

San Francisco Math Circle: Evaluation of Changes in Mathematical Attitude, First Report

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MathFest 2012



Goals/Outline of Talk

Review of Math Circle Evaluation Development

- Developing Program Goals
- Developing Evaluation Framework
- Resulting Questions and First Report on Evaluation

Questions

SFMC Program Goals

- At San Francisco Math Circle we hope to develop a Safe Mathematical Community for individual students and teachers involved in the program which will result in:
- increased individual mathematical competency;
- increased problem solving competency;
- individual students choosing to do mathematical activities;
- individuals students choosing to explore harder mathematical tasks;
- increased persistence on mathematical tasks;
- an increased understanding of what math is.

Creating the Theoretical Model of Evaluation of San Francisco Math Circle

The literature has shown a strong connection between the SFMC goals and the measurable values of:

- Personal expectations of <u>mathematical competency</u>;
- Personal values of mathematical tasks and activities.
 - <u>Utility Value</u> Math is useful for my future goals
 - Intrinsic Value Math is important to me
 - Attainment Value It is important that I accomplish...
 - <u>Cost</u> Sacrifice required to participate in math



THEOLEGICAL PROVIDE TO FOR

Mathematical SOCIALIZERS

(MATH CIRCLE/ MATH CLASS/ OTHERS?)

Personal Math Goals

(MATH CIRCLE/ MATH CLASS/ OTHERS?)

Safe Mathematical

Community

(In this community, there is little expected emotional cost to ...)

Santa Martinez Hoope Pinole Vine Hill Marina Telegraph Black Diam District Pacheco Concord San Rafael Mines Regi El Sobrante Dovie Of 21013 San Pablo SFSU students & North Par Preser Kentfield Pleasant Hill Presidio of Clayton South Bay Richmond Nob Hill San Francise Corte 580 arkspur Briones Sea Cliff El Cerrito He teachers Regional Park Madera Valley 80, Japantown Tenderloin Aunicipal X Walnut Strawberry Albany Lafayette 1) Geary Blvd Orinda Creek Tiburon 101 SoMa South -Alamo Berkeley Mt Diablo Outer Beach Richmond Gate Park Sausality Square Alamo State Park Sa Moraga Haigh Golden Gate Emervville Diable Ission Bay Piedmont Incisco Danville Nationa Redwood 80 Blackhawkecreation Regional Park Mission The Castro 280 Oakland San Ramon Golden Gate Potrero Hill 580 Alameda Noe Valley Heights Students & 680 San Forest Hill Leandro Castro teachers Dublin 880 San Valley Glen Park Broadm France Francisco Bay Fairview buth Sar San Lorenzo Pleasanto **Bayview** students 35 Wood Francisco Hayward Portola (101) Hunters Point Dry Creek San Bruno Bayviet Kilkare Regional Park Woods & teachers Pacifica Parkr ۰ Union City (1)John Sunol 280 Crocker McLaren Park 8 21013 ienda Olympic Golf Club Amazon Sal Mateo Daly City Hillsboroug 680. San Fran Bayshore 84 E)emont Foster City Montara Crocker Newark 280 oss Beach Belmont Westlake El Granada Redwood San Bruno City SFSU teachers Half Mountain Broadmo (1) Moon Bay Emerald State Park Men Lake Hills Brisbane St Francis Palo Alto Colma Woodside Milpitas El Corte De Stanford 280 Rock Park Madera Creek 21013 Mountain Open Space Berryessa Serramont Portola View Sunnyvale 880 Valley South San Loyola Santa Clara Rancho San San Jose Francisco Antonio Open 280 La Honda Space Preserve Burban San Cuperting regorio

Spring 2010 Evaluation Form

			I NO	O YES	O NO
San Francisco Math Circle 2010 Program Evaluation	San Francisco Math Circle 2010 Program Evaluation			© NO	
We are asking everyone to complete the following evaluation of the 2010 SFMC Program. Please	We are asking everyone to complete the following evaluation of the 2010 SFMC Program. Please	San Experience Math Circle 2010 Browner Evolution	How much thinking do Math Circle activities require?		For me, being good in math is :
complete all the pages and bring it back with you next week for the SFMC Plenary Session at Mission High School.	complete all the pages and bring it back with you next week for the SFMC Plenary Session at Mission High School.	San Francisco Math Circle 2010 Frogram Evaluation	1 2 3 4 5	How certain are you that you can learn everything taught in math?	1 2 3 4 5
			a lot of thinking O O O O ont very much thinking	1 2 3 4 5	very important O O O O not at all important
You'll need a completed evaluation form at the meeting for your SHMC attendance prize so please fill it out!	You'll need a completed evaluation form at the meeting for your SHMC attendance prize so please fill it out!	Compared to most of your other activities, how important is it for you to be good at math?		Very Certain O O O O Uncertain	
These uses for taking the time to complete this form. We make assessible user feedback	There's uses for taking the time to complete this form. We make assumption user for there's	1 2 3 4 5	Success in math requires a big investment of my time.		Hard math problems scare me.
main you to taking the time to complete the form. The reary appreciate your resource.	many you to taking the time to complete the form. We reary appreciate your resounds.	very important	O YES	My teacher expects me to continue in math in the future.	U YES
			© NO	0 YES	□ NO
		How good are you at math?		0 NO	
Personal Information	Personal Information	1 2 3 4 5	Being a Math Circle participant is a major part of who I am		In general, I find working on math assignments
		Very Good () () () () () Not Good	O YES	Explanations are a big part of math	1 2 3 4 5
What grade are you in?	What grade are you in?		O NO	O YES	Very Interesting O O O O Very Borying
0 3	0 3	some kids are befor in one subject than in another. For example, you might be before in man than in reading. Compared to most of your other school subjects, how good are you in math?		© NO	
0 4	0 4	1 2 3 4 5	People at Math Circle tell me I can learn math.		It is important to me to be a person who reasons mathematically.
0 5	0 5	a lot better in math than in other subjects	O YES	Math will be useful for me later in life.	O YES
0.6	0.6		U NO	0 YES	0 ND
07	07	How good would you be at learning something new in math?		0.10	
0.9	0.9	1 2 3 4 5	If you were to list all the students in your class from the worst to the best in math, where would you put yourself ?		How much do you like doing math?
0.10	0.10	very good O O O O not at all good	where would you put yourself ?	Problem solving is an important part of mathematics	1 2 3 4 5
0 11	0.11		1 2 3 4 5	0 NO	not at all O O O very much
0 12	0 12	I enjoy the math we do at Math Circle.	One of the best		
O Other:	O Other:	YES NO		According to my teachers, it is important for main he shis to think and reason methamatically	Doing well on my math homework is important to me
			I would rather be in my math class than my other classes.	O YES	0 YES
		I enjoy solving challenging math problems.	E YES	O NO	O NO
What school do you attend?	What school do you attend?	C YES	□ NO		
		© NO		How well do you expect to do in your math class this year?	The Math Circle instructors want students in this class to respect each others' ideas
			I need to have good mathematics problem-solving skills to be successful in the future?	1 2 3 4 5	O YES
		renjoy the subject of math	O YES	very well 0 0 0 0 opt at all well	O NO
DON'T FORGET TO FILL OUT BOTH SIDES OF THE SURVEY	DON'T FORGET TO FILL OUT BOTH SIDES OF THE SURVEY		0 ND		
	BORT FORGER TO THE OUT BOTH BIDED OF THE BORVET			On Mandau afferences I second asthere ha at Math Circle they exception also	I enjoy studying math at Math Circle
QUESTIONS ARE ON THE FRONT AND BACK OF ALL OF THE PAGES	QUESTIONS ARE ON THE FRONT AND BACK OF ALL OF THE PAGES		In our math class, it's OK to make mistakes as long as you are learning.	YES	YES

□ NO	O YES	I enjoy studying math in my school math class.			
	0 NO	I YES	San Francisco Math Circle 2010 Program Evaluation	Please describe the hardest math problem you had ever worked on while attending the SFMC?	THANK YOU FOR COMPLETING THE 2010 SFMC Survey - Don't forget to
		E NO.			bring it next week to the group meeting at Mission High School!
In addition to getting the right answer in mathematics, it is important to understand why the					We are asking everyone to complete the following evaluation of the 2010 SFMC Program. Please
answer is correct	Some things that you learn in school help you do things better outside of class, that is, they				complete all the pages and bring it back with you next week for the SFMC Plenary Session at Mission
I YES	are useful. For example, learning about plants might help you grow a garden. In general, how useful is used used learning is math?	Success in math requires giving up other pursuits.	Did you enjoy Math Circle this Year?		High School. You'll need a completed evaluation form at the meeting for your SFMC attendance prize to please fill it cutil Thank you for taking the time to control the form. We really according your
□ NO		© YES	I YES		feedback.
	1 2 3 4 5	© NO	E NO.		
At Math Chain and teachers would like up to do shallownian with purchases over 10 protection	very useful 💮 💮 💮 💮 not at all useful		0.10		
mistakes.					« Back Continue »
I YES		Solving hard math problems is important to me.	Describe your overall experience with the Math Circle in 2 sentences:	Did you enjoy working on this problem?	Demonstrative Oceania Demo
CI NO.	Math is useful in everyday life?	C YES		0 YES	Powered by Google Loop
0.10	O YES	□ NO		© NO	Report Alexe - Terms of Service - Additional Terms
	() NO				
I have friends at Math Circle?				Did you think about the problem when you were at home, later that pipht?	
O YES	Operating the second of second data and data in the second of the second s	What are you going to do after you graduate from high school?		O yee	
O NO	Compared to most or your other activities, now useful is what you ream in math?			0.10	
	1 2 3 4 5			010	
	very useful O O O O not at all useful	Burry were in college now, what major would you choose?			
Knowing advanced mathematics is important to me, even if it's not necessary for the classes I			Have you met a mathematician while at the San Francisco Math Circle ?	Did you think about that problem later during the next week?	
taxe.			0 YES	O YES	
O YES	How often do you feel happy in Math Circle?		O MAYBE	0 NO	
8 NO	1 2 3 4 5	« Back Continue »	0 N0		
	all the time! O O O O never				
Learning a lot of new things is what is important to me in math.		Powered by Google Docs	Describe what a mathematician is. What do they do all day?	How mathematical are the following tasks?	
O YES		Report Atune - Terms of Service - Additional Terms		Very Somewhat Alittle Not at all	
() NO	Being good at problem solving in math is important to me.			mathematical mathematical mathematical mathematical	
	O YES			Drawing a Circle 0 0 0 0	
My math homework scaras me	© NO			Solving a math equation, O O O O	
0 YEB				Solving a Rubik's cube 0 0 0 0	
0 NO	The Math Circle instructors cares about how we feel.			Review of the second se	
	O YES			Paying a card game 0 0 0 0	
	() NO		Do you plan to come back to Math Circle Next Year?	Eating an apple O O O O	
During Math Circle I think about whether I understand what the teacher is trying to explain.			If No, Why not?	Building a bridge 0 0 0 0	
0 YES	Our Math Circle Instructors encourage us to share ideas with one another in class		O YES	Watching a group 0 0 0 0	
© NO	A YES		O NO		
	0.00		() Other		
In our Math Circle, it's OK to make mistakes as inon as you are learning	0.14				

12 PAGES – 6 pages front/ back Sent home with incentives to bring back

Fall 2011 Pre Program Survey

	I enjoy the subject of math.	Math will be useful for me later in life.	What are you going to do after you graduate from high school?		
SEMC Pre Program Survey	1 2 3 4 5	O YES			
or nic ric ricgram bar vey	Not at all O O O Yes, I love math	C NO			
Thank you for taking the time to complete this form. We really appreciate your feedback.			If you were in college now, what major would you choose?		
What school do you attend?	Some kids are better in one subject than in another. For example, you might be better in math	Problem solving is an important part of mathematics.	i you were in conege now, what major would you chouse?		
	than in reading. Compared to most of your other school subjects, how good are you in math?	O YES			
	1 2 3 4 5	O NO			
	A followerse in math than in other subjects O O O O O A followerse in math than in other subjects		Did you think you will enjoy your math sizes this you?		
What grade are you in?			Did you mink you will enjoy your main class ons year?		
		In my math class my teachers would like me to do challenging math problems, even if I make	U YES		
	Baing a Math Circle participant is a major part of who I am	mistakes.	() NO		
What math class are you taking?	O yes	O YES			
O Pre-Algebra	O TES	© NO			
Algebra	O NO		Have you met a mathematician before?		
Geometry			O YES		
PreCalculus		How well do you expect to do in your math class this year?	O MAYBE		
Calculus	I would rather be in my math class than my other classes.	1 2 3 4 5	O NO		
O None	O YES	Not at all well O O O Very well			
() Other	0 ND				
			Describe what a mathematician is. What do they do all day?		
		Hard math problems scare me.			
Who saked you to take this survey?	According to my teachers, it is important for me to be able to think and reason mathematically.	O YES			
O Mumath Institut	O YES	© NO			
Semenes from Eas Emerican Math Circle	O NO				
O Someone form San Phanosco Mach Circle		to addition to entitle the debt encours in each entities. We improve that the endowing of the			
		in addition to getting the right answer in mathematics, it is important to understand why the			
	I need to have good mathematics problem-solving skills to be successful in the future.	answer is correct.	How mathematical are the following tasks?		
	O YES	O YES			
Have you previously attended a Math Circle?	O NP	0 NO	Not at all A little Somewhat Very		
U Yes			mathematical mathematical Mathematical mathematical		
O No		Linear friends in any Math Class	Drawing a Circle 0 0 0 0		
Would you like to attend a Math Circle?	In our math class, it's OK to make mistakes as long as you are learning.	O YES	Solving a math equation, ax		
Yes	O YES	0.00	abrec 0 0 0 0		
□ No	© N9	0.10	Sobio a Bublic auto		
	0.00				
		Being good at problem solving in math is important to me.	Praying a care game 0 0 0 0		
What is the first letter of the street where you live?	Compared to most of your other activities, how important is it for you to be good at math?	O YES	Eating an apple O O O O		
	1 2 3 4 5	0 N9	Building a bridge O O O O		
	Net at all incontrat 0, 0, 0, 0, 0 key incontrat		Watching a movie 0 0 0 0		
	No as an importance of o o o very importance	I enjoy studying math in my school math class.			
		O YES			
What is the last three numbers of your phone number?		O NO	Thank you		
		0.00	I nam you for the completing the Math Circle Survey!		

2 pages – 1 front/ back

Given to SFMC, (CM)², SFUSD teachers, OEBMC – 300+ responses



2011-12 Survey Responders

Previously administered Surveys:

- Spring 2010
- □ Fall 2010/ Spring 2011

598 2011/2012 Pre-Surveys (September 2011)

- 362 identified non-MC
- 55 identified as returning Math Circle

235 2011/ 2012 Post-Surveys (May 2012)

- 120 identified non-MC
- 27 identified as Math Circle.

Perceived Value of Mathematical Tasks/ Activities Value: Interest enjoyment the individual gets from performing the task.

Evaluation Questions

Q: I enjoy the subject of math.

 Q: I enjoy studying math in my school math class. Perceived Value of Mathematical Tasks/ Activities Value: Interest enjoyment the individual gets from performing the task.

Evaluation Results

- Interest in math increased over the course of the year
- Students in Math Circle, both pre and post survey, have the highest interest in mathematics.

Perceived Value of Mathematical Tasks/ Activities Value: Utility how the task relates to future goals.

Evaluation Questions

Q: Math will be useful for me later in life.

Q: I need to have good mathematics problemsolving skills to be successful in the future. Perceived Value of Mathematical Tasks/ Activities Value: Utility how the task relates to future goals.

Evaluation Results

- Math Circle participants rank higher in the Utility compared to other participants
- MC ranked this task value highest in the survey.
- Students who come into the Math Circle in the Fall 2011 returned with the understanding of the Utility of mathematics.

Perceived Value of Mathematical Tasks/ Activities

Value: Attainment,

the importance to the self of doing well on a task.

Evaluation Questions

- Q: Being good at problem solving in math is important to me.
- Q: It is important to me to be a person who reasons mathematically.
- Q: In addition to getting the right answer in mathematics, it is important to understand why the answer is correct.
- Q: Compared to most of your other activities, how important is it for you to be good at math?

Perceived Value of Mathematical Tasks/ Activities

Value: Attainment,

the importance to the self of doing well on a task.

Evaluation Results

- All students responded that it was both important to have the correct answer and to understand why the answer is correct.
 - This is something that stuck with the students over the summer and supports a long-term attitudinal change of the students.
- The Math Circle students (compared to others) were the only group that improved their task value related to Attainment.

Perceived Value of Mathematical Tasks/ Activities Value: Cost

the accumulated negative aspects of engaging in the task, and the amount of effort required to succeed at the task.

Evaluation Questions

- Q: I would rather be in my math class than my other classes.
- **Q:** Hard math problems scare me.

Perceived Value of Mathematical Tasks/ Activities Value: Cost

the accumulated negative aspects of engaging in the task, and the amount of effort required to succeed at the task.

Evaluation Results

For most students, their scores increased for the Cost task value. This means that students had a reduced negative impact from their participation in math over the course of the year.

It should be noted that all students had less appreciation for their Math classes at the end of the year.



Nature of Mathematics

Evaluation Questions

- **Q:** Have you met a mathematician before?
- Q: Describe what a mathematician is. What do they do all day?
- Q: Problem solving is an important part of mathematics

Nature of Mathematics

Evaluation Results

Surprisingly, in this question set the students identified in Math Circle responded more negatively that they had not met a mathematician before (3.59) and more positively (3.83) that they had met a mathematician at San Francisco Math Circle. Overall their responses show that they have had more exposure to craft of mathematics and have gained a larger understanding of the field.

Nature of Mathematics

Describe a Mathematician

- I think they are a group of men that they only know how to solve the unsolved problems in math
- I'm sure their daily activities vary. You expect me to answer, "they're old, boring and do math, " however, they are not exactly all like that, even if they do practice math as a career
- They helped us solving challenging problems
- MATH. EAT. SLEEP
- A mathematician teaches and solves math problems.
 Also they can try and find new theorems

Safe Mathematical Community

Evaluative Questions

- Q: Being a Math Circle participant is a major part of who I am.
- Q: In our math class, it's OK to make mistakes as long as you are learning.
- Q: In my math class my teachers would like me to do challenging math problems, even if I make mistakes.
- **Q:** I have friends in my Math Class.

Safe Mathematical Community

Evaluation Results

- Students indicate it is safe to make mistakes while learning
- Math Circle students indicate that it is important to think and reason mathematically
- All Math Circle students indicate: In my math class my teachers would like me to do challenging math problems, even if I make mistakes.
- Math Circle students have friends in Math Class



Thank you very much!

Do you have any questions?

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