

Math Olympiads for Gifted and Talented Students at Larsen Elementary

A Project Presented to
The Faculty of the School of Education
California State University Channel Islands

In fulfillment
Of the Requirement for the Degree
Masters of Arts

By
Irma Cervantes

May 2013

© 2013

Irma Cervantes

ALL RIGHTS RESERVED

MATH OLYMPIADS FOR GIFTED AND TALENTED STUDENTS AT LARSEN ELEMENTARY

APPROVED FOR THE SCHOOL OF EDUCATION

Dr. Mary Kay Rummel 4/19/13

Dr. Mary Kay Rummel

Date

Conrad Rummel April 19, 2013

Dr. Conrad Rummel

Date

APPROVED FOR THE UNIVERSITY

Gary W. Kinsey 4-29-13

Dr. Gary W. Kinsey

Date

Non-Exclusive Distribution License

In order for California State University Channel Islands (CSUCI) to reproduce, translate and distribute your submission worldwide through the CSUCI Institutional Repository, your agreement to the following terms is necessary. The author s retain any copyright currently on the item as well as the ability to submit the item to publishers or other repositories.

By signing and submitting this license, you (the author(s) or copyright owner) grants to CSUCI the nonexclusive right to reproduce, translate (as defined below), and/or distribute your submission (including the abstract) worldwide in print and electronic format and in any medium, including but not limited to audio or video.

You agree that CSUCI may, without changing the content, translate the submission to any medium or format for the purpose of preservation.

You also agree that CSUCI may keep more than one copy of this submission for purposes of security, backup and preservation.

You represent that the submission is your original work, and that you have the right to grant the rights contained in this license. You also represent that your submission does not, to the best of your knowledge, infringe upon anyone's copyright. You also represent and warrant that the submission contains no libelous or other unlawful matter and makes no improper invasion of the privacy of any other person.

If the submission contains material for which you do not hold copyright, you represent that you have obtained the unrestricted permission of the copyright owner to grant CSUCI the rights required by this license, and that such third party owned material is clearly identified and acknowledged within the text or content of the submission. You take full responsibility to obtain permission to use any material that is not your own. This permission must be granted to you before you sign this form.

IF THE SUBMISSION IS BASED UPON WORK THAT HAS BEEN SPONSORED OR SUPPORTED BY AN AGENCY OR ORGANIZATION OTHER THAN CSUCI, YOU REPRESENT THAT YOU HAVE FULFILLED ANY RIGHT OF REVIEW OR OTHER OBLIGATIONS REQUIRED BY SUCH CONTRACT OR AGREEMENT.

The CSUCI Institutional Repository will clearly identify your name s as the author s or owner s of the submission, and will not make any alteration, other than as allowed by this license, to your submission.

Math Olympiads for Gifted and Talented Students at
Title of Item Larsen Elementary

Math Olympiads Problem Solving, Math for Gifted Students
3 to 5 keywords or phrases to describe the item

Irma Cervantes
Author(s) Name (Print)

Irma Cervantes 4-17-13
Author(s) Signature Date

Chapter One Introduction

Statement of Problem

Over forty years ago the U.S. Congress showed concern about the methods and programs that were being offered to the gifted and talented children across the nation. The department of education conducted a study in 1971 to investigate the validity of programs used with gifted and talented children (GATE) and discovered that there were not enough programs or modified curriculum to teach and address the high academic levels and areas needed for these students. The results were alarming since they learned that GATE students were performing below expectations.

Today California has identified and services about half a million gifted and talented students in their public schools. The Hueneme School District proudly assists about 1,000 GATE students in grades 2-8. Although there have been many positive changes over the past four decades to better assist gifted and talented students, there are still many improvements administrators, educators, and parents can offer for these students in order to enhance their potential and make them strong and successful future 21st Century leaders in math, science, art, and writing among other careers.

Purpose of the Study

The purpose of this study is to find out if the Math Olympiads will effectively enhance, differentiate learning styles, and enrich the mathematical abilities of Larsen fourth and fifth grade GATE students.

1. Will the Math Olympiads enhance the mathematical skills of GATE students at Larsen school?

2. Will GATE students develop problem solving skills by participating in the Math Olympiads?
3. Does this program satisfy curriculum differentiation for Larsen's GATE students?
4. To what degree does Math Olympiads satisfy the need of differentiated curriculum for GATE students?
5.
 - a) How do selected participants feel about the Math Olympiads?
 - b) How do parents feel about their child's participation in the Math Olympiads?
 - c) How do the classroom teachers feel about the student's participation in the Math Olympiads?

Significance

This problem interests me for two reasons. First, as a mother of a GATE student, I noticed that my son wasn't challenged enough in the area of mathematical reasoning during class instruction and in the after school GATE class. Second, as a teacher, I believe all students can learn when placed in appropriate program; whether it is for language acquisition, special education, or differentiation in accelerated academics for gifted and talented students.

Unfortunately with the NCLB Act many schools are labeled as Program Improvement (PI) and their main focus is on the progress of the general student population. They are not placing GATE education as one of their priorities. Birdsall and Correa (2007) mention in their article "Gifted Underachievers" that some people including educators and administrators believe that GATE students don't need accelerated differentiation because they are gifted and talented

already. However, they also found research which demonstrated the opposite. Gifted and talented students who were not challenged or did not experience enhancement to their learning dropped their performing levels dramatically.

Setting

Ansgar Larsen Elementary school is one of the nine elementary schools of the Hueneme School District. It is located in a low socio-economic Hispanic neighborhood in the south area of Oxnard. This school was built in 1952 to accommodate about 300 students, but today it proudly educates almost 800 kindergarten through fifth grade students. Most of the families in this neighborhood are blue-collar and field workers; 67% of our parents did not graduate from High School, 23% are High School graduates, 7% have some college, and only 2% have graduated from college. Even though a large percentage of Larsen's parents don't have a High School Diploma, they are a supportive community that highly values education.

Larsen Elementary is one of the few schools in the Hueneme School District that still offers an Alternative Bilingual (late transition, 4th grade) Program as well as Structured English Immersion (SI) and Mainstream English (EO). Parents have a choice in selecting a program, after viewing a presentation on the various programs, and receiving information regarding their child's proficiency assessments. This school has the second highest percent of English Language Learners (ELL) in the district; therefore, it was obvious that faculty needed to select the best educational program to fit its student body. Larsen has 8% GATE students in 2nd through 5th grade and 6% of its students are in Special Education. Staff believes all students can learn and deserve the opportunity to be placed in appropriate programs to support their education.

Definitions of Terms

GATE: Gifted and Talented Education; program name for gifted and talented students.

GATE: Term used to refer to gifted and talented students or high achievers

ELL: English Language Learner; any student whose first language is other than English.

LEP: Limited English Proficiency; students whose first language is Spanish, but who have acquired enough English language to score high on the District's English test at the beginning of their education. These students are placed in SEI classes.

RtI: Response to Intervention, schools provide additional support for students to meet their academic goals.

SEI/SI: Structured English Immersion; LEP students are assigned into this type of setting in which the teacher holds a BCLAD or CLAD credential. Instruction is in English and if students need clarification in mother tongue, the teacher may provide the assistance.

MOEMS: Math Olympiads for Elementary and Middle Schools

Chapter 2 Literature Review

Theory of Mathematic Problem Solving

Mathematical problem solving is a skill many students and adults don't understand or often practice, yet it is an essential part of math curriculum because it ensures that students really understand and know how to apply math concepts when solving real life problems. Cai & Lester (2010), mentioned that problem solving is an important element that must be used when teaching mathematics in K-12 schools because students use their mathematical understanding and it challenges their true understanding of problem solving. Students must apply their prior language and computational skills when solving these types of problems. Cai & Lester quote researchers (Hieber & Wearne, 1993; Marcus & Fey, 2003; NCTM, 1991; van de Walle, 2003) who state "problem solving problems are tasks that promote students' conceptual understanding, foster their ability to reason and communicate mathematically, and capture their interest and curiosity" (p. 6). According to The National Council of Teachers of Mathematics (NCTM) (1991), "worthwhile problems are those which direct students to investigate important mathematical ideas and ways of thinking towards learning" (p.1). The Math Olympiads for Elementary and Middle Schools (MOEMS) provides such math problems which focus on challenging students' mathematical understanding and reasoning.

Researchers and math educators, such as Ernest, Wearne D, along with the NCTM and the Cockcroft Report (1982) all agree that problem solving approaches should be at the forefront of teaching mathematics. However the challenge of teaching mathematics in a different way may not be an easy change for teachers since it requires them to use a different method of teaching math. Many teachers are not comfortable teaching problem solving. Ernest (1989) states the

following, “It depends fundamentally on the teacher's system of beliefs, and in particular, on the teacher's conception of the nature of mathematics and mental models of teaching and learning mathematics” (p. 1). One way that teachers will start to incorporate problem solving skills would be through the practice of the Common Core State Standards (CCSS). The goal of these standards is to prepare K-12 students for college. These standards focus on providing a rigorous content and application of knowledge through higher order thinking skills. The creators of these standards believe that our students need to be ready to compete in the 21st century competitive global economy. The best way to prepare students for college is to develop problem solving skills to enable them to apply their prior computational and knowledge when solving real life problems.

Math Olympiads for Elementary and Middle Schools (MOEMS)

A. Math Olympiads Background

MOEMS is a non-profit organization founded 34 years ago by Dr. George Lenchner. Its goal is to help students grow mathematically and become problem solvers while they stretch to their full problem solving potential. Each year schools, home schools, and institutions may participate in the Math Olympiads. Each institution forms teams of up to thirty-five students in grades 4 through 8 who meet weekly to solve math problems that promote problem solving skills. The coach is known as the PICO (Person In Charge of the Olympiads). Once the team has been formed, s/he may use the different materials to help students practice solving problems. Two books that are highly recommended are Creative Problem Solving in Schools Mathematics 1st and 2nd Editions and Math Olympiad Contest Problems for Elementary and Middle Schools by Dr. Lencher.

B. Strategies Used By Math Olympiads

The Math Olympiads recommend the use of different strategies to help students reach their mathematical potential. It is highly advised by the Math Olympiads Organization that coaches meet with students for at least an hour a week. Coaches should use the book Creative Problem Solving in Schools Mathematics 2nd Edition to practice problem solving with students. It is also recommended that students practice solving problems from past Math Olympiads so they can experience the type of problems they will be solving when they take the real Math Olympiad test. Organizers have received feedback from teachers who have coached Math Olympiads who believe that maximum growth occurs when students and coach go over solutions. Adams and Hamm (2010) found that “collaboration sparks problem solving and inquiry activities where students strive to develop knowledge and understanding of mathematical ideas” (p. 64). Homework is another strategy mentioned in the Math Olympiads New Team Training. It is suggested that problems from books mentioned above be used for students to practice.

Differentiation for Student Learning

Thirteen years ago, I started my teaching career and in order for me to teach a diverse class of language and academic levels I needed to use differentiation. I believed that teachers who had the lowest academic classes had to differentiate in order to teach low-performing students. However, now that I have read additional articles about differentiation, I realize that GATE and high-achieving students also are in great need of differentiation.

Franklin-Rohr (2012) stated:

Differentiation is not a singular process; it is rather a complicated process of adapting

instructional strategies so that ALL students can be successful. This term has been around since the 60s, but it really wasn't successfully brought to teachers' awareness until Carol Ann Tomlinson introduced her ideas about this concept in 1995. Now, differentiation is an essential cornerstone of successful teaching. (p. 25)

I agree with Franklin-Rohr's idea that in order for schools to produce high achieving students, teachers must use differentiation strategies with all students. A frightening statement by Franklin-Rohr (2012) suggests that if teachers require gifted students, who understand the process of solving math problems, to work at the same level as the rest of the students in their class, the gifted students could make careless mistakes when computing math problems. This process will limit gifted students access to opportunities for high-level learning, new mathematical concepts, or applying known knowledge in problem solving. MacFarlane (2012) also mentions in her article "Differentiating: Teacher Professional Development with Design" that if GATE or advanced students don't receive adequate academic challenge, they might become at-risk students for developing underachievement over the course of several years of not being challenged to stretch to their full potential.

An excellent analogy Stephen Schroeder-Davis (2010) mentioned in his article "Differentiation: Transparent or Opaque?" compares teachers that don't differentiate instruction to doctors who would treat all patients with the same medication for different conditions. He believes that the key for schools and teachers to successfully address the needs of advanced or GATE students is differentiation. In his article he provides different strategies for teachers to implement in their classroom in order to target and enhance the learning of high-achieving students. One of the methods he recommends is for teachers to group students according to ability which could be readiness in a content area, interest, learning style, learning profile, and

student choice. He suggests that teachers need to select appropriate academic extensions that would benefit GATE or advanced students: “An effective extension should: involve complexity rather than difficulty, provide students with options, including those suggested by students, relate to the standards being studied, foster autonomy, and offer opportunities for self-assessment” (p. 23).

As an experienced teacher who has differentiated for low-performing students, I know that planning for different ability and language groups could be challenging. According to Franklin-Smutny (2012), teachers must be flexible in order to differentiate when planning. She suggested that teachers focus on content, process, and products in order to make the differentiation process easier. Content can be taught at a higher level and faster pace for student learning. The process of grouping students according to ability, interest, etc. can assist with the planning of differentiation, and the teacher can use products such as computer programs or science projects that are advanced-level, in-depth, and inquiry-based.

Adams and Hamm (2010) found that differentiating instruction will make subjects more accessible to student’s varied interests, needs, and learning styles (p. 30). Researchers keep finding that in order for students to achieve higher academic levels, differentiation is the key. Today schools throughout California are using Response to Intervention (RtI) to differentiate instruction and provide additional support for at-risk and under-performing students; however, Schroeder-Davis (2012), an advocate for differentiation for GATE and advanced learners, mentions that RtI should also be used to assist high-achieving students. He believes that in order for advanced learners to advance and be challenged to their full potential, they need additional support to meet their different academic, interest, and learning style needs.

Best Ways to Make Math Olympiads Successful at Schools

After reading several articles about Math Olympiads and best ways to accomplish a positive learning experience for gifted and high-achiever students I believe that coaches need to follow the following suggestions:

1. Coaches should use the books developed by the Math Olympiads founder, Dr. George Lenchner, and teachers who have coached teams in the past.
2. Students should meet weekly to practice problem solving, review test results, share different methods students used to find solutions.
3. Some schools, such as the Avid Academy for Gifted Youth, give daily homework.
4. Allow students suggest topics of interests and let them work in cooperative groups in order to maximize gifted students' development of problem solving and communication when they share their solutions.

Effectiveness of Math Olympiads

As I researched to find out if other institutions had used Math Olympiads to develop and challenge advanced students, I came across two different institutions that have and continue to use the Math Olympiads to enhance and provide opportunities that will challenge gifted students. Both schools have invited the highest achieving students since the Math Olympiads has problem solving that requires students be gifted in the area of math or be talented students who will take the challenge and find solutions to the math problems. As mentioned earlier, the Math Olympiads main goal is to allow opportunities for gifted and talented students to expand their problem solving skills.

Candlewood Middle School in New York has had teams participate in the Math Olympiads since 1991 led by teacher and coach, Betty J. Volpe. After she analyzed sixth graders' scores on the California Achievement Test (CAT), she invited the top ten percent of sixth grade students to join the Math Olympiad team. She was thrilled to have a large number of interested students. However, she noticed that boys would find solutions faster, participate more, and were not afraid to take risks to find the solutions. Because the girls felt uncomfortable and were shy to participate many girls dropped out of the team, so the coach realized that she needed an all-girls Math Olympiads team which she started in 1994. As she focused on a girls' team, her colleague, Ann Hickey, coached the boy's team. Again, she invited the top female students to join the math team and was able to recruit nineteen students. She mentioned that she had to compete with different clubs such as cheerleaders, sports, Helping Hands, and other clubs because those clubs or teams also wanted to recruit the top students. She had to remind students, parents, and staff that the girl's participation in the math team was very important since they would develop and broaden their math skills, learn different strategies for problem solving, and extend their career opportunities as they became more confident in math. Mrs. Volpe's goal in having an all-girls math Olympiad was to help girls recognize that they were capable of solving math problems. Her dedication to this team helped female middle school students feel confident and capable of participating in the Math Olympiads. She surveyed some of her students and these were some of their responses:

Volpe (1999)

“I like it because it made me feel equal [to] and even better than the boys because boys are the only people who get their own teams.”

MATH OLYMPIADS FOR GIFTED AND TALENTED STUDENTS AT LARSEN ELEMENTARY

“I liked being on a women's Math Olympiad team because it is a little easier to work with women than with men. I would like to try something different and join the boys. Next year I wouldn't care if the team is an all-girls team or a mix of boys and girls” (p. 293).

After reading the student's responses, it was obvious that the use of the Math Olympiads was an effective and successful program at Candlewood Middle School.

Avid Academy for Gifted Youth is a learning center founded by Dr. James Li in 2006 whose goal was to provide learning opportunities through different programs and experiences to maximize gifted youth potential. One program this academy uses to further develop and challenge gifted students in grades 5-11 is the Math Olympiads for Elementary and Middle Schools (MOEMS). This academy offers summer Math Olympiad camps among other camps for science in order to prepare Orange County gifted students for the Math Olympiad Competitions the coming school year. They have two sessions during the summer and each session is two weeks long. The focus of the summer Math Olympiad camp is to prepare students for future competitions by teaching them mental math tricks, problem solving skills, and math competition strategies in a fun and stimulating environment. They invite students who are gifted, bright, and talented who must pass an entrance assessment to demonstrate ability in problem solving. It is with pride that the institution lists the names of winners of the Math Olympiads and other math and science competitions.

With the findings of these programs I want to analyze Larsen's first Math Olympiads which I helped to organize as an assistant coach.

Chapter 3 Methodology

Part 1

Curriculum and program differentiation for students is the key for the success of all students. Schools across the state are using different academic programs to better assist the general student population; however, not much attention is given to the GATE student differentiation. It is alarming to read research that pinpoints that high achievers are under performing due to the lack of learning institutions providing special programs that will challenge and enhance their abilities.

Currently, Larsen has identified over 65 GATE (Gifted and Talented Education) students in fourth and fifth grade and many of these students are not being mathematically challenged in their classrooms or in the after-school GATE program. Although Larsen's GATE student population is 8%, they need the opportunity to participate in programs that will challenge and expand their potential. The Math Olympiads is a program that will develop mathematically challenging and enhanced problem solving skills for Larsen's fourth and fifth grade GATE students.

This was the first year that Larsen Elementary participates in the Math Olympiads. Forty-two gifted and talented fourth and fifth graders were part of this program, but only thirty-five of them were selected to be the official team because of the Math Olympiads regulations. The principal and the coaches decided to keep the rest of the students since they wanted to participate and these students also needed to be challenged and to expand their knowledge in problem solving. All of these students attended the meetings, had a Google account to use the website, and took tests. I was an assistant coach during the Math Olympiads. For my study, I analyzed the official scores of the team and included all participating students in the survey since I evaluated


whether the Math Olympiads provided learning opportunities and enhanced Larsen's gifted and talented students. The math club met every Friday at noon for an hour. There was a coach and two assistant coaches who also attended the meetings, assisted students, and gave tests. The Math Olympiads began in November and ended in March. There were monthly tests and students took tests during the third week of the month. Students learned problem solving strategies before the test and used the website to practice solving math problems. On the days when students took the test they left as soon as they completed the test. Test results were discussed in the following meeting.

Math Olympiads for Elementary and Middle School (MOEMS) is a non-profit organization whose goal is to help students grow mathematically and become problem solvers. This program provides an opportunity for students to solve math problems using their problem solving, computational, technology, and communication skills.

Part 2

Quantitative Data

I used the Math Olympiad monthly tests scores' to analyze student performance. The Math Olympiad organization released one contest test every month for coaches to print. Each math test consisted of five math problems. Students had a limited amount of time to work out each problem by themselves. See example below.

	Division E	Mathematical Olympiads December 11, 2012 for Elementary & Middle Schools	Contest 2
---	----------------------	--	---------------------

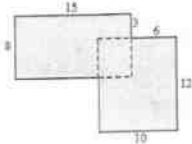
2A Time: 3 minutes
 What is the value of $(47 \times 8) + (8 \times 27) + (26 \times 8)$?

2B Time: 5 minutes
 Juan uses the digits 1, 2, 3, 4, 5, and 6 to make two 3-digit numbers. Each digit is used once. The numbers are subtracted. What is the greatest possible difference?

2C Time: 5 minutes
 Four volunteers can pack 12 boxes every 30 minutes. How many **additional** volunteers are needed to pack 72 boxes every hour? [Assume all volunteers work at the same rate.]

2D Time: 6 minutes
 How many 3-digit numbers are multiples of 21?

2E Time: 7 minutes
 The region is formed by two overlapping rectangles. Determine the area of the entire region. The lengths shown are in cm.



Please fold over on line. Write answers on back.

Copyright © 2012 by Mathematical Olympiads for Elementary and Middle Schools, Inc. All rights reserved.

After each test was taken and corrected I analyzed how the students solved the math problems. I looked at how they used strategies discussed in previous meetings. I also looked at the whole team's cumulative scores. In addition to analyzing the team's scores I examined how my four students performed individually. I asked them if they had understood what they did wrong while they solved the problems. Together we looked at each problem and discussed what they thought the question was asking them for and how they solved the problem.

Qualitative Data

To evaluate the success of program I used my anecdotal notes, student, teacher, and parent surveys and a student presentation to the school board about the Math Olympiads.

Anecdotal Notes

I took anecdotal notes during the math weekly meetings. I was attentive to what students' interests were, how they solved math problems, and what they liked to use once they logged into the math website.

Surveys:

I gave the following surveys to all the participating GATE students, some parents, and two fourth and fifth grade teachers to find out if the Math Olympiads challenged and enhanced math problem solving.

a. Student Survey

Larsen’s Math Olympiads 2012-2013

Please read each question and answer it. Don’t forget write your reasons in the comment area.

	Questions		Comments
1.	<p>Did you like participating in the Math Olympiads?</p> <p>Write what you <i>liked</i> and <i>disliked</i> in the comment area.</p>	Yes /No	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
2.	<p>Did the Math Olympiads help you solve math problems? Explain</p>	Yes /No	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
3.	<p>Did you think the Math Olympiads were challenging? Explain</p>	Yes /No	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
4.	<p>Would you participate in the Math Olympiads again? Why or why not?</p>	Yes/No	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
5.	<p>If you could make a change for the Math Olympiads, what would it be? Why?</p>		<hr/> <hr/> <hr/> <hr/> <hr/> <hr/>

I analyzed all the students' responses and a small group of students to find trends and important information about the program in their responses.

b. Teacher Survey:

Teacher Survey

Larsen's Math Olympiads 2012-2013

Teachers please answer the following questions.

1. Did you see math problem solving improvement with your GATE students?

2. Would you recommend GATE students to participate again in the Math Olympiads?

Please add any suggestions to improve the Math Olympiads.

c. Parent Survey:

Parent Survey

Larsen’s Math Olympiads 2012-2013

Please rate the Math Olympiads Club from 1 through 4, 1 being the lowest and 4 the highest.

		Rating			
1.	My child liked participating in the Math Olympiads.	4	3	2	1
2.	My child benefited from participating in the Math Olympiads.	4	3	2	1
3.	The Math Olympiad helped my child improve problem solving skills.	4	3	2	1
4.	The Math Olympiads helped my child improve his/her math grade.	4	3	2	1
5.	I would like my child to participate in the Math Olympiads again.	4	3	2	1

Feel free to write additional comments or suggestions.

Encuesta para los Padres

Olimpiadas de Matemáticas de la escuela Larsen 2012-2013

Favor de calificar el programa de las olimpiadas en matemáticas donde el 1 es el más bajo y el 4 el más alto.

		Calificación			
1.	A mi hijo/a le gusto participar en las olimpiadas de matemáticas.	4	3	2	1
2.	Mi hijo/a se benefició al participar en las olimpiadas de matemáticas.	4	3	2	1
3.	Mi hijo/a mejoro su manera de resolver problemas matemáticos con su participación en las olimpiadas.	4	3	2	1
4	La participación de mi hijo/a en las olimpiadas de matemáticas ayudo a mejorar su calificación en matemáticas.	4	3	2	1
5.	Recomendaría que mi hijo/a volviera a participar en las olimpiadas de matemáticas.	4	3	2	1

Favor de agregar sugerencias o comentarios adicionales.

Student School Board Presentation:

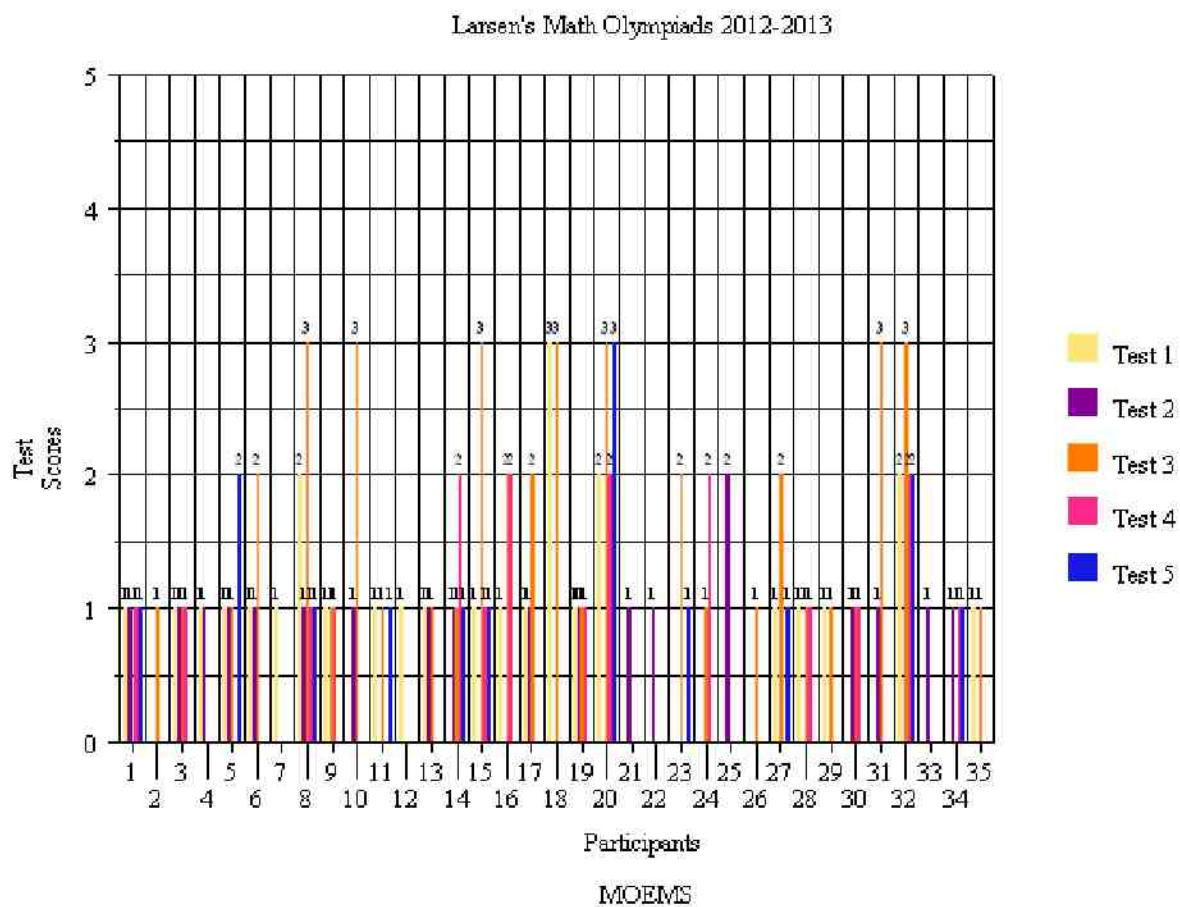
Selected students presented a small speech to the Hueneme School Board about their participation in the Math Olympiads.

Chapter 4 Findings

Quantitative Data

I collected the scores of thirty-five participating fourth and fifth grade scores and forty surveys. I also selected the scores and surveys of five fourth and five fifth graders to discuss in more detail.

Scores for all participating students



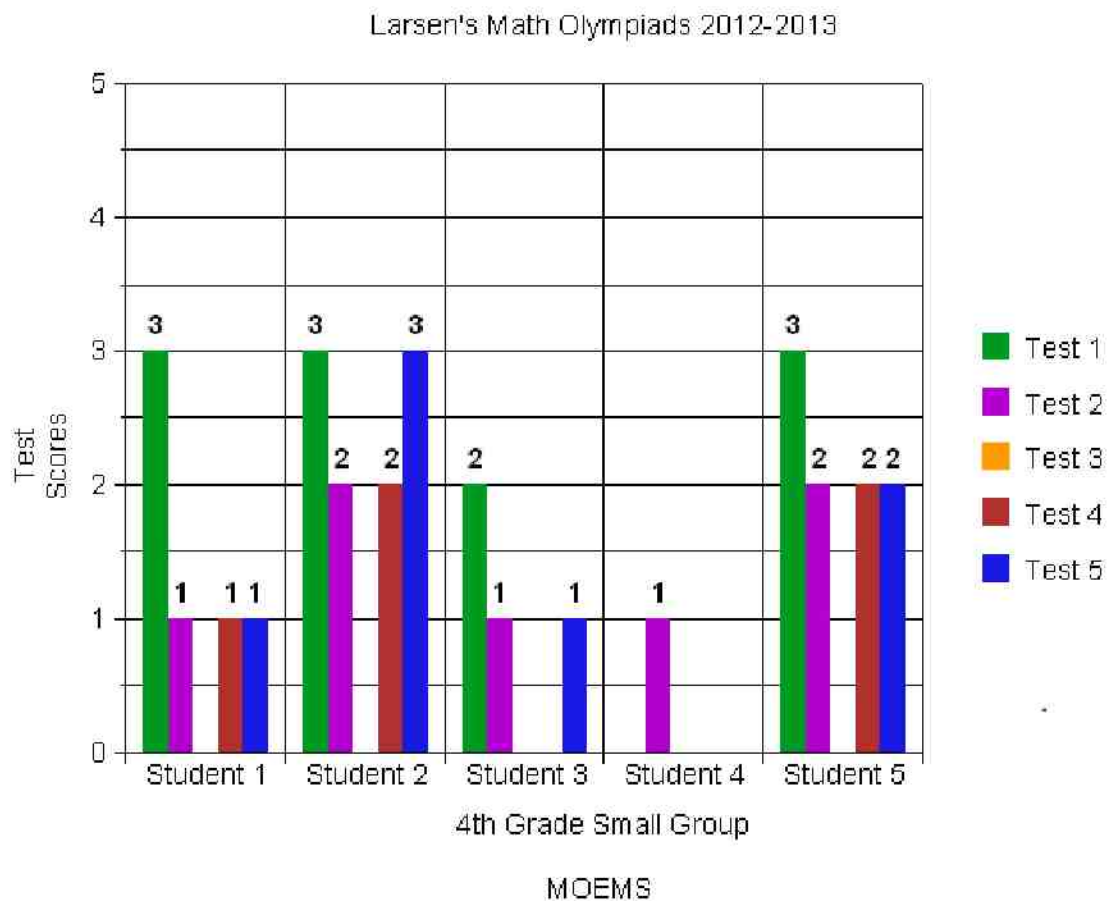
Findings:

After analyzing the above data from the thirty-five participating gifted and talented students I concluded that the Math Olympiad was very challenging for students. I had expected that the last test scores would be higher than the first ones since students were learning problem solving

MATH OLYMPIADS FOR GIFTED AND TALENTED STUDENTS AT LARSEN ELEMENTARY

strategies; however, that was not the case. On tests one and two, many students scored at least a one versus test four where many students got zeros, including participants number eight, ten, fifteen, eighteen, and thirty-one who typically scored well. I also noticed that participants number fourteen, twenty-four, and thirty-four scored low on the first tests, but were able to score higher on the last two tests. This showed a very low percent of student's increased scores in the competition.

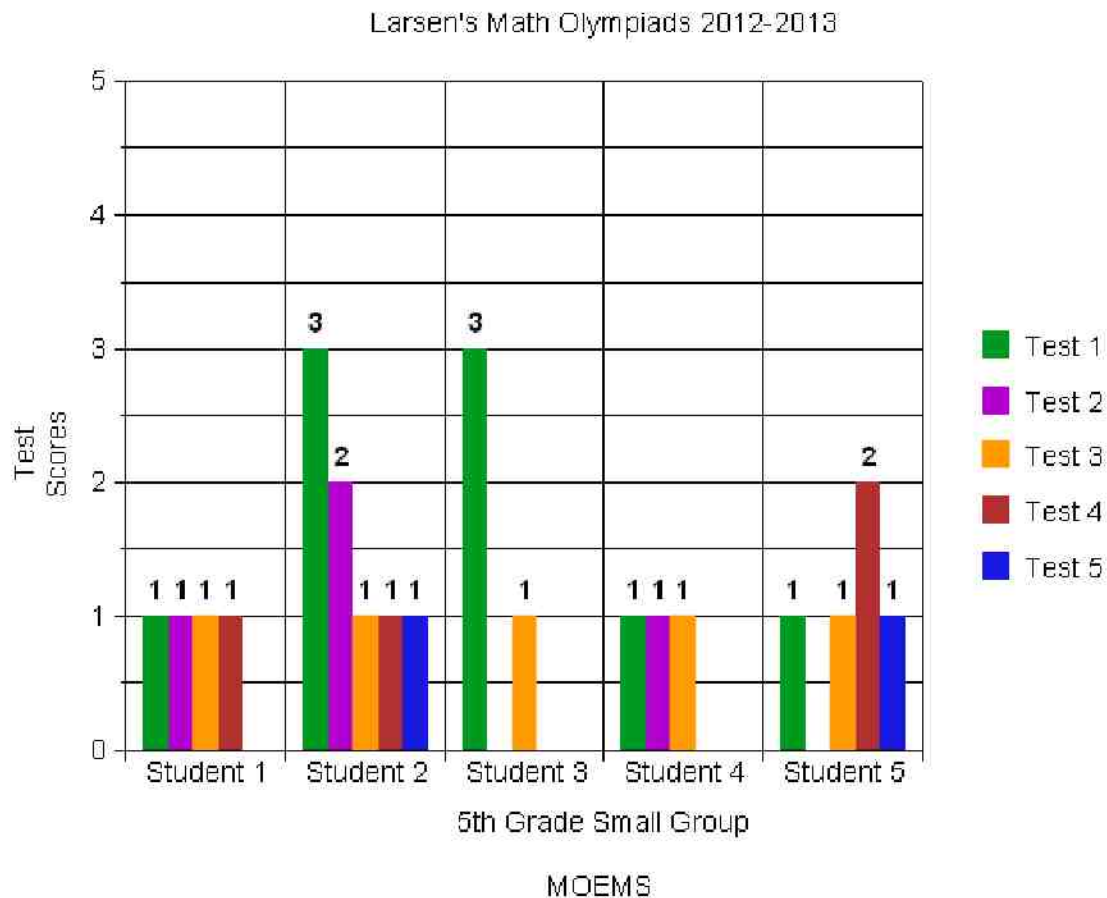
Scores for five 4th grade students



Findings:

This data indicates that the first test was easier for most of fourth students than the rest. Test three was the most difficult for this group of students since all five of them scored a zero. Based on how the students performed the Math Olympiads were very challenging for students.

Scores for five 5th grade students



Findings:

Overall fifth graders scored lower than the fourth graders, but the fifth graders were able to answer at least one question from test three; whereas, the above fourth graders scored a zero on

this test. A trend I noticed with the small group of fifth grade participants is that the majority of them accurately answered one question in each test.

Qualitative Data

I. Selected Observational Data from Notes

November's Meetings

I was very surprised to see a large number of interested GATE students wanting to participate in the Math Olympiads. Out of the fifty invitations the principal sent out, forty-two were signed and returned. I had several parents asked me about the program and they encouraged their child to be part of the program even when they knew it would be challenging. It was nice to see the parent support.

The Math Olympiads Organization required a team of only thirty-five students, yet forty-two students showed up to the first meeting. The principal and coach decided to keep all forty-two students in the math club and only selected thirty-five students as the official team. Students who scored the highest in the first Olympiad were selected as the official team. It was good to see that the coach was willing to keep all students. He firmly believes that high achieving students need to be exposed to problem solving.

All students attended the rest of the month's meetings and started solving math problem based on past Olympiad tests that the coach was able to use. Students seemed interested in solving math problems together. When the first test was given, I was surprised that some students didn't try to use strategies the coach had taught them. I noticed some students guessed the answer instead of trying to work out the problem. The following week, the assistant coaches

went over the test. Students were divided into five groups and each group worked out one of the problems. After they found the solutions and shared their reasoning, the assistant coaches gave the test back to them. Many were surprised to see the mistakes they had made because they had not read the questions thoroughly.

December's Meetings

The coach explained the blog web-page that was designed and available only for the Hueneme Math Olympians. Each student received a Google account to be able to access the blog page. I noticed that many students were eager to use the web and try out the different parts that were in the web-site. The blog page had different sections, such as daily Math Challenges for 5:00 & 7:00 p.m., Problem of the Week, Math Olympiad Problems, Friday Challenges, and Math Blog. This page also had a section for math practice sites, Khan Academy and IXL.com, which provided a wide variety of math problems for students to practice.

Students took the second Olympiad test right before winter break so the coach didn't get to go over the results as the previous month. Scores were not better than the first test. Although only thirty-five students' scores were official, all forty-two students took it.

January's Meetings

During the math meetings, the coach provided feedback about test 2. Again students realized their misunderstanding as the coach reviewed each problem. The web site's most popular and visited sections by students were the 5:00 & 7:00 O'clock Challenges and the Khan Academy. I also got an account and was able to log into the site and as I did I observed that students tried their very best and helped one another to solve the math problems that were posted. I found it interesting that students congratulated the winner of the challenge.

I noticed that students were not discouraged by the difficulty of the math problems on the blog, practices, and test. Each one of them kept attending the math meetings and were excited to be part of the Math Olympiads. I also observed that the coach always had a positive attitude towards student's wrong responses. The coach kept encouraging students to participate in the daily evening challenges.

February's Meetings

The meetings were as usual. Students took the next test which seemed harder than the other ones. Again the coach shared their responses and worked out the problems using different approaches. It was interesting to see students realize their mistakes once the coach broke the problem down and modeled how to solve it.

At one of the meetings the coach shared with students how to break down math word problems. He provided a sheet that had strategies to successfully solve word problems. Students seemed to understand the process and participated during the meeting. I noticed some of my students stopped logging into the math site for the evening challenges due to extra-curricular activities.

March's Meetings

Forty-two students kept attending the math meetings, even if they had received low scores on the previous tests. The meetings' content was as usual; the coach brought some samples for students to work out. On other meetings students were able to log in the web site and go into one of the blogs that were available. The most common one was Khan Academy and Friday Challenge.

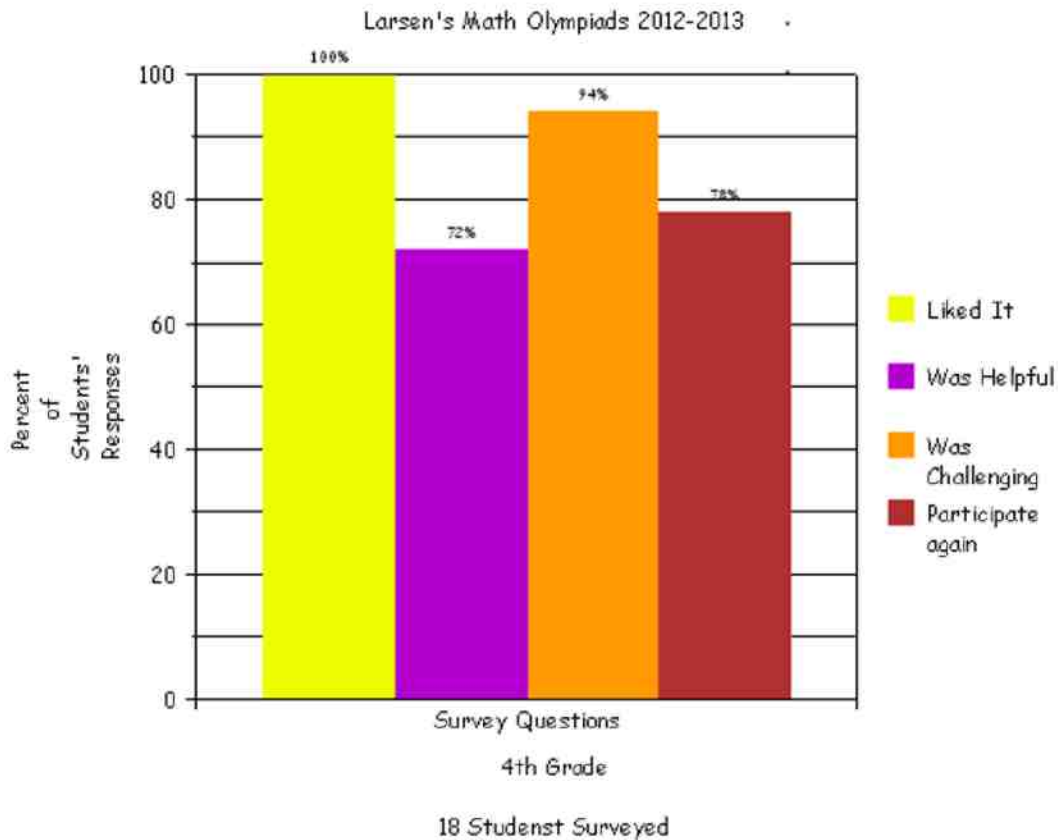
Students took the last test which seemed difficult. On the following meeting, the coach went over test scores and modeled how to solve problems. Again students discovered that they had not read the problem thoroughly and did not follow the steps to break-down the problem. The coach mentioned that he would be posting more brain teasers during Spring Break.

Discussion:

After assisting the Math Olympiads, I observed that the Math Olympiads' purpose of challenging students in problem solving was achieved, although, the test scores were not the highest. The GATE students met every Friday for an hour during part of their lunch with the coaches to solve math problems and review test results. A trend I observed was that all students showed up to all meetings even when they knew how difficult it was to solve the math problems. I noticed that students seemed to understand the process of breaking down the word problem when the coach modeled how to; however, they didn't apply those skills when they worked independently on tests.

II. All 4th and 5th Grade Student Surveys

4th Graders Survey Results



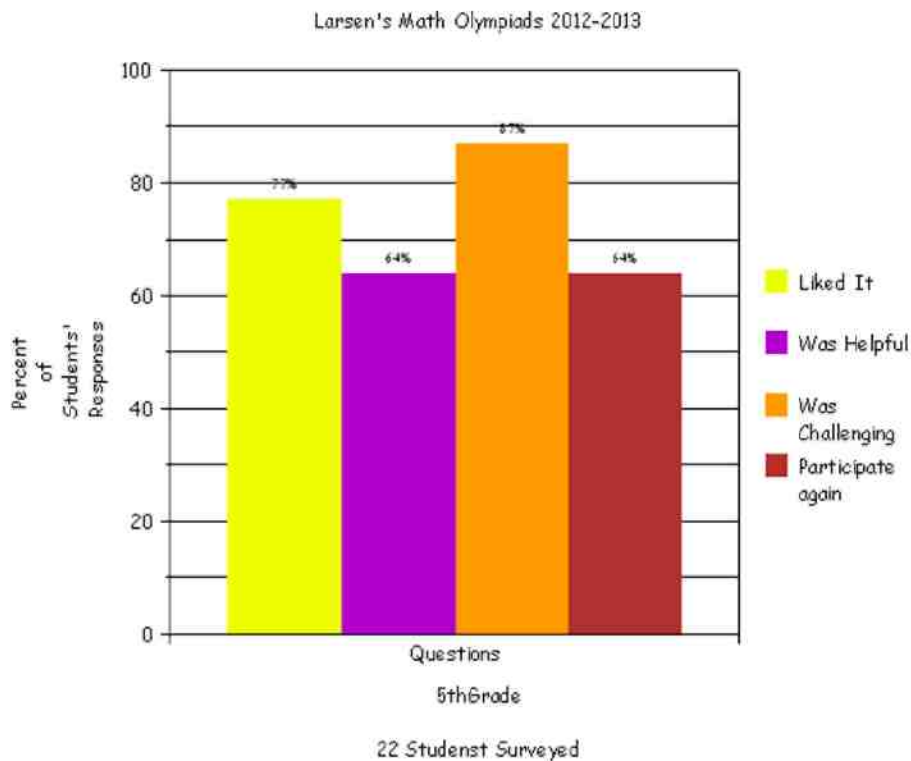
Findings:

I was surprised to learn that all of the participating GATE fourth graders liked attending and being part of the Math Olympiads meetings; even though, 94% of them felt the problems were challenging. 28% of fourth grade participating students expressed that the Math Olympiads didn't help them solve math problems because they had forgotten the procedures, the problems were too advanced for them, and they felt that they were not making progress. I found it interesting to learn that 78% of them would participate again in this program because they knew that the strategies they learned when they reviewed test results were helpful for them and further

MATH OLYMPIADS FOR GIFTED AND TALENTED STUDENTS AT LARSEN ELEMENTARY

assist their math learning. 22% of them mentioned that they wouldn't participate again in the Math Olympiads because it was too much responsibility to be attending the meetings and being there for the whole team and they felt that they were not making progress, so they were discouraged.

Fifth Grade Student Survey



Findings:

It stands out that the fifth grade GATE students were less pleased to attend the Math Olympiads versus the fourth graders. 23% of the twenty-two surveyed fifth graders didn't like participating in the Math Olympiads versus 0% of fourth graders. Fifth grade students enjoyed working on the computers versus paper-pencil activities. They especially liked the different practice sites available through the website and that they had a Google account. Many of them also liked the

way the coach explained solutions and different methods which helped with problem solving although 64% didn't find that the Math Olympiads helped increase their classroom math skills. 87% of them didn't think the Math Olympiads were challenging, yet they scored less than the fourth graders; and 64% of them would participate in the Math Olympiads again. Many of these students mentioned that they wished the meetings didn't take that long and to have them at a different time because they lost their recess. Another common comment among the fifth graders was that they disliked being pulled-out of their regular classroom to be able to attend the meetings. Some students felt they missed important classroom lessons and felt lost when they returned to class.

Students suggested the following ideas for next year: 1) Change day, time and length of meetings. 2) Separate grade levels to have fewer students in the meetings. 3) Have tablets available for students who don't have a computer at home. 4) Provide hands-on activities. 5) Have a Math Challenge during the school day since some students don't have computers or internet at home or have other activities and can't log in at 5:00 or 7:00.

Further Discussion of Survey Responses Small Group (Five Fourth and Fifth Grade Students)

Question 1. Did you like participating in the Math Olympiads?

All of the participating GATE students said they liked participating in the Math Olympiads. Their response to what they liked best was: attending the meetings to discuss test results and learn strategies to solve math problems, taking tests, and using the website's blogs to workout different problems. The five fourth grade students mentioned that they disliked that the meetings

were too short and the fifth graders felt that the meetings were too long and it took their recess time.

Question 2. Did the Math Olympiads help you solve math problems?

All ten students said that they did learn how to solve math problems in different ways. A trend I noticed was that they all mentioned that they learned different methods to solve a particular problem. One student mentioned that she was able to recall previous methods that the coach had modeled when working out problems on test and was able to apply the same skills to find the answer.

Question 3. Did you think the Math Olympiads were challenging?

All ten students also agreed that the Math Olympiads were challenging. Some stated that some of the problems were easy to solve once they were able to figure out what the question was asking and/or eliminating the distractors when reading the math problem. Others mentioned that some problems were completely new to them and didn't know how to solve it. But they did agree that once the coach went over the problems, they realized their mistakes and understood how to get to the answer.

Question 4. Would you participate in the Math Olympiads again?

All of the ten students said that they would like to participate again although it was challenging they knew their participation would improve their math skills.

Question 5. If you could make a change for the Math Olympiads, what would it be?

Student suggestions were great and valuable for coach/es to consider for next year. Two fourth grade students said they would like to have longer meetings to have more time to review test

problems and solve additional practice problems. Several of the students mentioned that it would be helpful to have manipulative tools, such as cubes to use when it would help them to understand and solve problems. Another suggestion was to have test-prep problems to be better prepared for the official test. I found that next suggestion was extremely valuable since many students did not have a chance to go online for the 5:00 or 7:00 O'clock Math Challenges, it would be good to add a Math Challenge during the school day so students who don't have internet access at home or time to log in at those times, can participate during school hours.

Discussion:

I was happy and excited to learn that they all wanted to participate again next year; even though, the concepts were challenging. I was surprised that several students suggested having longer meetings to discuss more problems. I was under the impression that they would be tired of working out different math problems in one hour, but they proved me wrong. Also, the suggestions they made are easy fixes we can accomplish without many problems.

III. Teacher Surveys

Teachers mentioned that they did see problem solving improvement with their gifted and talented students. They mentioned that their students had lost the fear of solving word problems and saw how they worked collaboratively in class to find solutions. A fourth grade teacher wrote that her GATE students really enjoyed being part of the Math Olympiads and would choose to log into the Math Olympiads Website during their free time to work math problems or visit the practice sites provided for them. They would recommend for GATE students to participate again in the Math Olympiads since it opened the door of opportunities towards finding resources to problem solving while using technology, collaborative skills, and communication. The

suggestions they mentioned were: 1) to provide this program again for students although the test scores were not as high as were expected; 2) consider day and time of meetings; 3) report test scores to teachers who have students participating in program.

IV. Parent Surveys

I was only able to collect ten parent surveys from participating students. The majority of them rated the Math Olympiads high in all areas. A weak area was that the Math Olympiads didn't improve their child's math grade. All of them responded that they would like for their son/daughter to participate again in the Math Olympiads. One parent suggested that there should be more explanations for problem solving and to move time of meetings to after school so students wouldn't miss class time and lunch recess. I concluded that many of the surveyed parents were happy with the Math Olympiad program.

V. Student School Board Presentation

At the School Board meeting, I asked some of the participating students for their opinions with regards to the program and these were their responses:

“I really like the math blogs because you get to answer questions. Some of them are quite challenging, but students online help sort it out together which makes me understand. I think Math Olympics is a fun thing to do. I have watched one of the videos, and it really helped me solve one of the problems. My coach is great at Math Olympics.”

“I like to participate in the 5:00 O'clock Challenge. I like it because it helps me become better in math and because I get to work it out with other math Olympians.”

MATH OLYMPIADS FOR GIFTED AND TALENTED STUDENTS AT LARSEN ELEMENTARY

“I have been on the Math Olympics blogs. I like the 5:00 Challenge as well as the math practice sites. Sometimes the math problems can be a little challenging, but it helps me understand math better. I think Math Olympiads is a fun activity to do.”

“I am a 4th grade Math Olympiad whose favorite thing to do in our math meetings is to explore the web-site and try to solve the math problems. I especially like the Problems of the Week and Friday Challenges.”

In Chapter Five I will discuss the implications of my findings and add recommendations regarding future Math Olympiads.

Chapter Five Implications and Recommendations

I. Will the Math Olympiads enhance the mathematical skills of GATE students at Larsen school?

The Math Olympiads tests were very challenging for the fourth and fifth grade GATE students. Each test targeted and required different math skills and problem solving to solve problems accurately. Although the majority of students did poorly on contest tests, they were able to see their mistakes and understand different ways to find solutions after the coach went through them. Many students saw their mistakes and others realized that they had worked too hard to find the solution. As mentioned in the literature review, teachers who have coached Math Olympiads believe that maximum growth occurs when student and coach go over different approaches to find the solutions. After analyzing student data, taking anecdotal notes, and reading student surveys, I believe that the Math Olympiads did enhance Larsen's gifted student's math skills and improve problem solving.

II. Will GATE students develop problem solving skills by participating in the Math Olympiads?

Despite the low performance on Olympiad tests, Larsen's GATE students did develop problem solving skills. They learned that some word problems have additional information that is not needed, which are "distractors" and learned how to eliminate that information in order to focus on what the problem was really asking. Students also learned how to use different approaches to find the answer as they shared how they solved the problem. I saw that students

listened to one another and said, “Oh, I get it” or “Oh, I see how you did it” as they were working together or going over test results.

III. Does this program satisfy curriculum differentiation for Larsen’s GATE students?

The Math Olympiads did satisfy the criteria for curriculum differentiation for Larsen’s GATE students because it challenged and enhanced their math ability to find answers; therefore, problem solving skills were developed or strengthened. In addition to students finding solutions to real world problems, they learned how to navigate the school districts’ Math Olympiad website. This site offered many blogs, selected videos to learn or review a process or skills, practice sites, and email to communicate with other students or coaches. Blogs such as the 5:00 and 7:00 O’clock Math Challenges were among the student’s favorite because they had to solve different math problems, post their answers and validate them with an explanation as how they got the answer.

IV. To what degree does the Math Olympiads satisfy the need of differentiated curriculum for GATE students?

After analyzing student data and surveys I believe that the Math Olympiads definitely differentiated for GATE students. It offered a wide range of math problems where students had to apply prior math knowledge and problem solving skills. Students learned different ways to how to break up math word problems in order to find solutions. As students went through that process, they developed thinking skills and applied what they knew to answers.

The Math Olympiads also offered the opportunity for Larsen’s GATE students to use a website page to communicate with other students and coaches, use the blogs, and navigate through the different categories it offered. Many of Larsen’s gifted students have internet access

at home and were able to use technology to work out two words challenging math problems and communicate through the blogs with gifted students across the school district.

V. Student, Parent, and Teacher Surveys

a) How do selected participants feel about the Math Olympiads?

Overall the gifted and talented fourth and fifth grade students liked participating in the Math Olympiads. Both grade levels mentioned that they liked attending the math meetings to learn more math skills, even though they recognized that the program was very challenging. The majority of them said that they would participate again in the future to increase their math abilities.

b) How do parents feel about their child's participation in the Math Olympiads?

The parents who participated in the survey rated the Math Olympiads high. They seemed pleased with their child's participation in the program because it helped their son/daughter expand their math abilities. A suggestion to improve the program was for the coach to dedicate more time to explain more in detail how to solve math problems.

c) How do teachers feel about the student's participation in the Math Olympiads?

All in all teachers felt that the Math Olympiads provided learning opportunities for GATE students. Some teachers stated that their students enjoyed participating in the Math Olympiads and took advantage of the website whenever they had extra time by logging in to practice solving math problems. Another teacher mentioned that she used the Math Olympiad Website as an extra tool to use with her advanced students. She required her GATE students to log in the website to

complete math problems when they had reached certain math goals in class. They support the idea of the program being offered again in the future.

Recommendations

While the gifted and talented students' test performance was not optimal, their effort, dedication, and enthusiasm to participate in the program was phenomenal. From the time GATE students were invited to participate, to realizing the complexity of contest tests, to the end of the program, they did not mind giving-up their lunch recess once a week to dedicate time to learn new math skills and develop problem solving. I was astonished to witness fourth and fifth grade GATE students' dedication when they attended every meeting even though; they knew how difficult it was to solve the problems and knew they had gotten a bad score on tests. During the first few meetings, I predicted that many of the students would drop-out because of the high level of problem solving ability they needed to solve problems. Yet, they proved me wrong. Since all of the participating GATE students continued to attend the math meetings, I changed my opinion about them quitting the Math Olympiads. I discovered that to them it was not about competing, it was about meeting with a group of students and coaches to go over math problems and learn new skills and strategies for problem solving.

I would unquestionably recommend the Math Olympiads program and assist the coach next year for several positive reasons. First, I learned that students enjoyed attending the meetings and were proud of what they learned. Second, through my research I learned that gifted and talented students need teachers to provide differentiation programs to maximize their talents and challenge their high learning abilities. The Math Olympiads tests, preparation materials, and

designed webpage, were excellent sources to use with gifted and talented students to enhance, empower, and challenge their math, reasoning, and communication abilities.

I would consider making the suggestions students, teachers, and parents provided in surveys to improve the Math Olympiads next year. I would highly suggest for the meetings to be offered after school and have separate grade level meetings to target smaller groups of students. If the meetings were held after-school, students wouldn't miss class time or recess and all of them would have access to computers and be able to use the website.

As a future educational leader I learned that gifted and talented students need as much attention as at-risk students. Because of the No Child Left Behind law, schools have dedicated limitless time and effort to under-achieving students, but if GATE students are left without opportunities to enhance and challenge their talents, they might become under-performing students too.

References for GATE Project 2013

Avid Academy for Gifted Youth. (n.d.). Retrieved from

<http://www.avidacademy.com/about-us>

Adams, D., & Hamm, M. (2010). *Demystify Math, Science, and Technology: Creativity, Innovation, and Problem-solving.*

Birdsall, P., & Correa, L. (2007). Gifted Underachievers. *Leadership*, 21-23.

Cai & Lester quote researchers (Hieber & Wearne, 1993; Marcus & Fey, 2003; NCTM, 1991; van de Walle, 2003 from Why is Teaching with Problem Solving Important for Students?

Common Core State Standards

<http://theholmeseducationpost.com/2012/02/what-is-the-purpose-of-the-common-core-state-standards/>

Ernest, P. (1989). The impact of Beliefs on the Teaching of Mathematics. (pp. 249-254).

London: Falmer Press. Retrieved from

<http://people.exeter.ac.uk/PErnest/impact.htm>

Franklin-Rohr, C. (n.d.). Differentiation and the Twice-Exceptional Student. (2012).

Understanding Our Gifted, 24(2), 25-27. Retrieved from

<http://www.ourgifted.com/Journals/UOG24-2.pdf>

Franklin-Smutny, J. (n.d.). Differentiating for Young, Curious, and Imaginative Learners.

(2012). *Understanding Our Gifted*, 24(2), 4-8. Retrieved from

<http://www.ourgifted.com/Journals/UOG24-2.pdf>

Journal for the Education of the Gifted October 1, 1996 19: 405-436

Math Olympiads. (2013, April 22). Organization and Procedures. Retrieved from

<http://www.moems.org/MDOrganization.htm>

MacFarlane, B. (n.d.). Differentiating Teacher Professional Development with Design.

(2012). *Understanding Our Gifted*, 24(2), 9-13. Retrieved from

<http://www.ourgifted.com/Journals/UOG24-2.pdf>

The National Council of Teachers of Mathematics (1991).

A Theory of Developing Competence with Written Mathematical Symbols by Heibert and

Wearne 1986 http://link.springer.com/article/10.1007%2F978-0-306-47124-5_1?LI=true

Schroeder-Davis, S. (n.d.). Differentiation: Transparent or Opaque?. (2012).

Understanding Our Gifted, 24(2), 15-24. Retrieved from
<http://www.ourgifted.com/Journals/UOG24-2.pdf>

The U.S. Commisiner of Education. Department of Health, Education, and Welfare. (1971).

Education 0n the gifted and talented. Retrieved from Office of Education website:
<http://www.eric.ed.gov/PDFS/ED056243.pdf>

Volpe, B. (1999, February). A Girls' Math Olympiad Team. Retrieved from

<http://search.proquest.com.summit.csuci.edu:2048/docview/231063911?accountid=7284>