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FOCUS ON MATHEMATICS ISSUE

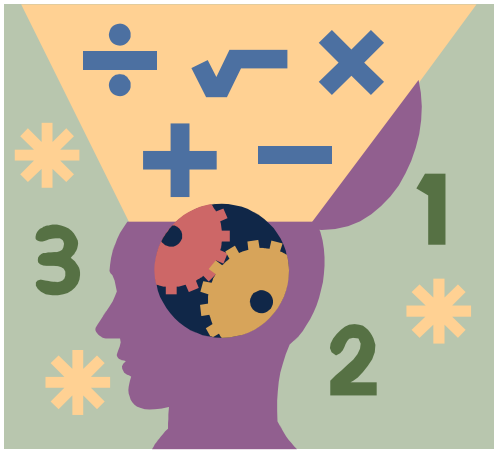
Middle Grades Division

NATIONAL ASSOCIATION FOR Gifted Children

MIDDLE MATTERS

FOCUS ON MATHEMATICS

INSIDE THIS ISSUE:



Letter from the Co-Chairs

Welcome to the Spring Issue of Middle Matters.

Last month Division leaders gathered in Washington, DC for updates from NAGC and to work on the 2007 NAGC Convention program. Del Siegle will assume the NAGC Presidency on September 1, 2007 and he shared a few of his goals. These included developing opportunities to support educators with professional development opportunities (beyond the annual conference), increasing the international participation in NAGC (note: this year international program proposals were reviewed as a separate "division" and will have scheduled places in the Convention program), and to discuss ways that teacher education programs might increase the training in gifted education practices for all teachers.

Other than Convention business, the other area of concentration for the Division leaders during the meeting was to discuss ways to strengthen and streamline the role of the divisions in NAGC. This included how to increase participation in the Divisions, how to support and cultivate new leadership in the Divisions, and how the Divisions might be organized in a meaningful structure to meet the needs of the NAGC membership.

We hope to see many of you at the 2007 convention in Minneapolis on November 7-11, 2007. Highlights include a closing keynote by Garrison Keillor and over 300 presentations representing 16 strands. In addition, there will be mini keynotes on research in gifted education, reflections on the Templeton Report: A Nation Deceived and a presentation on IQ testing research.

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LETTER FROM THE CO-CHAIRS

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The Middle Grades Division had over 50 proposals submitted for the approximately 24 presentation slots at the Convention. These sessions address curriculum strategies, social and emotional issues of gifted middle school students and other topics that we hope will help you meet the needs of your gifted middle level students. In addition to the presentation slots, a number of people will be invited to present poster sessions, which were very popular last year. THANK YOU to Diane Heacox, Jan Hersh, Linda Kubik and Jamie MacDougall who served as proposal reviewers for the division. Their input in the proposal process helped to define the program for the Middle Grades Division.

To prepare for your attendance at the national Conference, please note that The Middle Grades Division Preconference Institute on Wednesday, November 7, 2007 will be "PCM: Integrated, Relevant, Challenging and Exploratory Curriculum for the Middle School" featuring a variety of educators who use the Parallel Curriculum Model (PCM) with middle level students. If you have a PCM Unit that you would like to share contact Susan Rakow at susanrakow@earthlink.net if you haven't already. There will also be some visits to middle schools in the Minneapolis area, one of which is a PCM school! How timely!

Another project that is in the works as a result of the Spring NAGC work meeting is the collaboration between our division and the Professional Development division to create a Middle Grades Gifted ToolKit. The form and contents are still in the very early stages. Thanks to all of you who've already submitted ideas. More information will be coming your way as this project evolves. Again, if you have suggestions for what your middle school teachers and administrators would find useful in a "ToolKit", email Susan at susanrakow@earthlink.net.

For those of you looking for a foundational resource with teaching suggestions for gifted middle grade students, check out the 2006 NMSA publication, *Smart in the Middle Grades: Classrooms That Work for Bright Middle Schoolers (ISBN 978-1-56090-195-2)* by Carol Ann Tomlinson and Kristina Doubet (available for $24.00 from NMSA at www.nmsa.org)

Happy Spring to all of you!
Susan Rakow and Susannah Richards
Middle Grades Division Co-Chairs

Susannah Richards
susannahr@commongroup.net

Susan Rakow
susanrakow@earthlink.net

Helping Mathematically Talented Girls Achieve at the Highest Level

Nancy N. Heilbronner and Sally M. Reis
University of Connecticut

During the last few decades, an increasing volume of research has focused on the gender gap between males and females in math and science (Benbow & Stanley, 1983; Dorans & Livingston, 1987; Pallas & Alexander, 1983; Reis & Park, 2002). Beginning in middle school and continuing throughout their academic careers, women still continue to take fewer advanced math and science courses, achieve fewer advanced degrees, and go into math and science related fields in fewer numbers (Reis & Park, 2002). Although this gap has decreased slightly (National Center for Education Statistics, 2005), the overall trend of women scoring well below men on the mathematics portion of the SAT (SAT-M) continues (College Board, 2006). Unfortunately, these lower SAT-M test scores negatively affect females' acceptances in disproportionate numbers from the best colleges, graduate schools and professions, so that the situation becomes a self-perpetuating one. Strategies that can change this negative process and implement positive change are the subject of this research study.

To address these concerns and the limited research on mathematically talented young women, this qualitative study (O'Shea, Heilbronner, & Reis, in press) was conducted to examine the experiences of 23 young gifted females who excel in math. By focusing on school experiences, researchers tried to identify the cognitive and affective factors that enabled these talented high school students to achieve in math. It is hoped that the results of the study may help teachers to promote higher achievement in mathematically talented young women.

Review of Research: School Factors

The psychosocial factors of school and home significantly affect achievement in mathematics, as school environment plays a role in girls' underachievement in mathematics (Reis, 1998). Teachers interact more often with males, either positively or negatively, as they question males more frequently, and give male students the opportunity to respond to more high level cognitive questions than females (Good, Sikes, & Brophy, 1973; Jones & Dindia, 2004). Teachers provide interactions with males to help them learn, but tend to do tasks for females (Jones & Dindia, 2004; Serbin et al., 1973). Perhaps most significantly, high achieving girls receive less attention in math classes than high achieving boys (Good, Sikes, & Brophy, 1973). Mirroring students' issues with self-efficacy, teachers may attribute males' success to ability, and females' success to effort (Fennema, 1990). On the other hand, teachers who challenge girls to defend their answers, who show a passion for their subject, and who use a variety gender-sensitive strategies may have more success with both girls and boys in their classrooms (Klein, 1985; McDaniel, 1994).

Taking advanced level coursework may also play a role in the development of mathematical abilities in high achieving women (Pallas & Alexander, 1983). An interesting change in the last decade is that girls are now taking more classes in higher level mathematics than boys (Bleuer and Walz, 2002), a fact that may eventually lead to increased achievement among women in the highest levels of mathematics careers and academia.

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Findings

The study focused on the experiences of 23 talented females with high achievement in mathematics, defined as being identified as gifted, scoring above the 95th percentile on the SAT-M, and excelling in math in school, in an attempt to investigate the school factors that influence smart girls' achievement in mathematics learning. A set of common factors that included positive math experiences at home or school were identified for these 23 young high achievers, and these are discussed with examples that illustrate some of these factors.

Attributional Style

Attributional style, or how an individual explains success or failure, varies between males and females. Women often attribute success to effort rather than ability, while males often view success as the result of ability (Dweck & Bush, 1976; Kloosterman, 1990; Reis, Callahan, Goldsmith, 1994; Wolleat et al., 1980). However, over half (57%) of the participants attributed their math success solely to ability. These women were clearly aware of their abilities in math. One participant stated, "I pick math and physics up faster than kids who are actually paying attention." Another indicated, "I've got the 'thinking genes'." Another two participants attributed their success to both ability and effort. Seven attributed their success to effort, stating "I'm not absolutely brilliant but I work hard to make up for it." It is interesting to note that 80% of the participants who scored over 750 on the SAT-M attributed their success solely to ability.

Usefulness of Math

Confirming earlier research (Eccles et al., 1985; Gavin, M., 1998; Gjertsen, 1999; Kelly, 1986; Leder, 1988; Pedro et al., 1981; Tocci & Engelhard 1991), all of these talented young women understood that math was useful in life, and this view was fostered in both home and school environments. For example, several participants' parents utilized math in their careers. These women either related its usefulness to a career they would like to pursue in the future or they described it as useful to everyone in general:

> Math is useful to everyone. For some people it's more important than others. If you go into engineering or architecture you deal a lot more with it. I'm hoping to go into therapy, but it still requires some math. Everything requires math in it.

It is particularly interesting to find that 70% of the women interviewed had at least one parent who had majored in math, science or engineering, or was using math in some type of applied fashion in their current work. Teachers and parents who constantly emphasize that mathematics is a vibrant, useful subject, meaningful in real life, encourage young women to value and respect the domain.

School Factors

School environment.

Over 95% of participants viewed their schools positively. These women were overwhelmingly positive about their overall school environment and the opportunities afforded them for learning. Many described their schools as nurturing, supportive, helpful, and challenging. One participant stated, "This school has given me a lot of opportunities. " Another concluded, "They want the students to excel." One student felt "lucky to go to this school."

Math instruction.

All participants had well above average group IQ scores, and several of the women's scores were

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over 140. The majority of these academically talented young women had taken higher-level courses such as advanced placement calculus and physics. However, participants were mixed, but generally positive in their responses as to the quality of their mathematics instruction. Fifty percent of respondents believed that their mathematics classes had been "demanding" or "good". Thirty eight percent felt it had been "fair" or that it "depended on the teacher". Ten percent believed that they had "never been challenged" or that instruction had been "poor".

The participants were universal in their belief that taking higher level courses beyond algebra and geometry helped them to be powerful mathematical thinkers and enabled them to do well on the SAT-M. One suggested, "There is so much application of algebra and geometry in Algebra II and Calculus you get a much deeper understanding of math." Another explained, "Taking Calculus and Pre-Calculus gives you more speed in answering problems because you don't take as much time to think about how you are going to get an answer. You already know, it's already processed in your head." Consistent with the research of Pallas and Alexander (1983), encouraging capable young women, from an early age, to take the most rigorous academic program available to them in mathematics may help to prepare them for higher achievement levels later (Reis, 1998).

Classroom instruction on test-taking strategies also appeared to help these women. All of the participants utilized such strategies on the SAT, including logical guessing to eliminate incorrect problems, and more. In support of Gallagher and Johnson's 1992 findings, many of the participants had been given timed tests in the classroom and taught to focus on working quickly and efficiently. Teachers who use these classroom strategies, and who provide practice on timed test-taking strategies may help female students do better on the SAT-M.

The importance of teachers.

The women in the study were definitive about their perception that there was no difference in the way their mathematics teachers treated males or females. Ninety-five percent of participants described teachers as treating men and women absolutely equally, stating that they were "very equal" and "pretty much the same." One participant demurred, stating her teacher "would sometimes laugh at questions from girls."

Over half of participants believed that a teacher's personality, style, and passion for the topic affected how well students learned in class. Confirming previous research (Klein, 1985; McDaniel, 1994) teachers who nurture and challenge their students, particularly their female students, may positively influence how hard these students will work in class. In one high school group of participants, for example, one teacher elicited especially high praise from all of her students. Participants who had Mrs. D. for math stated, "Mrs. D. made math very cool because she loves it so much. She continues until everyone gets it, so it's really good." Another suggested, "The women in the class gave more" because of her [Mrs. D] enthusiasm and her wanting to make sure 'everyone gets it'." In addition to excitement, another 29% felt that compassion and interest in the students was a key characteristic of good teachers. Mrs. D was described as being "like my mother…she makes everyone understand...I just love her!" Clearly, participants admired teachers who expressed their enthusiasm for the topic. They also worked harder for teachers who they saw as caring and nurturing. It is interesting that only 18% of participants felt that a varied teaching style or intelligence was important to being a good teacher.

Teachers who exhibited their passion for mathematics seemed to produce results, and participants in this study also reported that they did well with teachers who get to know students by taking an interest in their lives outside of the classroom.

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Conclusions

Women are still under-represented in a number of upper level mathematics courses, and later, in mathematically oriented careers. Female's scores on the SAT-M are still lower than their male counterparts. Although previous studies have often attempted to determine reasons for these gaps, this study focused on identifying factors responsible for the success of these 23 women who achieved at the highest levels of the SAT-M.

These young women possessed an attributional style that enabled them to clearly see their talents in math and attribute success to those talents. They saw math as useful in everyday life. They had taken a rigorous set of math courses and had been exposed to test-taking strategies that included timed tests to improve speed. They had been influenced by warm, nurturing teachers who were passionate about their subjects, and had been encouraged both at home and school to view math as a useful pursuit. Parents had created a stimulating environment in the home that encouraged academic pursuits, and especially mathematical achievement.

Instead of focusing on deficits, educational and home communities would do well to focus instead on promoting characteristics that enable young women to achieve in math. Young women's interest in and views of math as important can be influenced both at home and school through nurturing, enriching environments. Girls can be taught how to set realistic, achievable goals in the area of mathematics and then how to work to attain them. Challenging curriculum accompanied by test-taking strategies helps to boost math achievement. Teachers and guidance counselors can exert a positive influence over their students to create a new generation of confident, capable, mathematically talented women.

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The Needs of the Mathematically Gifted

Grayson H. Wheatley, PhD
Emeritus Professor, Florida State University (Formerly Purdue University)
ghwheatley@aol.com

In large part because of "No Child Left Behind", schools are focusing their attention on the students who might past the end-of-year test with a bit more help. Gifted students are being totally ignored since they will pass the test no matter what their instruction is like; its all test-driven. The effect is that these potential leaders on whom we depend to make the breakthroughs in science and technology are not *being allowed* to develop their potential. Most school mathematics is procedural in nature taught using an ineffective explain-practice method. Such an experience is detrimental to all students but especially for more able learners. When taught effectively, gifted students learn at prodigious rates. Consider the following case study.

I began working with Michael when he had just turned seven and in two and one-half years, he had finished high school mathematics. This was accomplished in two after school sessions a week with no explanations being presented. Most of the time I would pose carefully chosen problems. One day while we were studying analytic geometry and he was in a gifted grade three class in school, he had the need to multiply two three-digit numbers. He commented, "The kids in my class would not be able to do this because we have not gotten beyond the sixes." If Michael had not been working with me, his math in a gifted class would have been focused on memorizing the times tables.

In designing mathematics learning environments for gifted students, two factors must be considered, topics and instructional methods. Wheatley (1999, 2002) has formulated an instructional strategy, especially appropriate for gifted students, that consists of the teacher posing well chosen problems, putting students in pairs, and later having the students present their solutions to the class. This approach has proven effective in many studies. Critical to the implementation of Problem Centered Learning (PCL) is the choice of instructional materials. It is difficult to use PCL when traditional textbooks are used.

Rather than focusing on procedures, the emphasis must be on number sense, spatial thinking, and most importantly, mathematical reasoning. Students in nearly all our schools are not learning to reason mathematically. Consider the following problem:

"It takes 15 minutes to saw a log into four pieces. Given that each cut takes an equal amount of time, how many minutes does it take to cut the log into six pieces?"

The students in this 2007 study were the top 15% of sixth graders from a school system that scores high in a state that has high NAEP scores. So we are looking at a relatively high performing school system (by some standards) and the task does not require remembering formulas or facts. Yet these gifted students were not able to reason mathematically; only 6.5% (20 of 309) of them were able to answer correctly. The only conclusion is that their school mathematics experiences had not *allowed them* to develop the minimal level of reasoning needed to solve this problem.

A striking example of how our gifted students are being left behind is shown in the interview below.

An interview was conducted with a bright eighth-grade student. She was poised, the top student in her math class, and scored at the highest level on the end of year state test. Her goal was to be a veterinarian; truly a gifted student. In an effort to determine the nature of her mathematics, an individual clinical interview was conducted. A segment of the interview is shown in the transcript below. It shows her response to a problem requiring a minimum of specific mathematical knowledge.

G – Let's look at this problem. Please read it aloud.

S – A swimming pool in the shape of a rectangle is surrounded by 3 feet of walkway. The pool is 23 feet wide and 32 feet long. How long would the fence be that just encloses the walkway and the pool?

G – Take your time to think what it means.

S – I'll draw a rectangle and 3 feet wide surrounded by 3 feet wide walkway and then the pool is 23 feet wide and 32 feet long. So they just want to know how long it is.

G – I'm going to a hardware store to buy a fence and I want to know how much fence to order.

S – OK

G – Tell us what you have done here.

S – I was trying to find the area of the rectangle which is the pool.

G – And you did that by **multiplying** 23 times 32 and you came up with 736. OK.

S – And then, I am not sure, just 3 times 3 equal 9.

G – Just try anything you like. So, where is the fence that we are going to build in terms of your picture here? Where would the fence be?

S – It would be around the outside.

G – Yeah, that's where it would be and we want to know how much fencing to buy.

S – OK, lets try 23 plus 3, 26, and 32 plus 3 cause it is all the way around. The let's do that instead. OK, let's try about…OK, I took the 23 and added the 3 and the 32 and added the 3 and I **multiplied** the sums and got 850.

G – Yes.

S – So I think that's…

G – So when I go to the hardware store, I should order 850 feet of fencing and that would just do it.

S – I think so.

G – OK, so 850 feet would be the distance around the pool. I understand just how you thought about it. Thanks a lot.

As you can see from the transcript, this student did not make sense of the problem. She traces around the rectangle to show where the fence would go but multiplies length and width rather than adding the length of sides. Also, she fails to use the correct length and width of the new rectangle. She sticks by her answer of 850 ft. which is an unreasonable number given the dimension of the pool. This very bright and highly motivated student had not learned to reason mathematically and her number sense was weak.

A math program for gifted students should be composed primarily of problems. There is no dearth of problems. Anyone interested can contact me and I will send or suggest appropriate problems. The activities in the two books cited develop number sense and mathematical reasoning. There is no place for lecture or explain-practice instruction in working with gifted students. Problem Centered Learning works well but the tasks must be novel and challenging. There is no limit to what students can accomplish under this plan. A final comment: In order to be an effective teacher of the gifted, one must be a listener and, in all likelihood, make a paradigm shift from how he or she was taught mathematics.

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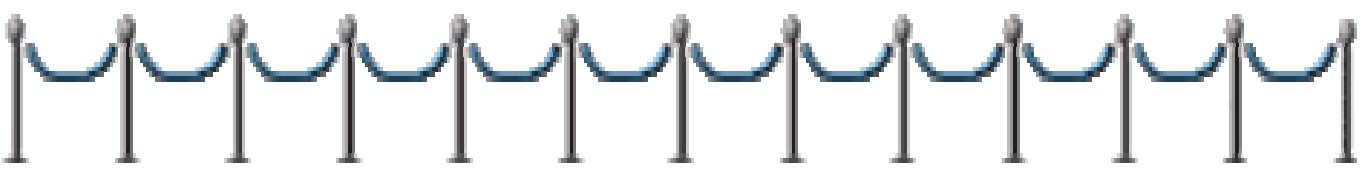

MATHEMATICS MATERIALS YOU CAN USE!!!

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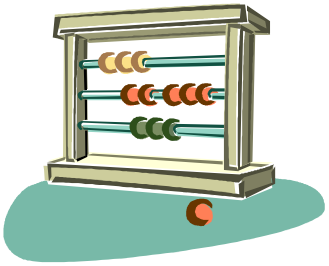

UNDO
The book review in the January 2007 Issue on "How to Teach so Students Remember" was written by Kathy Ross, not Susan Rakow.

I love mathematics ... principally because it is beautiful, because man has breathed his spirit of play into it, and because it has given him his greatest game – the encompassing of the infinite.

Roszo Peter

GIFTED IN THE NEWS

NAGC's list of great Resources!
http://www.nagc.org/CMS400Min/index.aspx?id=1003

Number Base Unit Available

Teaching about number bases isn't as popular now as it was a several decades ago when "New Math" was popular. Part of the problem was that New Math was focused on a body of mathematics that was fairly unfamiliar to most classroom teachers and many of them were unprepared to teach such a curriculum. New Math was also typically begun in the elementary grades and, for many teachers at this level, mathematics is their least favorite subject. Many of them are comfortable only with arithmetic and the lowest levels of geometry, data analysis, measurement, and problem solving.

Thus, over the years, much of New Math has fallen by the wayside. Set theory, one of the cornerstones of new math, is rarely taught at this level any more, even though it is very important for serious mathematical study. Alternate number bases are not taught either. But at least in the case of number bases, I feel this is a mistake. It is difficult to understand the power of the invention of zero or the reasons behind the use of base 10, unless there are contrasts to different counting systems and different bases. Learning any major concept involves understanding what it is and what it is not. Just as a student gains in understanding democracy by contrasting it to dictatorship, base 10 and place value are better understood if contrasted to systems with no zero or systems that group with different bases. If all we ever teach is base 10, students don't really understand the power of the system – why we make such a big deal about grouping and ungrouping by a factor of ten with each place; why it is better than base 2 for humans, but why computers can work better with binary. True, many teachers still do not understand number bases; but the concept is important enough that I feel children should be exposed to number bases other than 10, especially gifted children for whom this level of abstraction tends to solidify their understanding. Place value is an extremely important and pervasive construct in mathematics and a thorough understanding of its meaning is important, both for teachers and for students.

I have written a number base unit for gifted classes from 5th grade through 8th grade. Certain parts of the unit could be used with younger children; older students who have not been introduced to different number bases might enjoy it with some compacting. If you are interested in a copy of the unit, please email lwalsh@acsalaska.net. The unit is free of charge. Please specify whether you would like to have it in Microsoft Word format or PDF format.

lwalsh@acsalaska.net
http://llwcontemplations.blogspot.com
Laura Lynn Walsh
Fairbanks Northstar Borough School District
Fairbanks, Alaska

Math Websites for Enrichment and Practice

(Checked for accuracy 4/2007)

These sites are full of great things for kids. Send your gifted ones to sites above their level and offer the struggling students easier ones.

http://www.naturalmath.com/- games, jokes and questions for the elementary student

http://forum.swarthmore.edu/dr.math- Ask Dr. Math - answers math questions from elem. through college

http://www.freeworksheets.com/- select topic and grade level, also free software and math generator - all ages

http://www.mathpower.com/- Prof. Freedman's Math Help - clear explanations of algebra, etc. for high school

http://www.math.com/- free games and practice for middle school and up

http://www.funbrain.com/- K-8 games at increasing levels - great site for teachers too

http://www.mathcats.com/-fun practice on lots of topics for grades 1-6

http://www.scugog-net.com/room108/MadMath/mmm.htm- tons of practice and fun games for elementary kids

http://www.brainbashers.com/- games, puzzles, and optical illusions for middle and high school students

http://www.glencoe.com/sec/math/cool/index.htm- has links to many resources for teachers and games for k-12

http://coolmath4kids.com/- an amusement park for math ages 3 - 100

http://www.greylabyrinth.com/- a really hard math site designed by a gifted adult for college students

http://www.mathgoodies.com/- puzzles, worksheets and homework help for grades 4-9

http://www.c3.lanl.gov/mega-math- unusual and important math ideas and activities for grades 3-8

http://www.qbyte.org/puzzles- Nick's Mathematical Puzzles - great for high school - new ones each week

http://www.figurethis.org/- great problem solving for middle school kids from Nat. Council of Teachers of Math.

http://www.bbc.co.uk/education/mathfile/index.shtml—The Math Files game Show—high Level work with lots of humor—very appealing to our gifted students

Math Programs for Gifted Middle Schoolers

An interesting math program for gifted middle schoolers is the Math Olympiad. Students compete by trying to solve five problems in a secure setting on a pre-selected day each month, from November to March. The students scores are turned in by the sponsor for team and individual rankings. The problems are interesting, multi-step, and not easy! This competition days could be amended with practice activities on similar problems or past competition problems, solved as a group or with partners, though the actual competition is individual. Math Olympiad could be set up as an elective for those who enjoy puzzles and problem-solving, or a team that meets after school. Prizes are awarded at the end based on performance, but the greatest strength of the program is the fun you have trying to figure out how to find the answers.

Bonny Collins
Springfield, NJ

Middle Grades Division of the
National Association for Gifted Children

1707 L Street NW
Suite 550
Washington, DC 20036

NATIONAL ASSOCIATION FOR
Gifted Children

MIDDLE DIVISION CO-CHAIRS:
Susan Rakow
susanrakow@earthlink.net
Susannah Richards
susannahr@commongroup.net

MIDDLE MATTERS EDITOR:
Jan Hersh
jan_hersh@comcast.net

Special Thanks to Linda Kubik who is acting as newsletter proofreader!

MISSION STATEMENT

The Middle Grades Division recognizes the unique needs of gifted middle grades learners and educators. Middle school is the level at which gifted students face great challenges to full development of their potential and is a time when a large number of gifted students, particularly girls and minority students, begin to underachieve in response to perceived societal and peer pressures. The division recognizes the need to develop appropriate strategies for working with these students. To address these concerns, the division works in the areas of curriculum, instruction, research, and communication and dissemination, to assist students, teachers, and administrators as they endeavor to make the middle school years a positive and challenging experience for gifted students.

MIDDLE MATTERS

- Is **your** Middle Division Newsletter!
- Become part of it by sending items for publication!
- Send in questions for our new Question/ Answer column!
- Articles, stories, humor, or anything you'd like to share relating to Middle Level Gifted Education.
- 75—500 words (or more if need be)

HAVE YOU ALWAYS WANTED TO PUBLISH AN ARTICLE BUT DIDN'T KNOW HOW?

Well, here's your chance to get something that you're great at, or something that you'd like to share IN PRINT!!!

Send in an article about anything that relates to teaching Gifted in Middle School.

We'll do the editing (if you'd like), and you'll have your article published.

THE NEXT NEWSLETTER TOPIC IS GIFTED SCIENCE EDUCATION. Share your resources with other Middle Division Members!