Competitions and the Mathematically Gifted

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Early signs of mathematical giftedness
• a liking for numbers (in stories & rhymes)
• an ability to argue, question, and reason using logical connectives such as: if, then, so, because, either, or...
• pattern-making revealing balance or symmetry
• precision in positioning toys, e.g. cars set out in ordered rows, dolls arranged in order of size
• use of sophisticated criteria for sorting and classification
• pleasure in jigsaw puzzles and other constructional toys

Different types of mathematical giftedness
• Analytic: This child thinks in verbal-logical terms and doesn’t need visual supports.
• Geometric: This child likes visual supports.
• Harmonic: This child displays the characteristics of both.

Characteristics
• Has exceptional reasoning ability.
• Has a tendency to choose to do mathematics when presented with a choice of activities.
• Masters typical content more quickly and at an earlier age than his or her classmates.
• Often skips steps in problem solving and may solve problems in unexpected ways.
• Enjoys posing original problems.
• Is capable of more independent, self-directed activities.
• Is more willing and capable of doing problems abstractly; often prefers not to use equipment.
• Enjoys and is successful looking for patterns and relationships and attempts to explain them.
• Concentrates for long periods of time on a problem that he or she finds interesting.
• Enjoys the challenge of mathematical puzzles and games.
• Enjoys mathematics competitions.

Research Aims and Objectives
• to examine the mathematical experiences, past and present, for a group of students identified by their teachers as gifted and talented in mathematics; and
• to examine these experiences from multiple perspectives - those of the students, teachers, parents, and the researcher as observer.
• What are the characteristics of mathematical giftedness recognized by school policies and procedures, teachers, parents and students?
• How are they identified?
• What provision for the students’ education in mathematics has been made within the classroom and school contexts?
• What roles have parents played in their child’s mathematical development?
• How is school transition managed for the gifted student?

Methods and Sample
• Questionnaires: Parents, students
• Documents: School policies, teacher work plans, student work
• Classroom observations
• Interviews: teachers, parents, students
• 15 students - 10 Year 6 and 5 Year 8
• Phase 1: Three schools - Year 6 (x2) (10-11 years) 10 students - Year 8 (12-13 years) 5 students (boys & girls)
• Regular class, fulltime gifted class, cross-class ability group
• Phase 2: Eight schools (a range of types of schools)
Why have students compete?
Competitions provide opportunities for gifted and talented students to compete or perform, exhibiting their special abilities and talents, and as such, have long been a cornerstone of gifted education. (Riley & Karnes, 2006, p. 145)

- Identification purposes
- Viewed as part of the continuum for provision
- Opportunity to develop team-work and individual skills
- Enhances self-directed learning skills and sense of autonomy
- Personal achievement
- Students can compare themselves with others

What does the research say?
- Fosters motivation (intrinsic and extrinsic awards) (Riley & Karnes, 1988/89; Udvari, 2000)
- Indicative of particular type of mathematical talent (Ridge & Renzulli, 1981)
- Feeds on the competitive nature of many Western cultures (Udvari, 2000)
- Some negative outcomes (stress, feelings of failure) (Davis, Rimm, & Siegle, 2011)
- If emphasis on speed and memorisation, may encourage the valuing of these instead of problem solving (Ruscyk, 2012)

But…….
- Limited empirical studies (Campbell, Wagner, & Walberg, 2000)

What competitions are available in NZ?
Local Competitions
- Mathematics Teachers’ Associations (involves problem solving and teamwork)
  (eg. Cantamaths, Manawatu’s Mathex, H.B Mathletics)

National
- Problem Challenge
  Interested students undertake in-depth mathematical investigations independently, or cooperatively, over an extended period of time developed within classroom programmes or in student’s own time.
- Bank sponsored competitions
- Maths Olympiad Problems

The New Zealand Maths Olympiad Committee provides maths enrichment materials and selects and trains New Zealand high school students for participation in the International Mathematical Olympiad.

International

Key Findings from this Study
These are derived from multiple sources:
School policy (policy to practice), students, teachers, and parents
- School policies: competitions were acknowledged as part of the school provisions for gifted students by 6/11 schools
  - they were part of the documented mathematics programme but in practice relied on school and teacher organization
- There were some varying perspectives and issues among the students, teachers, and parents
  - Some competitions were viewed more positively by the teachers than by the students
  - Teachers recognised benefits but in some cases there was a haphazard approach – which competitions each year and who participated
  - Teachers liked to use results as part of the monitoring process
  - Teachers had mixed views and some concerns, a gendered view – believed that boys especially benefitted from taking part in competitions
  - Students and parents – very committed, wanted regular participation and knew which ones they wanted to compete in.

Students’ Views
- Students were very motivated and keen to participate each year and in different types of mathematics competitions– they strived for high levels of achievement (eg. distinction) and wanted to at least maintain previous achievements if not improve on results
- Enjoyed the team competitions (from preparedness to representing the school)
- Enjoyed national and international competitions as a means of comparison outside of school but across the country and internationally
- Most found them enjoyable, especially the challenge of competitions
- Expected to participate annually

Student’s Voice
- We did do this other one which I didn’t like, the questioning was so different, it asked pointless questions which didn’t test your true academic ability in maths, it asked you strange things…..I got distinction, I didn’t like it; I’m not doing it again. They were just pointless questions like how many acute angles can you have in a polygon with 2001 sides, it was harsh, no calculators. First questions were real easy Year 6 and last ones were ridiculous. I prefer, …[when] it actually asks what you know and what you should know rather than random ones. (Nina-Year 9 student)
Teachers' Voices

- It’s good because they have to work within a team and quite often they might be gifted mathematicians who just like to focus on their own and not to problem solve in a group. I think it’s good for them as they may not be used to problem solving in a group. (Year 6 teacher)

- Personally, I sit on the fence on it, in some ways I think that it’s good because there are some students who thrive on the challenge and like to compare themselves against others in the world and they find that absolutely inspiring whereas there are others that find it a chore….I don’t force them, it’s upsetting; some just don’t enjoy competition at all. (Head of Mathematics Department)

- Not all of the students thrive on competition, so I have to be very careful about how I use them. Probably 60 to 70% of this class are more extroverts and like competitions. They have to feel safe and comfortable so I don’t use them at the start when they are sorting each other out and they are afraid to make mistakes. Now they are really comfortable with each other so I can use competitions more. (Year 9 teacher, co-educational secondary school)

Issues and Implications

- Why competitions are being offered? How effective are they? What type of mathematical thinking do they use? Do they support individual or team work?

- Who decides on participation?

- How aware are teachers of the availability of mathematics competitions?

- Are teachers and parents aware of the advantages and disadvantages of participation?

- How does the school organize entries? Is there a planned coordinated approach?

- What are the costs? Who pays?

- What do the results indicate? Are they being used, and if so, how?

- Are they part of a planned programme of provision for the gifted and talented child?

References


- http://www.artofproblemsolving.com/


Useful websites

- Otago Problem Challenge http://www.maths.otago.ac.nz/cz/


- International Competitions and Assessments for Schools http://www.eaa.unsw.edu.au/about_icas/newzealand


- Gifted and talented online http://gifted.tki.org.nz/For-students/Competitions

The Rural Student Voice