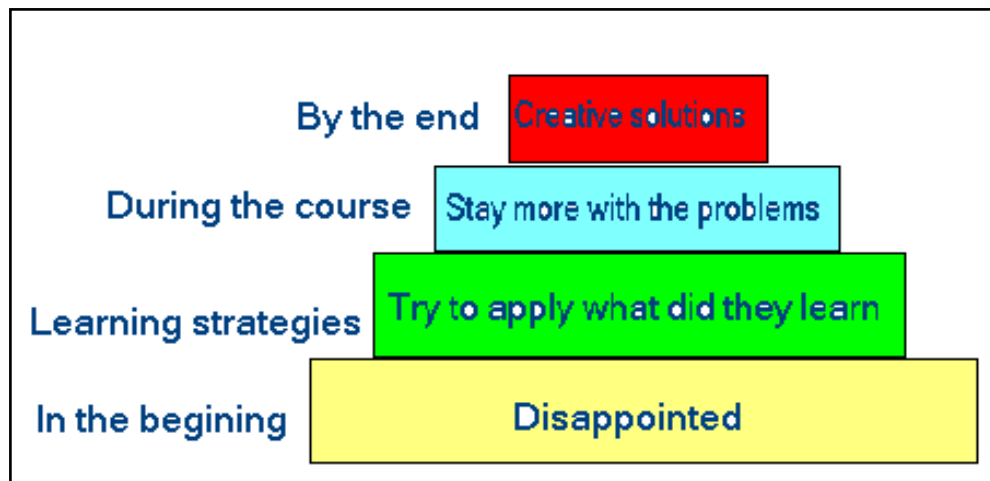
- In the diagnostic test the student were very disappointed – their marks were so low.
- Started the training course the students started to learn new strategies and started to change the way they are thinking with.(marks started to rise up in test1 and test 2,it is good affirmation and confirmation for them)
- By the end of the course the progress of the performance is clear and we think the way they are using to solve a problem is completely different and changed .

### **The attitude progress:**

During the course we observed the students carefully. their feelings and their reactions are varied and gradually changed as follow:

- in the beginning of the course they were disappointed and just few of them tried to solve any of the questions that in the first sheet.
- when they learnt some of the new strategies they began to stay with the problems more time and try to apply the strategies to the problems between their hands.
- more strategies and extra ways of thinking a competition started among the girls and the best one who can solve the problem with more than one way.

### **The attitude progress**



### **By The End:**

- \* From this experience, we are sure that teachers must focus on how to teach not only what to teach.
- \* More strategies you teach more creative solution you get.
- \* Videos, math programs, workshops, challenge questions and tasks... even your encouragement, affirmations, and confirmations are very important to let the students trust their selves and try to solve what they thought it is hard.
- \* the way you think with can change according to the way you learn with.....  
( and this what happened in our project, let us try to apply it in our classes)

## **References:**

(<http://www.math-videos-online.com/geometry-videos.html>)

<http://www.mathplusfun.com/Default.aspx>

<http://www.mathplayground.com/index.html>

<http://www.johnpratt.com/index.html>

<http://www.tea.state.tx.us/index.html>

check list

Questionnaire

Opened discussion

# Supplements

## Check list

Date: .....  
Class:.....

	never	rarely	Some times	often	always
1) The student looks interested and motivated.					
2) The student stays in task.					
3) The student achieves her home works.					
4) The student can deal with the new problems easily.					
5) The student comes on time.					
6) The student feels comfortable with teaching strategies and the academic stile.					
7) The student applies this work independently.					

Write notes about students activation .



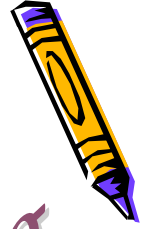
Students' questionnaire

Name:

Class:

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1-During the Math Club meetings the class atmosphere is interesting.					
2-The lessons increase your commitment to learn how to think with different ways.					
3-The new academic strategies refresh and enhance your thinking.					
4-During the Math Club lessons you can achieve your work independently.					
5-Practicing using different thinking strategies make you more confident.					
6-The exercises achieved during the Math Club lessons are varied.					
7-During the Math Club lessons you feel motivated.					

# Problem Solving Strategies



There is a common saying  
"Don't just stand there, do  
something!"

When solving a problem, don't  
just think, write something!  
Draw a diagram or make a list!



# Problem Solving Strategies are:

- 1) Look for a Pattern.
- 2) Making a Table or an Organized List.
- 3) Working Backwards.
- 4) Guess and Check.
- 5) Draw a Picture .
- 6) Write a Number Sentence.
- 7) Solving a simple problem .
- 8) Using Logic
- 9) Using laws of math



## Why do we use STRATEGIES ?

The comprehensive nature of the list of problem solving strategies allows individuals to use a checklist approach to problem solving. It also could facilitate training others in problem solving. The classification of the strategies into types, may facilitate the development of new strategies ,that fit into a specific category.



## *Remember That:*

- \*The student should acquire as much experience of independent work as possible. But if he is left alone with his problem without any help or with insufficient help, he may make no progress at all.
- \*If the teacher helps too much, nothing is left to the student.
- \*The teacher should help, but not too much and not too little, so that the student shall have a reasonable share of the work.



## *Look for a Pattern*

Find the sum of all  
numbers from 1 to 100??



# The Farmyard Problem



In the farmyard there are some cows and some chickens.

In fact there are 87 heads and 266 legs.

How many cows are there in the farmyard?



## Making a Table



cows	chickens	Cows legs	Chickens legs	total	difference
50	37	200	74	274	8
40	47	160	94	254	-12
42	45	168	90	258	-8
46	41	184	82	266	0



# Working Backwards.



If the square root of the square root of the square root of a number is 2

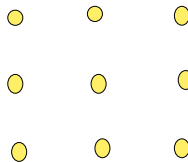
what's the number ?



# Guess and Check



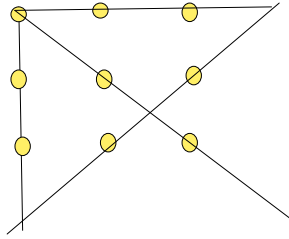
How can you connect nine dots (in three straight rows of three) with four straight lines without raising the pencil from the paper?



# A creative Solution

This calls for a creative answer.

It requires going beyond the end of the square of nine dots:



# Write a Number Sentence.

Five boxes .in each box  
there are 5 boxes , in each  
box there are 5 boxes.

How many boxes are there?



# a Number Sentence is :

$$5 + 5 \times 5 + 5 \times 5 \times 5 =$$

155



# Using Logic

1) Two mothers and two daughters were fishing. They managed to catch one big fish, one small fish and one fat fish, since they caught a total of only three fish, how is it possible that they each took home a fish?

2) An ant ascends the wall with height 16m, it ascends 3m each hour. And slip 2 m. After how many hours will the ant reach the top of the wall?



# Using laws of math



1) Without using a calculator, list the numbers

$$2^{100} \quad 3^{75} \quad 5^{50}$$

in order from the smallest to the Largest

( show your work)?

2) How many digits does the number  $2^{1999} \times 5^{1989}$  have?

3) what is the unit digit of the product of the 100 smallest primes ?

4) Correct this equation by repositioning one number and doing nothing else  $62 - 63 = 1$  ?



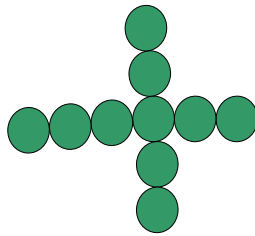
5) It takes a man one hour to dig a hole 2 metres long, 2 metres wide and 2 metres deep. How long would it take the same man to dig a hole 4 metres long, 4 metres wide and 4 metres deep, assuming that he digs at the same rate of speed?



# Draw a Picture



- 1) Arrange seven coins in three rows or columns, In each three coins?
- 2) Move one coin to get two straight lines in each 6 coins, and intersect from the middle?



- 3) Two equal test tubes , in the first there is one ameba, in the second there are two amebas each ameba can double in 3 minutes , the two amebas need two hours to fill the test tube, how much time does one ameba need to fill the test tube?



# Problem Solvers said:

☀ The real obstacle when we are faced with an impossible problem is inside us.

It is our experiences, mistaken assumptions, half-truths, misplaced generalities, and habits that keep us away from brilliant solutions.

☀ It's not that I'm so smart, it's just that I stay with problems **longer**



Albert Einstein

