TSG 6: Activities and programs for gifted students

Team Chairs: Viktor Freiman, Université de Moncton, Canada,
viktor.freiman@umoncton.ca
Ali Rejali, Isfahan University of Technology, Iran, a_rejali@cc.iut.ac.ir
Team Members: Mark Applebaum, Kaye Academic College of Education, Israel
Arne Mogensen, Aarhus College of Education, Denmark
Pablo Dartnell, Universidad de Chile, Chile

1. Preparation for the congress

A call for papers was launched in September, 2007. Forty-one proposals were received and went through a peer-review by at least two reviewers. Twenty-five proposals were accepted. Each author of an accepted proposal wrote a paper, and all were published on the web prior to the congress: http://tsg.icme11.org/tsg/show/7#inner-documents.

2. Work during the congress

The work during the congress was organised in four sessions. The parallel sessions were attended by 30-40 participants each. The first one-hour slot was spent in a round table discussion with about 70 participants. Three presentations were made:

- The history of the topic at previous ICME congresses (presented by Viktor Freiman on behalf of Ed Barbeau, co-chair of the TSG4 at ICME-10).
- The state of research on the topic (presented by Roza Leikin, organizer of the last International Conference on Mathematical Creativity and Education of Gifted Students and Peter Taylor, co-chair of the ICMI-16 Study on Challenging Mathematics in and Beyond the Classroom).
- An overview of school practices with a provision for gifted learners (presented by Linda Sheffield, president of the NCTM Task Force on Mathematically Promising Students).

The remaining 3 slots were organised in the form of 15-minute presentations in consecutive or parallel sessions following periods of questions and discussions. The Group concluded with plans for further publications and collaborations.

3. Summary of papers and presentations

The papers and presentations treated several issues related to mathematical giftedness using variety of theoretical and methodological approaches, innovative experiences and practices. However, as is almost a tradition in mathematics education of gifted students, all of them can be grouped around three basic questions: who are gifted, how to identify them, and how to provide them with an appropriate learning atmosphere:

In her presentation, Brenda Bicknell (New Zealand) put emphasis on early and ongoing identification of mathematical giftedness by parents, students and teachers in she called a ‘wait and see approach’. Identification should be based on variety of criteria as there are no universally shared views. Moreover, the goal of identification is not identification itself but development and implementation of qualitatively differentiated mathematics programmes.

General issues and problem statement

Tony Gardiner (England) asked the somewhat provocative question: Mathematical giftedness: does it exist? And, further: What opportunities or activities give youngsters the best chance to allow their mathematical potential to blossom in a robust, lasting way? He suggested how to enrich students’ daily mathematical diet as well as supplement that diet in ways that appeal to different tastes—taking the risk of teaching good mathematics in opposition to preparing for the central assessments.

Mark Saul (USA) focused on cultural aspects of giftedness and the need to value it and to institutionalise support. He suggested reflection from outside the work—putting together the investigation of small areas towards a resolution of a large question.

Roberta McHardy (USA) analysed the situation with pre-school children making a quest for connections across the fields of gifted education, mathematics education and preschool education in order to find effective ways to meet the needs of gifted preschoolers with a talent for mathematics.

Linda Sheffield (USA) brought our attention to how to maximise the number and level of top students that she calls mathematically promising students based on latest developments in the brain research. According to them, intelligence is a potential that can be developed, so educators should not give up early. Active, hands-on situations are good to foster development of mathematical promise including the integration of all senses, planning ahead and organising learning, spaced and contextualised learning practice, connecting knowledge, allowing time—"sleep on difficult problems", using novel situations, letting students lead in suggesting problems—thus developing their passion, creating an atmosphere of enjoyment that helps to set positive chemical reactions.

Teacher preparation

Héctor Rosario (Puerto Rico) revealed the need for educating teachers who can design intellectually exciting lessons that induce mathematical awareness.

Valeria Pandelieva (Canada) shared concerns about elementary teacher mathematical knowledge arguing we should strengthen teacher's mathematics with a concept of mathematical sophistication.

Mark Applebaum (Israel), Viktor Freiman (Canada), and Roza Leikin (Israel) discussed teacher preparation for working with mathematically promising students. We need to expose them to the issues of giftedness using hands-on experiences developing at the same time their own higher-order thinking skills and abilities by means of challenging tasks leading to an understanding how to use those tasks in and beyond the classroom.

Manon LeBlanc (Canada), Viktor Freiman (Canada) looked at online mentoring that can be done by pre-service teachers to help them build more solid assessment competences: from understanding the mathematics children do, to guiding by talking mathematically and pedagogically to them.

In-school programmes for gifted students

Arne Mogensen (Denmark) reported her action research developing and trying out approaches which support the mathematically able in mixed ability classrooms. Differentiation was used in: demands, time, assistance, topics, educational resources, and ways of teaching.

Yuwen Li (China) reported how open-ended questions may be used to inspire wisdom, improve critical thinking and reasoning skills, challenge the imagination, stimulate interest, andfoster the creativity for different levels of students

Ildiko Peltzer (Mexico) discussed the importance of problem posing and personal development for mathematically gifted students. We should redefine mathematical creativity to develop shared assessment criteria.

Hae-Yaw Shyv (Taiwan) and Pao-Kuei Tsai (Taiwan) argued that we should teach without teaching: eliciting creativity and imagination from the students Teachers and students work together in finding the characteristics of a phenomenon with colloquial language as a first stage of concept development.

Leily Hatamzadeh (Iran) and Ali Rejali (Iran) analysed research data showing that special schools for the preparation of gifted and talented students for the Olympiads do not have a positive impact on the educational system. The alternatives are not separating gifted from other children but providing them with richer (extracurricular) opportunities.

Harvey B. Keynes (England) and Jonathan Rogness (England) discussed duplicating successful programmes for gifted students by universities. These involve long-time commitment of mathematics faculty, faculty knowledge of school curriculum, prior experience with schools and teachers, administrative issues, and valuing effort.

Daud Mamiy (Russia) reported the positive effect of the schools for the gifted on: choosing mathematics as a career; taking leading positions in mathematical contests; high quality mathematical training for students from rural areas; and building ties and traditions between generations.

Extracurricular opportunities

Peter Mitchell (England) collected data about extracurricular (summer) programmes for the gifted looking at staffing and curriculum (the programme is university led but includes experts in school practice). Student selection is based on combining interest and academic achievement. Content is broader than the school curriculum but aims (as does school) to develop generic mathematical thinking in a stimulating and enjoyable way. Assessment is done using portfolios (students' interests are in new ideas and less in the routine), however this raises a concern about the solidity of students' grasp of material. Going beyond mathematics—a social programme—is another important aspect of work with gifted students.

Alexander Soifer (USA) shared his experience of conducting mathematical Olympiads: creating a new enthusiasm for mathematics.

Overall summary and questions for further studies

All participants agreed on the following.

1. Some students show special characteristics that allow identification of their above average mathematical ability.
2. These students need particular attention and opportunities in learning mathematics.
3. We must develop and implement more efficient programmes and teaching methods as well as develop appropriate resources to meet their needs in a variety of settings.
4. Teachers need more preparation in the fields of mathematics, mathematics education and giftedness to better teach these students.
5. There is a need to reflect, to research, and to exchange ideas about these experiences.

More specifically, when one talks about such students, several 'key words' are being used to name them, such as gifted, talented, promising, or able. Many authors discuss whom to address the enriched and differentiated activities and programmes: to the very few who had a chance to be identified as gifted, or to all students each of whom can benefit from a richer and more challenging mathematical experience. Activities may be addressed to different levels and ages starting from the youngest up to post-school levels. Many ways exist to identify them: special tests, interviews, observations, or other means.

When participants talked about possible educational settings, a variety of options were mentioned such as in- and out of- school programmes, special mathematical houses, or camps. What activities are appropriate? While many different forms like problem posing, problem solving, competitions, investigations, research have been mentioned, several questions remain open. Who would participate in the activities and how? What is the quality of such activities and how do we evaluate their impact on gifted (and not gifted) learners? How do we assess knowledge and skills in students involved in these activities? If we know the good practices, how can we make them sustainable and multiply them?

The question of teaching mathematically gifted students was raised by several authors. Who works with these students and how? What knowledge (mathematical, pedagogical, and didactical) must the person have to work with these students? What role would this person play: teacher? mentor? guide? other? Is she ready to understand these students, their needs, their learning style in order to adjust her teaching? How can we meet the individual needs of these students and meet the requirements of standard curriculum and testing?

Many participants put emphasis on a need look closer at mathematical giftedness through reflection, enculturation, promotion, collaboration, research, knowledge building and sharing.

We believe that the work of TSG 6 merits continuing through a different kind of collaboration, possibly including a publication of proceedings and special issue of a journal, creation of new networks with other groups (for example groups dealing with mathematical creativity), and mathematical competitions. Selected papers will be published in a special issue of the Montana Mathematics Enthusiast Journal in 2010 (http://www.math.umt.edu/TMME/). Plans to create a new International Group on Mathematical Creativity and Giftedness are also welcomed (http://igmcg.org/), as well as the work of the 16 ICMI study on challenging mathematics in and beyond the classroom (Barbeau, Taylor, 2009) and the World Federation of the National Mathematics Competitions (WFNMC). A recently published book discussed issues related to creativity in mathematics and the education of gifted students (Leikin, Berman, and Koichu, 2009).

References

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Leikin, R., Berman, A., & Koichu, B. (Eds.) (2009). *Creativity in mathematics and the education of gifted students*. Sense Publishers, 420 pp.