

TSG3 Agenda

TSG 3 – Mathematical education for gifted students

Prof. Florence Mihaela Singer, *UPG University of Ploiesti, Romania*

Prof. Alex Friedlander, *Weizmann Institute Of Science, Israel*

Prof. Alex Golovin, *Saint Petersburg Lyceum 239, Russia*

Prof. Viktor Freiman, *Universite de Moncton, Canada*

Prof. Qiusheng Li, *The High School affiliated to Renmin University, China*

Class: A (Class A for TSGs with odd numbers; Class B for TSGs with even numbers)

**Please prioritize the sessions in “core-time” (from 19:30-23:00, Beijing time, i.e. Session 2, 3 for Class A and session 1, 2 for Class B) as they are friendly to most of the time zones in the world.

Session 1

1. Time: 14:30 – 14:40

Title of the Paper: STUDENT PERCEPTIONS OF SUPPORT PROVIDED BY A
SUMMER MATH CAMP

PA8

Author(s) (with the presenter name in BOLD if more than 1 name here): **Hiroko Kawaguchi
Warshauer**, Michael Hicks, Max Warshauer

Institution(s) (to school/department/research center) and Country/Region: Texas State
University, San Marcos, US

Short abstract of the paper (20 lines maximum):

In this paper, we consider the ways in which an out-of-school educational program supports young high-achieving African American students with an interest in STEM with respect to mathematical identity, mathematical competence, and sense of belonging to a community of mathematics learners. We present a qualitative case study that examines the perceived support in each of these areas as described by three female African American students

enrolled in a mathematics summer camp intended for high school students interested in higher-level mathematics. A key element is the flexibility of the camp in addressing the individual needs of each student.

2. Time: 14:50—15:10

Title of the Paper: DERIVATION OF REGRESSION EQUATIONS PREDICTING JAPAN MATHEMATICAL OLYMPIAD PRELIMINARY QUALIFIERS FROM WITHIN ARBITRARY GROUPS

PA8

Author(s) (with the presenter name in BOLD if more than 1 name here): **Atsushi TAMURA**

Institution(s) (to school/department/research center) and Country/Region: Iwate Prefectural University, Takizawa, JP

Short abstract of the paper (20 lines maximum):

A greater sample of students with advanced mathematical abilities and an analysis of the characteristics found in the sample are indispensable in the development of Math for Excellence educational materials. Tamura (2018) developed a mathematical talent checklist. Using this sheet, preliminary qualifiers were identified among a group of average high school students and Mathematical Olympiad preliminary qualifiers at a true discriminant ratio of over 93%. A secondary discriminant analysis was utilized via the Mahalanobis distance, making the discriminant function an extremely complex and intricate 48-variable quadratic equation. A logistic regression analysis via a variable-increasing method was utilized in this research. Following its application to random groups, a simple, general-purpose regression equation was derived.

3. Time: 15:10—15:30

Title of the Paper: HOW DO MATH STUDENTS USE INFORMAL REPRESENTATIONS? A COMPARISON BETWEEN GIFTED AND NOT GIFTED

PA8

Author(s) (with the presenter name in BOLD if more than 1 name here): **Florence Mihaela**

Singer, Cristian Voica

Institution(s) (to school/department/research center) and Country/Region: Petroleum Gas University of Ploiesti, Romania

Short abstract of the paper (20 lines maximum):

Usually, a mental representation is a hypothetical internal cognitive construct that represents external reality as a way of explaining and describing the nature of concepts. How do students represent abstract mathematical concepts beyond reproducing definitions, theorems and proofs? To answer this question, we exposed undergraduate students to a task that required the association of a few mathematical concepts to as many as possible meaningful images that could generate mental representations in school students. The sample of this study consists of 51 students in Mathematics; among these, 5 students were considered gifted, according to their academic results and their success in mathematics competitions. The preliminary results show that high-performing students focus on mathematical properties of concepts, for which they find meaningful images. Some of the other students use verbal descriptions (which are mostly related to intuitive explanations of concepts, and not on their core properties), and identify images about this verbalization. There are also cases where we could not find clear links between the given concept and the proposed image.

4. Time: 15:30—15:40

Title of the Paper: ROLE OF PEER AND TEACHER RECOGNITION FOR STUDENTS TALENTS IN STEM PROJECTS

PA4

Author(s) (with the presenter name in BOLD if more than 1 name here): **Viktor Freiman**, Jacques Kamba

Institution(s) (to school/department/research center) and Country/Region: Universite de Moncton, Moncton, CA

Short abstract of the paper (20 lines maximum):

Over the past decades, novel integrated STEM learning spaces have emerged in K-12 schools providing students with new interdisciplinary enrichment opportunities to express their gifts and talents. Based on the study of provincial makerspaces and maker projects we conduct since 2016, a clear trend can be identified to an increasing role of an expertise of some students which becomes recognized by the peers and is essential for the collective success of the project. In our presentation to the topic study group, we will share some evidence of this recognition.

5. Time: 15:40—15:50

Title of the Paper: SCHOOL STAGES OF EDUCATING THE MATHEMATICIAN-
INVESTIGATOR

PA4

Author(s) (with the presenter name in BOLD if more than 1 name here): **Aleksandr
Vasilevich Iastrebov**

Institution(s) (to school/department/research center) and Country/Region: Yaroslavl State
Pedagogical University, Yaroslavl, RU

Short abstract of the paper (20 lines maximum):

The following statements are explained in this article. 1) Shaping of skills and habits of the future mathematician can be started at the early stages of his education and upbringing, while he is still a school student. 2) Educating the mathematician-investigator at the early stages of education contributes to the implementation of general goals of school education, regardless of the students future profession. 3) Experience of the pedagogical society is sufficient for shaping the uniform, integral system of educating the mathematician-investigator at the level of school.

6. Time: 15:50—16:00

Title of the Paper: PROBLEM SOLVING AND CREATIVITY AMONG TALENTED
STUDENTS FROM A MULTI-AGE PERSPECTIVE

PA4

Author(s) (with the presenter name in BOLD if more than 1 name here): **Odelya Uziel**,
Miriam Amit

Institution(s) (to school/department/research center) and Country/Region: Ben-Gurion
University of the Negev, Beer-Sheva, IL

Short abstract of the paper (20 lines maximum):

This study deals with problem solving amongst 118 talented students in grades 5-12 who take part in the prestigious mathematical enrichment program known as "Kidumatica". Our goal was to examine the students' solutions from a multi-age perspective. Data was gathered from students products and teacher observations during a series of workshops devoted to 10 non-routine problems with multiple solution paths. Analysis of our findings reveals a troubling phenomenon: as the age of students rises, they are less prone to looking for creative and holistic solutions when solving problems, and more likely to be held hostage by their habitual use of algebra.

7. Time: 16:00—16:10

Title of the Paper: EDUCATING PROSPECTIVE TEACHERS IN THE FIELD OF
MATHEMATICAL

PA4

Author(s) (with the presenter name in BOLD if more than 1 name here): **Matthias Simon Brandl**, Attila Szabo, Elisabeth Mellroth, Ralf Benölken

Institution(s) (to school/department/research center) and Country/Region: University of
Passau, DE

Short abstract of the paper (20 lines maximum):

This article focuses on how prospective teachers can be educated in the field of mathematical giftedness. Three independently developed concepts are compared to deduce cornerstones of appropriate seminar concepts. As one main result, it seems that a combination of theoretical and practical parts is particularly important for a sustainable education in the context of giftedness.

8. Time: 16:10—16:20

Title of the Paper: PEDAGOGY FOR DEVELOPING THE MATHEMATICAL TALENTS AND CREATIVITY OF GIFTED SECONDARY STUDENTS

PA4

Author(s) (with the presenter name in BOLD if more than 1 name here): **Sharon Whitton**

Institution(s) (to school/department/research center) and Country/Region: Hofstra University, Northport, US

Short abstract of the paper (20 lines maximum):

This paper responds to a call for examples of effective pedagogy and activities for inspiring and developing the mathematical abilities of gifted and talented students (ICME-13). An effective pedagogy is identified and described in this paper, which is supported by extensive research. The pedagogy is illustrated as students discover mathematical relationships and patterns that emerge in their development of an award-winning project for a Math/Science Fair. This project involves factorials and factorial polynomials, ultimately resulting in the students creation of a factorial triangle, similar to Pascals Triangle, which includes numerous consistent patterns and unanticipated relationships. In their development of this project, students were guided to discover recurrence relations, develop symbolic representations, make conjectures, and create mathematical proofs. Therefore, this pedagogy fosters the development of mathematical mind-sets and mirrors how mathematics itself is created.

9. Time: 16:20—16:30

Title of the Paper: WHAT DO PROSPECTIVE TEACHERS EXPRESS AS TO
MATHEMATICAL GIFTEDNESS? AN EXPLORATORY STUDY

PA4

Author(s) (with the presenter name in BOLD if more than 1 name here): **Ralf Benoelken**,
Daniela Assmus

Institution(s) (to school/department/research center) and Country/Region: University of
Wuppertal, DE

Short abstract of the paper (20 lines maximum):

In order to be able to support all learners individually, teachers need to know, among many other facets, how to identify and support mathematically gifted children. The paper presents a study investigating which thoughts prospective teachers express with regard to mathematical giftedness. In summary, the impressions imply that their perceptions are rather shadowy compared to the state of research on the modeling of mathematical giftedness. Finally, derivatives for the design of their education will be deduced.

Session 2

1. Time: 19:30—19:50

Title of the Paper: QUESTIONS ABOUT THE IDENTIFICATION OF
MATHEMATICALLYGIFTED STUDENTS

Author(s) (with the presenter name in BOLD if more than 1 name here): **Marianne Nolte**

Institution(s) (to school/department/research center) and Country/Region: Faculty of
Education, Hamburg, DE

Short abstract of the paper (20 lines maximum):

This article gives an overview of questions on diagnostics and procedures of high mathematical talent. Various methods such as intelligence tests, school achievement tests and

checklists are presented and discussed. The conclusions favor multidimensional approaches with a focus on special mathematical tests. One example should illustrate how complex problems can be.

2. Time: 19:50–20:10

Title of the Paper: CONTENIDOS TEMATICOS MATEMTICOS Y LAS HABILIDADES DIDACTICAS PARA LA ENSEANZA DE LA MATEMATICA DE LOS ESTUDIANTES DE LA CARRERA DE EDUCACION PRIMARIA DE LA UNIVERSIDAD CATOLICA SEDES SAPIENTIAE, PERU

PA8

Author(s) (with the presenter name in BOLD if more than 1 name here): **Patricia Edith Guillen Aparicio**, Norma Fuentes Supanta De Fukunaga

Institution(s) (to school/department/research center) and Country/Region: Universidad De San Martn De Porres, Lima, PE

Short abstract of the paper (20 lines maximum):

El presente trabajo tiene como objetivo analizar los contenidos tematicos matematicos y las habilidades didacticas de los estudiantes de la carrera de educacion primaria de la Universidad Catolica Sedes Sapientia, Lima-Peru. Para ello se realizo el estudio de las practicas pedagogicas de estudiantes del decimo ciclo de Educacion, por medio de la observacion de clase, la aplicacion de un cuestionario de contenidos matematicos y las entrevistas. La investigacion se basa en un enfoque cualitativo. Los resultados muestran que los estudiantes docentes requieren de una capacitacin en los contenidos matematicos y una ayuda pedagogica personalizada, asi como el material didactico necesario para que su ninos logren un aprendizaje significativo y desarrollen su potencial matematico aplicado a la vida diaria, y a la sociedad en la que viven.

3. Time: 20.10–20:20

Title of the Paper: EGALITARIANISM IN INCLUSIVITY: THWARTING THE INTELLECTUAL GROWTH OF MATHEMATICALLY GIFTED STUDENTS IN SOUTH AFRICAN SCHOOLS

PA4

Author(s) (with the presenter name in BOLD if more than 1 name here): **Michael Kainose Mhlolo**

Institution(s) (to school/department/research center) and Country/Region: Central University of Technology, Bloemfontein, ZA

Short abstract of the paper (20 lines maximum):

Prior to gaining democracy, South Africa is among a few if not the only African country in which significant developments in gifted education were evident. However, since 1994 the focus moved from separate and specialized education for gifted learners to inclusive education with all learners being educated in regular classrooms. Although inclusive education policy initiatives in theory aimed at ensuring quality education for all, current empirical evidence shows that in many African countries including South Africa, excellence and egalitarianism have become out of balance as gifted students from previously disadvantaged communities do not reach their full potential in regular classrooms. Researchers have warned of the negative effects that an egalitarian and equalizing approach to education had in the field of gifted education suggesting a need to reconceptualise inclusive education. This article taps into recent theorizing on the economics of gifted education and how different student abilities impact the economy differently

4. Time: 20:20–20:30

Title of the Paper: LEARNING OPPORTUNITIES FOR MATHEMATICALLY GIFTED PUPILS IN INCLUSIVE SETTINGS

PA4

Author(s) (with the presenter name in BOLD if more than 1 name here): **Mirjam Harketstad Olsen, Anita Movik Simensen**

Institution(s) (to school/department/research center) and Country/Region: UiT The arctic university of Norway, Alta, NO

Short abstract of the paper (20 lines maximum):

This paper reports from a study on mathematically gifted pupils learning opportunities in an inclusive education system. The pupils in our study were receiving instruction in inclusive classrooms most of the school year, but in addition, they received instruction at a talent centre four times (two days each time). When we interviewed the pupils, they stated that they did not get adequate learning opportunities when working in heterogeneous small groups in their regular classroom. To better understand gifted pupils mathematical learning opportunities, we video-recorded their work in both the regular class and talent centre settings. Data were analysed from a multimodal perspective, focusing on both the pupils mathematical ideas and the frequency of their participation. In this paper, we report preliminary findings from the case of Anna (one of the gifted pupils in our study).

5. Time: 20:30–20:40

Title of the Paper: THOUGHTS ON THE ELITE MATHEMATICS EDUCATION OF MIDDLE SCHOOL IN CHINA

PA4

Author(s) (with the presenter name in BOLD if more than 1 name here): **Xue Suyue**

Institution(s) (to school/department/research center) and Country/Region: Soochow University, Suzhou, CN

Short abstract of the paper (20 lines maximum):

With the loss of our mathematical Olympics, many people have begun to re-examine the elite education and measure its importance to current education. But for elite education, we are still in the initial stage. This article is to provide some suggestions for elite education, which can improve our quality of talent training.

6. Time: 20:40–21:00

Discussion

Session 3

1. Time: 21:30–21:40

Title of the Paper: ACTIVITIES FOR THE MATHEMATICALLY GIFTED AND THEIR EVALUATION IN SLOVENIA

PA4

Author(s) (with the presenter name in BOLD if more than 1 name here): **Bostjan Kuzman**,
Mojca Juriševič, Urška Žerak

Institution(s) (to school/department/research center) and Country/Region: University of
Ljubljana, Ljubljana, SI

Short abstract of the paper (20 lines maximum):

Diverse and substantially rich examples of working with mathematically gifted pupils and students exist in Slovenia. We present a few outstanding activities such as mathcamps, research projects, competitions, and approaches of different parties involved (school teachers, educational institutions, expert groups, learned societies). Often, the success of these activities depends largely on the enthusiasm and competences of involved individuals. Within the PROGA project (2017-2020), we are evaluating these activities and establishing a support system for high school students with special talents in mathematics or some other fields

2. Time: 21:40–21:50

Title of the Paper: USING INTERDISCIPLINARY PROBLEM POSING TO PROMOTE GIFTED STUDENTS IN THE REGULAR CLASSROOM

PA4

Author(s) (with the presenter name in BOLD if more than 1 name here): **Sara**

Hinterplattner, Zsolt Lavicza, Marca Wolfensberger

Institution(s) (to school/department/research center) and Country/Region: JKU Linz, Linz,

AT

Short abstract of the paper (20 lines maximum):

Meeting the needs of all the students in an inclusive classroom is a challenging task. Gifted students often need more tasks and activities than teachers in regular classes can or are willing to offer. In such situations, it can happen that gifted students spent substantial time waiting in classrooms. If this waiting causes boredom, it could lead to various behaviors driven by dissatisfaction. To prevent boredom and misbehavior, an experiment with 10 gifted secondary school students was carried out. They were taken out from one mathematics class per week for 9 weeks and challenged with an interdisciplinary problem based on STEAM ideas. To solve this problem a combination of problem posing abilities, gathering knowledge from various fields, and their applying interdisciplinary ideas were necessary. After this experiment, students were asked about their experiences concerning the project itself, and its impact on their regular classes. Results show that the project was described as quite challenging and motivating. Also, its impacts on their regular classes were described as highly positive. Students reported that they used the time, they were usually waiting with solving the problems

3. Time: 21:50–22:00

Title of the Paper: MATHEMATICALLY GIFTED STUDENTS: CHALLENGES AND OPPORTUNITIES IN THE PRIMARY YEARS

PA4

Author(s) (with the presenter name in BOLD if more than 1 name here): **Ban Har Yeap**

Institution(s) (to school/department/research center) and Country/Region: Pathlight School, Singapore, SG

Short abstract of the paper (20 lines maximum):

This paper is based on an empirical study on how schools in different parts of the world handle the education of mathematically gifted students in the primary levels. One part of the study focuses on the challenges that schools face in catering to students who are mathematically gifted. Another part of the study focuses on the opportunities, both potential and actual, that result from schools endeavors in catering to these students. The findings of this study have implications on policy and practice in the education of mathematically gifted students in mainstream schools.

4. Time: 22:00—22:10

Title of the Paper: DISCOVERING AND EDUCATING THE GIFTED STUDENTS WITH EXCELLENT PROBLEMS

PA4

Author(s) (with the presenter name in BOLD if more than 1 name here): **Chan Xiangrui**

Institution(s) (to school/department/research center) and Country/Region: Northeast Yucai School, Shenyang, CN

Short abstract of the paper (20 lines maximum):

There are two kinds of students with good mathematics score. Someone gets the score with a lot of imitation and training from an early age, and the others get the score with their talents. For this kind of students, it is crucial to discover and provide them with personalized education. The problem is the heart of mathematics. Problem solving is the core content of mathematics teaching. Excellent problems can not only show the students ability and potential, but also be used as training for the gifted students to improve their ability. The gifted students need to solve a number of problems by themselves to understand some

wonderful ideas and how to create better methods. It is important to create and ask the appropriate problems.

5. Time: 22:10—22:15

Title of the Paper: MATHEMATICAL CULTURE AND TEACHING OF EQUATION

Author(s) (with the presenter name in BOLD if more than 1 name here): **Yanchun Liu**
PO

Institution(s) (to school/department/research center) and Country/Region: Dezhou No.2
Experimental Primary School, CN

Short abstract of the paper (20 lines maximum):

Mathematical culture is the treasure of human culture, and its contents, ideas, methods and language are important components of modern civilization. Nowadays, more and more people attach importance to mathematical culture. Therefore, teachers in the new era should think deeply about how to integrate mathematics culture into mathematics class and teaching practice, so that students can be influenced by mathematics culture in the process of learning. This paper will discuss about the practical experience of introducing mathematical culture into equation teaching for students in different grades, and explores how to maximize the charm of mathematical culture in equation teaching, so as to stimulate students' interest in learning, improve their learning efficiency and make more students fall in love with mathematics and mathematical culture

6. Time: 22:15—22:20

Title of the Paper: STUDY OF CONSTRUCTION BY QUADRATIC CURVE ADDITION METHOD

PO

Author(s) (with the presenter name in BOLD if more than 1 name here): **Hideyo Makishita**

Institution(s) (to school/department/research center) and Country/Region: Shibaura Institute of Technology, Tokyo, JP

Short abstract of the paper (20 lines maximum):

Wasan is traditional Japanese mathematics and the pre-modern Japanese higher mathematics in the Edo period according to Wasan books. The people learned mathematics for fun in order to solve quizzes, puzzles, and other entertainment problems, as well as mathematics for monetary exchange, land surveying and other everyday work activities. The author has been trying to use Wasan contents in modern mathematics education, especially not only in mathematics classes but also task-based learning and application of mathematics. In this session, the author will explain how to draw figures of Wasan from the viewpoint of mathematical utilization.

7. Time: 22:20—22:25

Title of the Paper: INTUITIVE SENSE CONSTRUCTIONS OF CHILDREN WITH MATHEMATICAL GIFTEDNESS

Author(s) (with the presenter name in BOLD if more than 1 name here): **Alena Witte,**
Franziska Strübbe

Institution(s) (to school/department/research center) and Country/Region: WWU Muenster,
DE

Short abstract of the paper (20 lines maximum):

Mathematically gifted children show a strong fascination for mathematical questions at an early age. They develop intuitive conceptual constructions with regard to various mathematical relationships. As part of a study, intuitive childlike constructions on the topic

of infinity were examined. Results of the investigations as well as practical realization possibilities are presented.

8. Time: 22:25—22:30

Title of the Paper: LEMAS' - A JOINT INITIATIVE OF GERMANY'S FEDERAL GOVERNMENT AND GERMANY'S FEDERAL STATES TO FOSTER HIGH-ACHIEVING AND POTENTIALLY GIFTED PUPILS

PO

Author(s) (with the presenter name in BOLD if more than 1 name here): **Lea Martina Schreiber**, Philipp Guillaume Girard, Yannick Ohmann, Julia Kaiser, Wiebke Auhagen, Prof. Dr. Friedhelm Käpnick

Institution(s) (to school/department/research center) and Country/Region: WWU Muenster, Dusseldorf, DE

Short abstract of the paper (20 lines maximum):

Compared to other countries, the proportion of high-achieving pupils in international comparative studies in Germany is relatively low. Therefore, Germany's federal government and Germany's federal states have launched an initiative in which an interdisciplinary network of scientists from 16 universities, together with 300 schools develops guiding principles and adaptive concepts to support gifted and talented pupils. The poster gives an insight into the aims, scientific work and two subprojects on mathematics run by the initiative.

9. Time: 22:30—22:35

Title of the Paper: UNIVERSITY STUDENTS SELF-EVALUATION: DIGITAL SOLUTIONS FOR IDENTIFYING HIGHLY MOTIVATED STUDENTS

PO

Author(s) (with the presenter name in BOLD if more than 1 name here): **Mirela Vinerean Bernhoff**, Yvonne Liljekvist, Elisabet Mellroth

Institution(s) (to school/department/research center) and Country/Region: Karlstad University, Karlstad, SE

Short abstract of the paper (20 lines maximum):

This poster shares preliminary results from a study with the aim of improving mathematics education for engineering students as well as identifying highly motivated students. The experiences are included in a pre-research step with a focus on how to use Learning Management System (LMS) to fulfil the aim. The students are asked to use LMS to self-evaluate their work on recommended tasks, which then provides the lecturer with statistics. The statistics provide useful information, such as the possibility of identifying highly motivated students when they evaluate the recommended and performed tasks as easy.

10. Time: 22:35–22:40

Title of the Paper: XPERIMENTAL STUDY ON INTELLECTUAL DEVELOPMENT IN ELEMENTARY SCHOOL STUDENTS

PO

Author(s) (with the presenter name in BOLD if more than 1 name here): **Yuwen Li**

Institution(s) (to school/department/research center) and Country/Region: Karlstad University, Karlstad, SE

Short abstract of the paper (20 lines maximum):

Intellectual development is very important for elementary school students. We conducted mathematics training for students volunteering participated from first grade to fifth grade at Changhe Elementary School in Dezhou, China, and compared their mathematics

achievement with comparable students who did not participate in the training. Through comparison studies on all participated students and prospective longitudinal studies on randomly selected students from both the experimental group and control group, we found students who participated in the training had significantly better mathematical achievement and abilities in geometry, logic, and innovation than their comparable peers. We expect to extend our training to all students at Changhe Elementary School in the future through adaptive training tailored to individual student's intelligence.

11. Time: 22:40—23:00

DISCUSSION