



Working Group 1: Mathematically gifted students



CMESG/GCEMD ***Day 2*** (Margo)

Placement of gifted kids:

Include or separate?

June 7, 2009



What is “mathematical cast of mind”?

(V.A. Krutetski)



- ★ tendency to view the world through mathematical lens, desire of learning
- ★ impressive concentration on math task
- ★ independence and originality of work
- ★ risk taking – willingness to explore
- ★ curiosity – seek alternatives, in depth
- ★ imagination - visualization, symbolization



Mathematically gifted kids:



- ★ may take longer to understand problem situation, ... and quick grasp of concept
- ★ tend to systematically explore number of possibilities, consider special cases
- ★ seek for generalization
- ★ often prefer reasoning to given algorithm
- ★ welcome challenge (but not tedious work).



*We should **not** assume that
gifted kids **automatically***



- ★ enjoy **all** mathematics tasks
- ★ work productively in **any** math lessons
- ★ want to collaborate with peers on routine exercises
- ★ posses higher order thinking (systematic reasoning, organization of data, etc)
- ★ learn without instruction or explanation





Gifted kids require special attention in a classroom!



Because they:



- ★ could feel frustrated, isolated, bored with repetitions and drills
- ★ will not seat and behave unless occupied and engaged in a task
- ★ may not like to explain their solution and write it neatly after the problem is solved





Gifted minority in classroom

All gifted students may experience isolation and pressure to hide their abilities, but minority students tend to feel the weight of these forces to an even greater degree. Gifted minority students report feelings of inferiority, as well as the need to constantly choose between using their talents and fitting in with their peers (Cropper, C. (1998). Fostering parental involvement in the education of gifted minority students. *Gifted Child Today*, 21(1), 29-24, 46.).



What can be done for gifted kids?



- ★ Selective or specialized school
- ★ Accelerated math class within a comprehensive school / streaming
- ★ Enrichment (extra-curricular, after school)
- ★ Differentiated instruction in heterogeneous classes



curriculum for gifted: 4 ways of modification



- ★ Acceleration
- ★ Enrichment
- ★ Sophistication
- ★ Novelty



Gallagher, J & Gallagher, S. (1994) *Teaching the gifted child*. Newton, MA: Allyn & Bacon.



Key Components of Mathematics Curriculum for the Gifted



- ★ Content with greater depth and higher levels of complexity
- ★ A discovery approach that encourages students to explore concepts
- ★ Focus on solving complex, open-ended problems
- ★ Opportunities for interdisciplinary connections



(Johnson, 1993)



Projects for gifted

AN IMPORTANT ASPECT OF TEACHING GIFTED STUDENTS IS

helping them create large-scale, complex products (Parke, 1989). Products that require students to **stretch their abilities** and **extend their knowledge** provide authentic and challenging learning experiences, as well as meaningful assessments.





Brain research informs:

If the content and tasks that have been deemed suitable for their grade level are too easy, they [gifted kids] will not be engaged, and as a result, they will not be learning. Brain research provides a physical explanation for students' failure to learn. **When tasks are not sufficiently challenging, the brain does not release enough of the chemicals needed for learning:** dopamine, noradrenalin, serotonin, and other neurochemicals (Schultz, Dayan, & Montague, 1997, cited in Tomlinson & Kalbfleisch, 1998).



Effective instructional methods

that have been linked to improved student achievement

- ★ Posing open-ended questions that require higher-level thinking
- ★ Modeling thinking strategies, such as decision making and evaluation
- ★ Accepting ideas and suggestions from students and expanding on them
- ★ Facilitating original and independent problems and solutions
- ★ Helping students identify rules, principles, and relationships
- ★ Taking time to explain the nature of errors

(Johnson & Ryser, 1996):



Common teaching strategies

to teaching gifted students in regular classroom settings occurred most frequently:

- ★ Establishing high standards
- ★ Making curriculum modifications
- ★ Finding mentors for students
- ★ Encouraging independent investigations and projects
- ★ Creating flexible instructional groups

Westberg and Archambault (1997)



For Gifted Girls

- ★ Communicate with parents about their daughter's abilities and the importance of mathematics and science for higher education and careers.
- ★ Encourage them to identify and address sources of gender bias.
- ★ Organize peer support groups for girls.
Mathematics and science clubs encourage girls to develop their skills and abilities and help connect them to other girls who share their interests.



For Gifted girls

- ★ Provide a safe environment for girls to share their confusion and fears.
- ★ Actively recruit girls to participate in advanced courses and extracurricular activities related to mathematics, science, and technology.
- ★ Encourage students to research and report on female contributions to mathematics and science.
- ★ Expose students to women in nontraditional careers. Help them to identify and connect with role models and mentors.

(Davis & Rimm, 1994; Smutny, 1998)



Cognitive-affective qualities



- ★ fluent thinking,
- ★ flexible thinking,
- ★ original thinking,
- ★ elaborative thinking.
- ★ Risk-taking,
- ★ complexity,
- ★ curiosity,
- ★ imagination

(Williams, 1986).



Strategies for creative thinking



- ★ Present students with **paradoxes** to analyze and test
- ★ Use **analogies** to introduce new concepts; ask students to create their own
- ★ Allow students to think about **discrepancies** in what is known
- ★ Ask **provocative questions** and provide time for inquiry
- ★ Examine **examples of change** and the process of change
- ★ Use **examples of habit** and the results of habit-bound thinking





Strategies for creative thinking



- ★ Encourage **tolerance for ambiguity** with open-ended problems
- ★ Encourage students to use their **intuition** and follow their hunches
- ★ **Study creative people** and their thinking processes
- ★ **Evaluate situations** by analyzing possible consequences and implications
- ★ Help students practice **creative reading, listening, and writing** skills

(Williams, 1986)



Independent learning

basic skills : (Tomlinson, 1993).

- ★ making choices,
- ★ planning,
- ★ setting goals,
- ★ identifying resources,
- ★ and self-evaluating

P.S. Independence is often cited as a characteristic of gifted students. But that does not mean all gifted students have the skills for self-directed learning.



Autonomous Learner Model

to help gifted students develop the skills of independent learning.

- 1. Orientation.** Students develop an understanding of their abilities, skills, interest, and learning styles.
- 2. Enrichment activities.** Students are exposed to a wide range of content areas, including cultural activities and field trips, and discuss their emerging interests.
- 3. Seminars.** Students explore topics of interest in small groups.



4. Individual development. Students learn skills for problem solving, goal setting, creativity, and self-assessment, as well as knowledge about careers and interpersonal skills.

5. Indepth study. Students pursue their individual interests and become producers of knowledge, often conducting original research.

(Betts & Neihart, 1986; Feldhusen, Van Tassel-Baska, & Seely, 1989)



Problem-based learning

- ★ Now the **teacher is not the expert** and does not provide students with information or outline processes to use (Van Tassel-Baska et al., 1993).
- ★ The teacher's role in problem-based learning is that of "**metacognitive coach**," thinking out loud with students and guiding them toward the questions they need to ask. The teacher also helps students in **planning** how to go about their work, **analyzing their progress** as they discover new information, and **questioning** their assumptions.



Problem-based learning

- ★ An **ill-structured problem** is an good way to introduce a new area of study to students. Instead of presenting students with a problem at the end of a unit, students begin their learning with a problem. The information they will need and the skills they must develop now have context and relevance (Gallagher et al., 1995).



Differentiating instruction



★ Open questions

It allows for correct responses at a variety of levels;



★ Parallel tasks

It allows struggling student to be successful and proficient student to be challenged;



Marian Small, Good Questions. Teachers college press.



Ability grouping



ability grouping increases student achievement by reducing the disparity in student ability levels, and this increases the likelihood that teachers can provide instruction that is neither too easy nor too hard for most students.

R.E. Slavin (1986) sees as the most compelling argument against ability grouping its creation of **academic elites**, a practice which goes against democratic ideals.



Successful practices-1

- ★ students are assigned to **heterogeneous homeroom classes for most of the day**, but are **regrouped according to achievement level for one or more subjects**. For example, all students from various homeroom classes of one grade level might be re-sorted into ability grouped classes for a period of math instruction. Results indicate that **regrouping for reading or mathematics can improve student achievement**.



Successful practices-2

- ★ place students in **flexible groups according to performance rather than age**. Thus, grade-level designations are eliminated. The curriculum for each subject is divided into levels through which students progress at their own rates. Well-controlled **studies** conducted in regular schools generally **support the use of comprehensive non-graded plans**.





Successful practices-3



- ★ Research on **within-class ability grouping in mathematics** clearly supports the practice, especially when only two or three groups are formed. **The positive effects are slightly greater for low-achieving students than for average or high achievers.**



Recommendations for grouping

- ★ --Students should identify primarily with a heterogeneous class. They **should be regrouped by ability only when reducing heterogeneity is particularly important for learning**, as is the case with math or reading instruction.
- ★ --Grouping plans should **reduce student heterogeneity in the specific skill** being taught, not in IQ or overall achievement level.
- ★ --Grouping plans should **allow for frequent reassessment** of student placement and for **easy reassignment** based on student progress.



Recommendations for grouping

- ★ Teachers must **vary the level and pace of instruction** according to student levels of readiness and learning rates in regrouped classes.
- ★ Only a **small number of groups** should be formed **in within-class ability grouping**. This will allow the teacher to provide adequate direct instruction for each group.

Slavin, Robert E. ABILITY GROUPING AND STUDENT ACHIEVEMENT IN ELEMENTARY SCHOOLS: A BEST-EVIDENCE SYNTHESIS. Baltimore, MD: Center for Research on Elementary and Middle Schools, 1986.



Research on ability grouping

★ pupils attaining **higher levels** in national tests at age 11 **made more progress in sets**, whereas lower attaining pupils made more progress in mixed-ability classes.

(IRESON, J., HALLAM, S., HACK, S., CLARK, H. & PLEWIS, I. (2002) Ability grouping in English, mathematics and science: effects on student attainment, *Journal of Educational Research and Evaluation*.)



Research on ability grouping

- ★ One of the biggest analyses of ability grouping to date (from James Kulik of the University of Michigan, surveying 23 major studies on grouping) found that when **high-ability students receive accelerated classes**, they **advance as much as a whole year more** than students of similar age and intelligence left in regular classrooms.



Research on ability grouping

- ★ Kulik's analysis found that specific subject grouping also helps slower students; **low-achieving** fourth graders put **in a very focused group** gained as much as **two-thirds of an academic year** over control subjects.





Research on ability grouping

- ★ But the University of Sussex research, done by Prof. Jo Boaler and her grad students, claims otherwise. The team followed 700 students over five years at three high schools. They state boldly that grouping kids by ability harms education.

Read the discussion at:

- ★ <http://giftedexchange.blogspot.com/2007/10/does-ability-grouping-harm-students.html>



Research on ability grouping



ability grouping effects on:
academic and non-academic
outcomes for pupils, including

- ★ self-esteem,
- ★ attitudes towards school,
- ★ and alienation





Research on ability grouping

- ★ For pupils in low-ability groups, the self-concept becomes more negative as they progress through school. (OAKES, A. (1985) *Keeping Track: how schools structure inequality* (New Haven, CT Yale University Press).
- ★ ability grouping tended to raise the self-esteem scores of lower aptitude pupils and reduce the self-esteem of higher aptitude pupils.

KULIK, J.A. & KULIK, C.L.C. (1992) Meta-analytic findings on grouping programs, *Gifted Child Quarterly*, 36(2), pp. 73-77



Research on ability grouping

Some pupils were unhappy with their set placement. Most wanted to change sets in an **upward** direction to **be given harder work**, improve their prospects in examinations and their **careers**, and their **status within school**. A small number of pupils wished to **move down** a set to **improve their understanding** and receive work which they perceived to be better suited to their needs.

HALLAM, S., IRESON, J. & HURLEY, C. Experiences of ability grouping in the secondary school 2: student preferences and rationales. *British Journal of Educational Psychology*



Research on ability grouping

Some 83% of the pupils interviewed in the setted classes wanted either to return to mixed-ability teaching or to change set. This dissatisfaction was not restricted to those in the lower sets. Some of the pupils taught in the highest sets felt disadvantaged because they **found it difficult to cope with the fast pace of the lessons and the pressures of consistently working at a high level.** (BOALER, J. (1997) When even the winners are losers: evaluating the experiences of 'top set' students, *Journal of Curriculum Studies*, 29, pp. 165-182.



Research on ability grouping

- ★ *mathematics self-concept was consistently lower than school and general self-concept;*
- ★ *all aspects of self-concept increased up to Year 9 and then declined in Year 10,*
- ★ *pupils in the higher sets tended to have higher self-concepts;*
- ★ ***pupil preferences for setting were greater in the higher year groups, as was the extent to which the top set was perceived to be the best.***



Research on ability grouping

- ★ *A substantial proportion of pupils wanted to move set, usually to a higher set.*
- ★ *Set placement itself did not appear to have a consistent effect on attitudes towards mathematics. This seemed to be mediated by the quality of teaching.*

SUSAN HALLAM & KIM DEATHE *Ability Grouping: year group differences in self-concept and attitudes of secondary school pupils. Westminster Studies in Education, Vol. 25, No. 1, 2002*



In any case...



We must remember that decisions about grouping are preliminary and that what matters most comes next Given poor instruction, neither heterogeneous nor homogeneous grouping can be effective; with excellent instruction, either may succeed.

"Is Ability Grouping Equitable?" (Gamoran, 1992)



Questions:



- ★ To what degree gifted kids should be separated from or integrated in regular classroom instruction?
- ★ When it is appropriate to set up gifted classes or schools?



Questions:

- ★ Can the standard curriculum be modified in a way that it supports maximum progress of gifted students and at the same time is accessible for the rest of students?
- ★ Can the materials designed for gifted students be used for general class instruction?



Questions:



★ Who should attend gifted programs:
students who look for enrichment or
students that are extraordinary talented?



★ What should gifted programs deliver:
more advanced material or
broader material?





Questions:



- ★ Is it possible to regulate the interaction between gifted and regular students in a classroom in such a way that regular students accept that some of their peers are talented while gifted students develop their ability without building their ego at the expense of others?
- ★ What is a proper award policy?



Questions:



★ In which way schools and universities can productively collaborate in order to support gifted kids ?



★ Should high school bright students take university courses?

