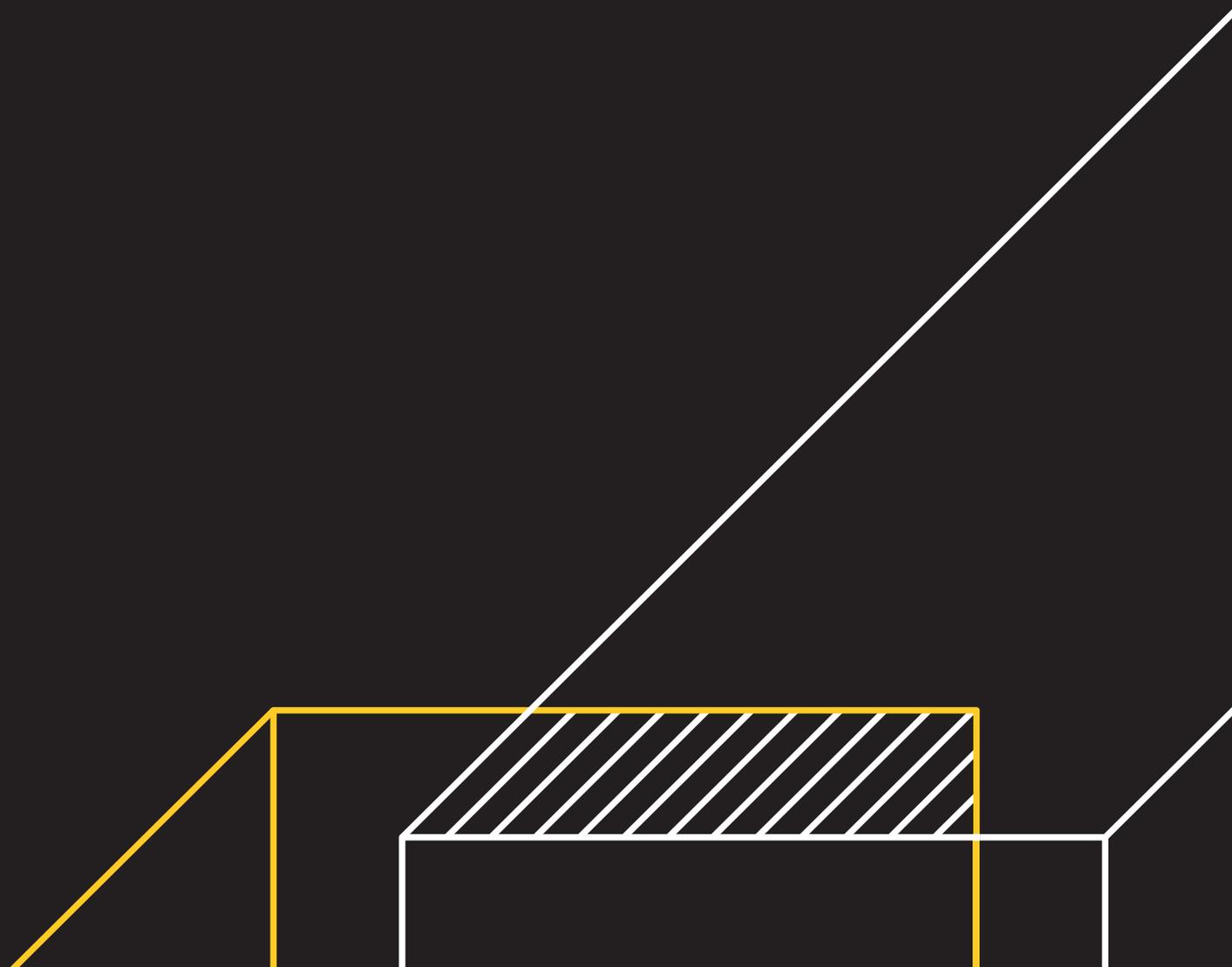


Yandex × FME

TECHNOLOGY AND PSYCHOLOGY FOR MATHEMATICS EDUCATION

Moscow, 2019



PME

The International Group for The Psychology in Mathematics Education has been founded at the Third International Congress on Mathematics Education (ICME-3) in 1976 and is an official subgroup of the International Commission for Mathematical Instruction (ICMI).

The PME conferences are the main annual meetings for the researchers from all around the world who are interested in psychology and other research issues in mathematics education.

PME provides annual funding for a regional conference to support researchers in regions currently underrepresented at PME. This initiative aims to support the development of a regional research community that pursues the goals of PME, and by doing so, encourage researchers from that region to actively participate in future PME conferences and help them in preparing top quality PME contributions.

Yandex

Yandex is a technology company that builds intelligent products and services powered by machine learning. Since 1997, we have delivered world-class, locally relevant search and information services.

Yandex participated in designing undergraduate, as well as MA level, courses in mathematics and IT which are being taught at six leading universities in Russia. We use the leading methodological and technological expertise to develop cutting-edge solutions for digital education. Our education platform facilitates personalized education in the Russian language and mathematics for primary school. It has been tested by 4,200 students in 73 schools in 15 regions in Russia and has received overwhelmingly positive feedback. Analytical tools that we provide allow teachers to follow the progress of each of their students, pinpoint factors that boost students' performance, and choose the best tactics to achieve top results.

Program Committee (IPC)

Anna Shvarts, Moscow Lomonosov State University, Utrecht University (Chair)

Angelika Bikner-Ahsbahs, Universität Bremen

Keith Jones, University in Southampton

Roza Leikin, University of Haifa

Elena Kardanova, National Research University Higher School of Economics

Sergey Polikarpov, Moscow Pedagogical State University

Local Organising Committee (LOC), Yandex

Natalia Chebotar

Lyubov Galitskaya

Alexandra Ledneva

Ekaterina Lomachenkova

Anna Smulyanskaya

Anna Shirokova-Koens

Support

We are grateful to the International Group for the Psychology of Mathematics Education (IGPME) for giving us the opportunity to host "Technology and Psychology for Mathematics Education" conference, and to Yandex for making it happen.

Design

Margarita Volkova

Contents

Welcome	4
Venue map	6
General information	7
Scientific program	8
Social program	25
Index of chairs and presenters	26

Welcome from Yandex

Dear Conference Participants,

I'm happy to welcome you in Moscow, at Yandex.

Yandex technologies would have never developed the way they have without Russia's strong traditions in mathematics and fundamental sciences.

We believe it is crucial to support and stimulate young generations' interest in mathematics and offer them opportunities in this field. For this reason, we developed a range of educational programs, from courses in programming for high school to advanced courses in data analysis to a digital learning platform for primary school.

Personally, I have drawn great inspiration from teaching programming and algebra, which I have been doing at Moscow State University since 2001, and I am now grateful for this opportunity that we have to explore the advances of technology and psychology and their application in teaching mathematics.

Dr Elena Bunina,

Professor of Higher Algebra at Moscow State University,

CEO of Yandex in Russia, Human Resources Director at Yandex

Welcome from PME

The International Group for the Psychology of Mathematics Education (PME) exists to promote lively and productive interaction between mathematics education researchers across the globe.

Over the years, we have organized 42 international conferences, the latest one attracting 689 participants to Umeå, Sweden. Yet, we see that some countries have been underrepresented in PME conferences. To make it easier for researchers from these areas to join PME, we initiated regional conferences.

I am very excited that this second regional PME conference is organized in Russia. The Russian mathematics education has a strong tradition unlike any other, and it is really a loss for PME that so few Russian mathematics educators and education researchers have participated in PME.

This conference has brought together Russian mathematics educators and active PME members. We hope that you make new friends and build new research collaboration networks. We hope to see more Russian researchers and educators in the future PME conferences. We welcome you to the PME family.

Markku S. Hannula,

President elect,

The International Group for the Psychology of Mathematics Education

Welcome from the Conference Chair

Russian mathematical education for gifted students is a unique phenomenon in the international landscape. Our school of thought in pure mathematics is well known, as well as the outstanding results of USSR and Russian school children at the international competitions in mathematics.

Our scholars also contributed greatly to the field of educational and development psychology, and such names as Vygotsky, Leontiev, Davydov, and Krutetsky still inspire many specialists all over the world.

The dialogue between Russia and other countries in the field of research in mathematics education evanesced after 1917. I reckon it should be re-established and maintained at the new level, as a joint effort of specialists from the variety of disciplines.

I believe there are many researchers in Russia, who are curious and excited to investigate what it means to understand mathematics. How subtle communication between a teacher and a student can support the latter, or which aspects of the teaching process can be efficiently outsourced to AI, are just two examples of studies that can prove useful to improve learning results across the country.

Our conference, themed “Technology and Psychology for Mathematics Education”, is an invitation for the Russian researchers to join the international community and to share their experience, results, doubts and inspiration.

I hope you will all enjoy these days and discussions, and I am looking forward to collaboration projects originating from this conference.

Anna Shvarts,

PhD, Conference Chair

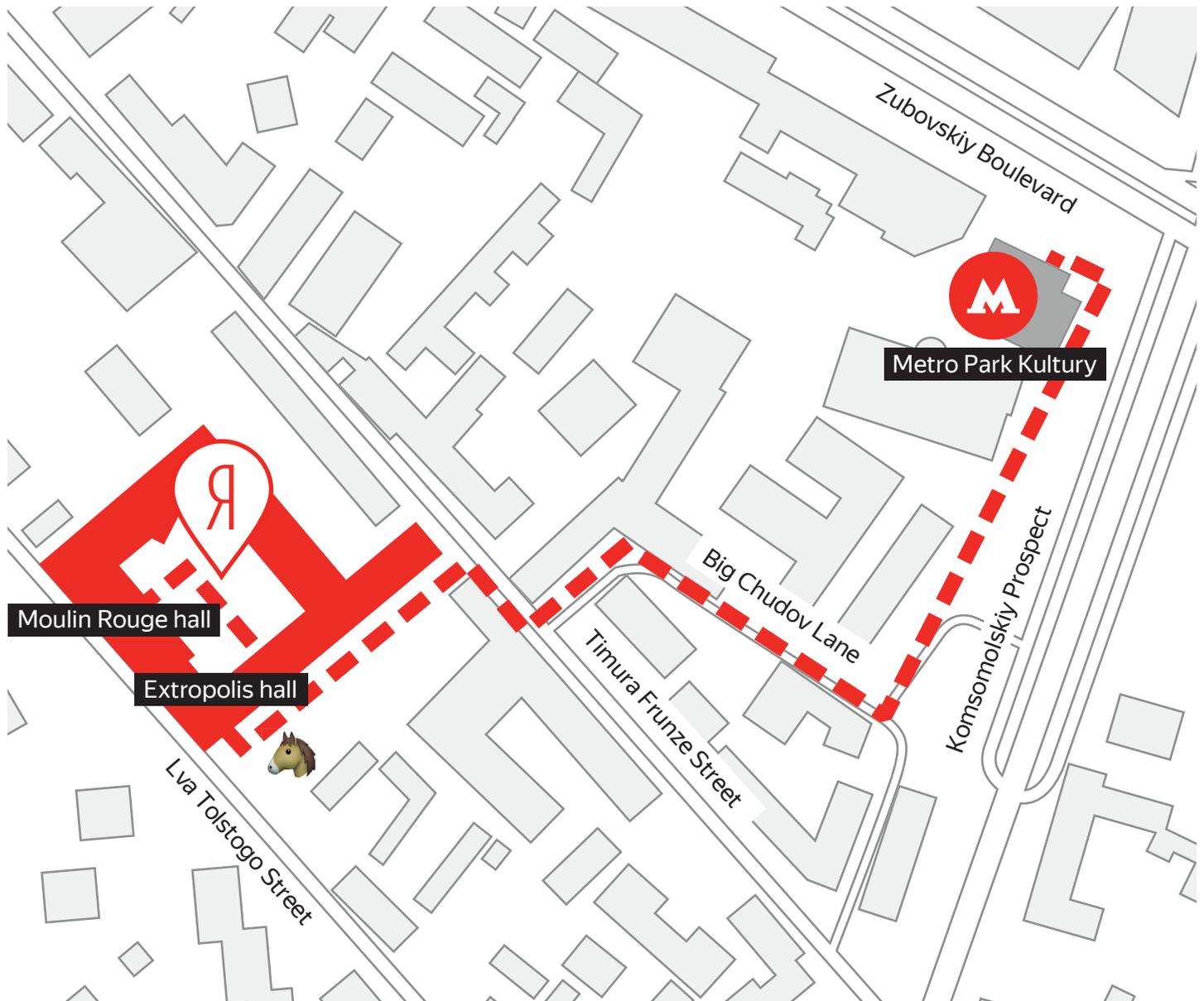
Venue

The conference will take place at Yandex: Lva Tolstogo Street 16, Moscow.

All the sessions take place either in the Extropolis hall or the Moulin Rouge hall.

To reach Extropolis, find the entrance with the respective sign near the horse monument.

To reach Moulin Rouge, enter the courtyard and find Entrance 4.



General information

Name Badges

All conference guests will receive a name badge. We kindly ask you to wear your badge during the four days in order to have access to the conference activities.

Badges are made in five different colors: black for participants and invited speakers, white for listeners, yellow for program committee members, red for local organizers.

Poster presentations

Poster presentations will be held in the Extropolis hall foyer on March 19, 10:20-12:00.

Kindly leave your poster at the Information Desk on March 18 before 17:00.

Information Desk

Information Desk is located in the Extropolis hall foyer during the conference activities. Staff at the desk will help you get oriented.

You can also reach us by phone or e-mail:

Organizational issues:

Lyuba Galitskaya +7 968 634-14-54

Program Committee Chair:

Anna Shvarts shvarts.anna@gmail.com

Internet access

Wireless internet access is available for guests in both conference halls. Please join the Yandex_Free network. It does not require a password.

Meals

Coffee, tea and light snacks will be available in both halls throughout the program.

Lunch is served as a bento-box meal, available for Conference participants only in the Extropolis foyer.

Your name badge gives you access to the lunches.

Everyone will be served the kind of meal which was indicated when they registered for the conference.

Special coffee, soft drinks and snacks can be purchased at Starbucks in Yandex premises which you can walk into from the courtyard or Lva Tolstogo street. You will also find many other cafes and restaurants inside and around Yandex campus.

Drinking water

Moscow tap water will not put your life in danger, but we do not recommend drinking it, if only for taste reasons. There are water stations and water coolers in both halls of the conference venue.

Excursion

We invite you to a bus excursion on March 19. Please register in advance at the Information Desk.

Helpful apps

We recommend downloading a few useful mobile apps so that you feel more comfortable navigating Moscow.

Yandex.Maps will show you how to reach your destination on foot or by public transport.

Yandex.Metro is an interactive metro scheme that helps you pick an optimal route when using the underground.

Yandex.Taxi is an easy to use taxi app. You can choose to pay in cash or by credit card.

Emergency Phone Numbers in Russia

General emergency: 112

Police: 102

Healthcare: 103

Scientific program

Formats

Plenary Lectures

There will be five Plenary Lectures from invited speakers.

Personal Presentations

There are four types of personal presentations. Research Reports (RR) are given 20 minutes for presentation and 20 minutes for the discussion. Oral Communications (OC) are given 10 minutes each for presentation and a total of 60 minutes for a group of three presentations, including 30 minutes for discussion. A Colloquium (CO) is a 90 minutes presentation of three interrelated papers (RR and/or OC). The Poster Presentations (PP) are given 1 hour 40 minutes, where participants can walk around and talk to the presenters.

Discussions

There will be two discussions, one held according to the Oxford-Style debate protocol, and one as a plenary panel where invited speakers make short speeches followed by a discussion.

	Extropolis	Moulin Rouge
	Registration	
9:00 am		
10:00 am	<p>Opening of the conference. Scientific research in education as a factor of digital economy and knowledge economy growth</p> <p><i>Markku S. Hannula, Natalia Chebotar</i></p>	
11:00 am–12:20 pm	<p>Plenary 1. The evolution of mathematics education research: Russia's place in this global movement</p> <p><i>Norma Presmeg</i></p> <p>#psychology</p>	
12:30 pm–1:10 pm	<p>Research report 1.1. Mathematics learning in language inclusive classrooms</p> <p>Chair: <i>Michael Meyer</i></p> <p>Authors: <i>Geoffrey B. Saxe, Joshua Sussman</i></p> <p>#teachingmethods</p>	<p>Research report 1.2. Thinking inside the post: investigating the didactical use of mathematical internet memes</p> <p><i>Samantha Bergen</i></p> <p><i>Giulia Giovanna Bini, Ornella Robutti</i></p> <p>#teachingmethods</p>
1:10 pm	Lunch	
2:10 pm–3:10 pm	<p>Oral communications 1.1. Teaching methods and learning obstacles</p> <p>Chair: <i>Anastasia Lobanova</i></p> <p>> Title: > Using measurement instruction to improve number sense in kindergarten students</p> <p>Authors: <i>Marina Vasilyeva, Elida Laski, Aleksander Veraksa, Daria Bukhalenkova</i></p> <p>#teachingmethods #cognitivescience</p>	<p>Oral communications 1.2. Teachers conceptions and beliefs</p> <p><i>Mourat Tchoshanov</i></p> <p>> Pre-service mathematics teachers' teaching and learning conceptions</p> <p><i>Wing Fat Lau</i></p> <p>#teachingteachers</p>
	<p>> Title: > On the content and methods of teaching math in elementary school for gat students</p> <p>Authors: <i>Yakov Abramson</i></p> <p>#teachingmethods #mathcontent</p>	<p>> Preparing math teachers for school discourse</p> <p><i>Svetlana Mugallimova</i></p> <p>#teachingteachers</p>

> Title > View on equations–sequential versus relational

Authors Angelika Bikner-Ahsbahs, Thomas Janßen, Stefan Bollen, Dmitry Alexandrovsky, Tanja Döring, Rainer Malaka, Anke Reinschüssel

#teachingmethods #mathcontent

> Prospective mathematics teachers' attitude towards the use of history in mathematics teaching

Ekaraj Pandit

#teachingteachers

● 3:20 pm–4:00 pm

Research report 2.1. Co-measurement as the spine of arithmetic curriculum: tentative learning progression

Chair Marina Vasilyeva

Authors Anastasia Lobanova, Elena Vysotskaya, Iya Rekhtman, Mariya Yanishevskaya

#teachingmethods

Research report 2.2. Learning intransitivity: from intransitive geometrical objects to “rhizomatic” intransitivity

Angelika Bikner-Ahsbahs

Alexander Poddiakov

#psychology #mathcontent

4:00 pm

Coffee break

● 4:30 pm–5:10 pm

Research report 3.1. Investigating math teachers' professional competencies

Chair Gulshat Shakirova

Authors Natalia Podkhodova, Victoria Snegurova

#teachingmethods

Research report 3.2. Thinking with objects in mathematics: the case of geometry

Ildar Safuanov

Sergey Bytchkov, Evgeny Zaytsev

#teachingmethods

● 5:20 pm–6:00 pm

Research report 4.1. The effect of phonological ability on math achievement in elementary school is modulated by socioeconomic status

Chair Natalia Chebotar

Authors Yulia Kuzmina

#psychology

Research report 4.2. Concentrated teaching and its applications in the design of the university mathematical course

Evgeny Zaytsev

Ildar Safuanov

#teachingmethods

Extropolis

Moulin Rouge

9:00 am–10:20 am **Plenary 2. Researching Vygotsky and researching with Vygotsky in mathematics education**

Steve Lerman

Author #psychology #teachingmethods

10:20 am–12:00 pm **Poster presentations**

PP1 > Functional investigation of the networks and white matter substrates associated with the processing of mathematical operations
Irina Matiulko, Sofya Kulikova, Ksenia Konopkina, Marie Arsalidou

PP2 > Mathematical problem solving: behavioral and neuroimaging studies
Ksenia Konopkina

PP3 > Fostering problem solving discussions through a gallery walk
Isabel Piteira Vale, Ana Barbosa, Isabel Cabrita

PP4 > Visual behaviour in natural environments — impact of photography on mathematics students' gaze fixation
Antje Meier, Markku S. Hannula, Miika Toivanen

PP5 > Diary of mathematical success
Tatiana Kigel

PP6 > Storytelling and early mathematic achievement
Taylor Crawford, Nancie Im-Bolter

PP7 > Crisis of maths thinking in the 21st century: myth or reality
Elena Golishnikova, Ekaterina Nikiforova

PP8 > Mathematics and students: one way to fit
Natalia Burmistrova, Vyacheslav Filimonov

PP9 > Directions and trends in the improvement of mathematical education
Vera Ustinova, Irina Ustinova

-
- PP10 > Bridging two theories: the theory of didactical situations and the theory of developmental instruction
Elena Polotskaia, Helena Boubilil-Ekimova
- PP11 > Utilitarian mathematical discourse on social media
Kumar Gandharv Mishra
- PP12 > Local interpretations of global comparisons: media content analysis in Turkey
Seyma Pekgoz
- PP13 > Associations with the word “mathematics”: the emotional value component
Oksana Pavlova
- PP14 > Measuring math self-concept among middle schoolers: questionnaire development and validation
Natasha Lebedeva, Ksenia Vilko
- PP15 > The impact of genetic teaching on pre-service teachers’ views of mathematics and its teaching
Ildar Safuanov
- PP16 > Influence of verbalizing geometry rules on their transfer in primary schoolers
Yulia Sudorgina, Alexey Kotov
- PP17 > Ratio-concepts through joint actions
Elena Vysotskaya, Anastasia Lobanova, Iya Rekhtman, Mariya Yanishevskaya
- PP18 > What derivative tells us about: a geometric and graphical approach
Maria Dullius, Gisele Scremin
- PP19 > Relationship between teaching practices and mathematical processes outcomes in secondary school: based on a longitudinal timss-pisa study
Galina Larina, Anastasia Kapuza
-

PP20 > Forming idea about graph isomorphism in mass contests with computer support

Athit Maytarattanakhon

PP21 > The effect of engineering-based mathematics activities on elementary students' problem solving skills

Ersen Yazıcı, Deniz Furtana

● 12:00 pm–1:00 pm

Oral communications 2: Individualisation of mathematics education

Chair Geoffrey B. Saxe

> Title > Study of the relationship of cognitive style “field independence / dependence” with the success in mastering mathematics

Authors Olga Silvanovich, Irina Seifert

#psychology

> Title > Quality of differentiation with technology in mathematics instruction by pre-service elementary school teachers

Authors Samantha Bergen, Irina Lyublinskaya

#teachingmethods

> Title > Latent structures of meaning – a prerequisite for inclusive learning in mathematics classrooms

Authors Michael Meyer, Simeon Schlicht

#teachingmethods

Wednesday, 20/Mar/2019

	Extropolis	Moulin Rouge
● 9:00 am–10:20 am	Plenary 3. Computer in productive learning of mathematics <i>Author</i> <u>Sergei Pozdniakov, Russia</u> #teachingmethods #technology	
10:20 am	Coffee break	
● 10:50 am–11:30 am	Research report 5.1. Preparing elementary school student-teachers to teach geometry with geogebra: comparing outcomes for russian and american participants <i>Chair</i> Mette Susanne Andresen <i>Authors</i> <u>Irina Lyublinskaya, Svetlana Tikhomirova</u> #teachingteachers #technology	
● 11:40 am–1:00 pm	Oral communications 3.1. Technology in teaching and learning geometry <i>Chair</i> Irina Lyublinskaya	Oral communications 3.2. Psychological factors of mathematical achievements Roza Leikin
> Title	> A primary pre-service teacher's instrumental orchestration of rotational symmetry	> Development of Symbolic Number Skills in Preschool
<i>Authors</i>	<u>Shajahan Haja-Becker</u> #teachingmethods	<u>Aleksander Veraksa, Marina Vasilyeva, Daria Bukhalenkova</u> #teachingteachers
> Title	> An investigation of students' recognition of geometric shapes in the arts studio	> Influence of motivation by using knowledge on students' achievements when studying Mathcad
<i>Authors</i>	<u>Mehtap Ozen-Kus, Erdinc Cakiroglu</u> #technology #cognitivescience	<u>Irina Ustinova, Elena Lazareva</u> #psychology
> Title	> Exploring friezes and rosettes: an experience with future teachers	> The formation of first-year students' socio-psychological adaptation at the mechanics and mathematics faculty
<i>Authors</i>	<u>Ana Barbosa, Isabel Vale</u> #teachingteachers #technology	<u>Anna Pecherkina, Svetlana Zhdanova, Andrey Kuznetsov</u> #psychology

> Title > Computer research in teaching geometry at the university

Authors Aliya Bukusheva

#teachingmethods #technology

> School engagement and math performance: ratings from students and teachers in Russia

Authors Morteza Charkhabi, Alexey Kotov, Anastasia Liashenko, Marie Arsalidou

#psychology #cognitivescience

1:00 pm Lunch

● 2:00 pm–2:40 pm

Research report 6.1. Role of the tool for teaching towards a modelling perspective on differential equation systems

Chair Ana Barbosa

Authors Mette Susanne Andresen

#teachingmethods #technology

Research report 6.2. Semantic alignment across whole-number arithmetic and rational numbers: evidence from a Russian perspective

Alexey Kotov

Authors Yulia Tyumeneva, Galina Larina, Ekaterina Alexandrova, Melissa dewolf, Miriam Bassok, Keith James Holyoak #cognitivescience

● 2:50 pm–4:10 pm

Plenary 4. A new world: educational research on the sensorimotor roots of mathematical reasoning

Author

Dor Abrahamson

#cognitivescience #technology

4:10 pm Coffee break

● 4:30pm–6:00pm

Discussion 1. How does technology change mathematics teaching and learning?

A debate between invited speakers followed by a Q&A session

	Extropolis	Moulin Rouge
9:00 am–10:20 am	<p>Plenary 5. Brain and mathematics: implications for education</p> <p>Author <i>Marie Arsalidou</i></p> <p>#cognitivescience</p>	
10:20 am	Coffee break	
10:40 am–11:40 am	<p>Oral communications 5.1. Teachers' content knowledge and preservice preparation</p> <p>Chair Ornella Robutti</p> <p>> Title > Qualitative analysis of lower secondary school mathematics teachers' topic-specific content knowledge: cross-national study</p> <p>Authors <i>Mourat Tchoshanov, Maria Cruz Quinones, Liliana Shakirova, Elena Ibragimova, Kadriya Shakirova</i></p> <p>#teachingteachers</p>	<p>Oral communications 5.2. Overcoming the gap between research and practice</p> <p>Angelika Bikner-Ahsbals</p> <p>> Cultural transposition and hybrid lesson study</p> <p><i>Maria Mellone, Alessandro Ramploud, Miguel Ribeiro, Gemma Carotenuto</i></p> <p>#teachingteachers #teachingmethods</p>
	<p>> Title > Examination of the perceptions of the pre-service elementary maths teachers toward the integral</p> <p>Authors <i>Özkan Ergene, Ahmet Şükrü Özdemir</i></p> <p>#teachingteachers #mathcontent</p>	<p>> Teaching and learning multiplicative relationships: action research in elementary school</p> <p><i>Elena Polotskaia, Annie Savard, Osnat Fellus</i></p> <p>#teachingmethods</p>
	<p>> Title > Root of 4 and mathematics teacher training</p> <p>Authors <i>Margo Kondratieva</i></p> <p>#teachingteachers #mathcontent</p>	<p>> The problem of connection between pedagogical science and teaching practice</p> <p><i>Alexey Borovskikh</i></p> <p>#teachingteachers</p>
11:50 am–12:30 am	<p>Research report 7.1. Mathematics self-efficacy of secondary school students in the uk: the role of parental support and perceived teaching practices</p> <p>Chair Emanuila Gelfman</p> <p>Authors <i>Ka Hei Lei, Maria Pampak</i></p> <p>#psychology</p>	<p>Research report 7.2. From prototypical phenomenon to dynamic functional system: eye-tracking data on the identification of special quadrilaterals</p> <p>Markku S. Hannula</p> <p><i>Anna Shvarts, Dmitry Chumachenko, Anna Drenyova, Anatoly Krichevets</i></p> <p>#cognitivescience</p>

● 12:40 am–
1:20 pm

Research report 8.1. School pupils' intellectual development during mathematical teaching: the role of educational texts

Research report 8.2. Eye movements during geometry problem solving lessons with and without computers

Chair **Ka Hei Lei**

Dmitry Chumachenko

Authors *Emanuila Gelfman, Marina Kholodnaya*

Markku S. Hannula, Miika Toivanen, Enrique

#psychology

Garcia Moreno-Esteva

#technology

1:20 pm

Lunch

● 12:20 pm–
1:00 pm

Oral communications 4.1. Teachers' attitudes to the students' misconceptions

Oral communications 4.2. Theoretical approaches to mathematical thinking and understanding

Chair **Margo Kondratieva**

Anastasia Sidneva

> Title > Secondary mathematics teachers' disposition and positional framing toward errors

> Theoretical justification of a structure model and the formation of mathematical thinking

Authors *Mariana Alvidrez, Mourat Tchoshanov*

Ilya Kaplunovich

#teachingteachers

#psychology

> Title > A phenomenological approach to mathematical lived experience: towards a radical change of attitude to student's (mis)conceptions

> Development of initial mathematical concepts

Authors *Andonis Zagorianakos*

Nina Salmina, Elena Zvonova, Anna Tsukarzi

#teachingteachers

#psychology

● 3:10 pm–
3:50 pm

Research report 9.1. Examining secondary mathematics teachers' not-knowing in the process of problem solving

Research report 9.2. Orientation towards given knowledge: conceptual basis and research perspectives

Chair **Wing Fat Lau**

Elena Polotskaia

Authors *Kevin Fierro, Mourat Tchoshanov, Gulshat Shakirova*

Anastasia Sidneva, Elena Vysotskaya

#cognitivescience #teachingteachers

#psychology #teachingmethods

3:50 pm

Coffee break

● 4:20 pm–
5:30 pm

Discussion 2. Technology and psychology for mathematics education: collaboration between the russian and international communities

A debate between invited speakers followed by a Q&A session

● 5:30 pm–
6:00 pm

Closing of the conference

Plenary abstracts

Plenary 1

THE EVOLUTION OF MATHEMATICS EDUCATION RESEARCH: RUSSIA'S PLACE IN THIS GLOBAL MOVEMENT

Norma Presmeg, Department of Mathematics, Illinois State University, Normal, USA

After outlining differences between research in pure mathematics, and mathematics education research, I highlight aspects of the founding and evolution of the International Group for the Psychology of Mathematics Education (PME), from its inception in 1976. This evolution entailed changes in theoretical paradigms, and in methodologies for research in mathematics education that were considered legitimate, ranging from an early paradigm in which only rigorous statistical research had scientific standing, through several decades of increasing acceptance of the value of qualitative research, to a more recent perception that quantitative and qualitative research methodologies have different purposes, and that each has its place—resulting in increasing use of conceptual lenses that make use of mixed methods of various types.

In Russia, the Soviet psychologist V.A. Krutetskii was ahead of his time in recognizing the potential for depth in research that involved clinical interviewing of 'capable' mathematics students with various individual differences, in their approach to types of mathematical problems that he collected and categorized. I highlight Krutetskii's book, first published in Russian in 1968, which was translated into English in 1976, and which formed a strong theoretical core for my own initial research on visual thinking in teaching and learning mathematics, starting in 1982 and continuing for several decades.

Plenary 2

RESEARCHING VYGOTSKY AND RESEARCHING WITH VYGOTSKY IN MATHEMATICS EDUCATION

Steve Lerman, London South Bank University, London, United Kingdom

Vygotsky's approach to child development has had, and continues to have, a major impact on teaching and learning and on research in education. In this talk I will show some of that work and its significance in the field of mathematics education, whilst pointing to misunderstandings circulating in the community. Vygotsky died young, aged just 37. It is evident, given how he developed and changed his ideas as he approached death, that he had so much more to say but did not have time to write enough nor elaborate fully his theory. Thus we continue to research him and his ideas, as well as work to apply his insights in our studies of teaching and learning. I will propose some future directions for research in mathematics education building on Vygotsky's thought.

Plenary 3

COMPUTER IN PRODUCTIVE LEARNING OF MATHEMATICS

Sergei Pozdniakov, Department of Mathematics of the Saint Petersburg Electrotechnical University, Saint Petersburg, Russia

The main ideas of productive learning in mathematics appeared much earlier than the appearance of a computer. In the works of Wertheimer, Hadamard, Polya and others, the basic principles of a productive approach to teaching mathematics were formulated. At the same time, the practice of mathematics teaching did not rely on these results because these principles contradicted the state of learning technologies back then. Emergence of the computers in everyday life has opened up opportunities for technological support of productive learning methods that were previously technologically inefficient.

The lecture demonstrates the possibilities of using a computer as a tool for a student's development, as it was developed in Vygotsky's ideas about the role of a tool in child development. However, the transition to a new structure of educational system requires a

large period of time, during which a new educational culture will be formed on the basis of new technological capabilities and a new generation of teachers who perceive this culture as their own will emerge. The report will present an analysis of different ways to use a computer to support productive learning.

Plenary 4

A NEW WORLD: EDUCATIONAL RESEARCH ON THE SENSORIMOTOR ROOTS OF MATHEMATICAL REASONING

Dor Abrahamson, Graduate School of Education, University of California, Berkeley, USA

Recent developments in the theory and methods of cognitive science are enabling educational researchers to evaluate empirically the historical thesis that mathematical concepts are grounded in sensorimotor activity. My presentation will survey results from several recent design-research studies that have used eye-tracking techniques to capture the moment at which a student first sees the world in a new way. For the student, this spontaneous perceptual construction serves as a handy solution for coordinating the control of an interactive system. In turn, through cultural mediation this construction evolves into a new way of reasoning that becomes a mathematical concept. I will speculate on implications for educational technology.

Plenary 5

BRAIN AND MATHEMATICS: IMPLICATIONS FOR EDUCATION

Marie Arsalidou, Faculty of Social Sciences at National Research University Higher School of Economics, Moscow, Russia

According to the world economic forum an estimated 65% of children who are now entering elementary school will graduate to work on completely new occupations that do not exist today (Chapter 1: The Future of Jobs and Skills, 2016). Although, our world is changing rapidly and future labor market requirements are not fully understood, researchers agree that future workforce will have a higher demand for Science, Technology, Engineering and Mathematics

(STEM) majors (Fayer et al., 2017). Mathematics is essential for STEM majors and occupations that are progressively more on demand.

Traditionally, mathematics has been a core subject in school curricula and research shows that success in math relies in part on the child's age and their readiness to receive instruction (Agostino et al., 2010). Advances in mathematical performance coincide with the development of fundamental cognitive processes such as mental competence and the protracted development of brain structures such as the prefrontal cortex (Pascual-Leone et al., 2010).

This plenary will discuss brain correlates of mathematical problem solving in adults and children, and potential implications to education. About twenty years ago, a neurofunctional model was proposed to explain the brain areas that support mental arithmetic, mainly focusing on the functions of the parietal cortex, in posterior parts of the brain (Dehaene & Cohen, 1997; Dehaene et al., 2003).

Although this model is based mainly on lesion patient studies, it has stimulated a substantial body of functional magnetic resonance imaging (fMRI) research with healthy individuals. fMRI studies on mathematical cognition typically fall into two categories those that use number tasks (i.e., stimuli are numbers or quantities and participants are asked to make simple magnitude judgements) and those that use calculations tasks (i.e., formal mathematical operations such as addition, subtraction, and multiplication).

In quantitative Activation Likelihood Estimation (ALE) meta-analyses we examined neurofunctional activity associated with number and calculation tasks in healthy individuals, children (Arsalidou et al., 2018) and adults (Arsalidou & Taylor, 2011). Data shows that a large overlap exists among brain regions implicated in number and calculation tasks, however the regions in which they differed were most notable, such as distinct areas in prefrontal cortices. Specifically, compared to number tasks, solving calculation tasks elicit more activity in prefrontal brain areas; a difference, which suggests that calculations implicate more core cognitive resources, such as working memory and mental-attention (Arsalidou et al., 2013).

Moreover, addition, subtraction and multiplication differentially implicated brain regions in the parietal and prefrontal cortex in the left and right hemispheres. Similar to adults, children activate a varied set of brain areas in established parietal and frontal regions when solving problems with numbers and calculations (Arsalidou et al., 2018). Importantly, children implicate extensively the insular cortex when solving calculation tasks. The insular cortex has not been previously emphasized in its role in mathematical cognition; instead it has best known for its involvement in processes of emotion and motivation (Duerden et al., 2013). Concluding, this presentation will highlight neuroscience evidence to underline potential implications for teachers' professional development and students learning experiences, and discuss the importance of Developmental Cognitive Neuroscience in evidence-based education.

Research Report Abstracts

Research report 1.1 (Extropolis)

Chair: Michael Meyer

MATHEMATICS LEARNING IN LANGUAGE INCLUSIVE CLASSROOMS

Geoffrey B. Saxe, Joshua Sussman

In the U.S., English Language learners (ELs) score lower in elementary mathematics compared with their English Proficient peers (EPs). To provide information on strategies for enhancing learning opportunities for ELs and EPs, we document the efficacy of Learning Mathematics through Representations (LMR), a 19-lesson curriculum unit on integers and fractions. LMR features the number line as a representational context and the use of embodied representations to support students as they explore mathematical ideas, construct arguments, and elaborate explanations. The lessons were implemented in 11 LMR classrooms and 10 matched comparison classrooms. Both theory and empirical results support the value of LMR as a math intervention benefiting both EL and EP students in language inclusive classrooms.

Research report 1.2 (Moulin Rouge)

Chair: Samantha Bergen

THINKING INSIDE THE POST: INVESTIGATING THE DIDACTICAL USE OF MATHEMATICAL INTERNET MEMES

Giulia Giovanna Bini, Ornella Robutti

We venture in the almost unexplored field of mathematical Internet memes, with the aims of investigating their didactical features in a teaching and learning setting. The work is framed within the research field studying the links between emotions and mathematical thinking and takes off with a schematization of the meanings carried by a meme, formulated through an a-priori analysis of spontaneous web productions and results of an exploratory experiment. The analysis is then compared to the data collected in a teaching experiment conducted at high school level. Results sustain the conjectured meanings structure and elicit evidence of students'

emotions and of their role in the learning process initiated by the interaction with memes.

Research report 2.1 (Extropolis)

Chair: Marina Vasilyeva

CO-MEASUREMENT AS THE SPINE OF ARITHMETIC CURRICULUM: TENTATIVE LEARNING PROGRESSION

Anastasia Lobanova, Elena Vysotskaya, Iya Rekhtman, Mariya Yanishevskaya

Learning ratios is difficult. There is a strong evidence that math curricula fail to provide appropriate scaffolding for ratio-based concepts. One of the most psychologically adequate Math curricula is based on the idea that number is a ratio between the quantity and its measure. Yet it exploits only part-whole relations. As we revise the measurement paradigm of Davydov's curriculum, we see the potential to put the idea of measurement in the context of co-measurement, i.e. the coordinated measurement of two different values to control the corresponding intrinsic value. Expected benefits in terms of students' goal-oriented actions are discussed. A tentative learning progression based on co-measurement is presented.

Research report 2.2 (Moulin Rouge)

Chair: Angelika Bikner-Ahsbans

LEARNING INTRANSITIVITY: FROM INTRANSITIVE GEOMETRICAL OBJECTS TO "RHIZOMATIC" INTRANSITIVITY

Alexander Poddiakov

A new class of intransitive objects – geometrical and mathematical constructions forming intransitive cycles $A > B > C > A$ – are presented. In contrast to the famous intransitive dice, lotteries, etc., they show deterministic (not probabilistic) intransitive relations. The simplest ones visualize intransitivity that can be understood at a qualitative level and does not require quantitative reasoning. They can be used as manipulatives for learning intransitivity. Classification of the types of situations in which the transitivity axiom does and does not work is presented. Four

levels of complexity of intransitivity are introduced, from simple combinatorial intransitivity to a "rhizomatic" one. A possible version of the main educational message for students in teaching and learning transitivity-intransitivity is presented.

Research report 3.1 (Extropolis)

Chair: Gulshat Shakirova

INVESTIGATING MATH TEACHERS' PROFESSIONAL COMPETENCIES

Natalia Podkhodova, Victoria Snegurova

The paper describes the results of a research of professional competencies of mathematics teachers. Problems of readiness for professional activities were identified. The components of the professional competence of a mathematics teacher are highlighted. We also describe levels of mastery and teaching tools.

Research report 3.2 (Moulin Rouge)

Chair: Ildar Safuanov

THINKING WITH OBJECTS IN MATHEMATICS: THE CASE OF GEOMETRY

Sergey Bytchkov, Evgeny Zaytsev

The emphasis laid upon the skills of numerical calculations and algebraic transformations, which dominated the pre-computer era, is gradually losing its significance. Today mathematical education is viewed as aiming at the formation of scientific thinking skills. The paper suggests an approach to mathematical education based on the concept of object-oriented mediation. The characteristic feature of this approach consists in that the student is placed in conditions similar to those that historically led to the formation of new sections of mathematics.

Research report 4.1 (Extropolis)

THE EFFECT OF PHONOLOGICAL ABILITY ON MATH ACHIEVEMENT IN ELEMENTARY SCHOOL IS MODULATED BY SOCIOECONOMIC STATUS

Chair: Morteza Charkhabi

Yulia Kuzmina

Current study focused on estimation of the effect of phonological ability on math achievement during first year of schooling and testing the hypothesis that this effect varied depending on students SES. To achieve our aims we used two-waves longitudinal study which were conducted on large sample of first-graders (N= 2948) in Tatar Republic (Russia). The results revealed that phonological ability had a significant positive effect on math achievement even when reading achievement, number identification skills and SES were controlled for. The effect of phonological ability was higher for students with larger number of books at home and who used not only Russian language at home.

Research report 4.2 (Moulin Rouge)

Chair: Evgeny Zaytsev

CONCENTRATED TEACHING AND ITS APPLICATIONS IN THE DESIGN OF THE UNIVERSITY MATHEMATICAL COURSE

Ildar Safuanov

The new method of the concentrated teaching of mathematics is proposed and considered. It includes requirements related both to the construction of the course as a whole (preparation, anticipation, repetition and deepening) and to the development of a separate topic (combination of functions, linkage). Requirements related to the arrangement of the content and to the impact on various channels of perception by students are also important. The implementation of this method in the course “Algebra and Number Theory” at the pedagogical university is described.

Research report 5.1 (Extropolis)

PREPARING ELEMENTARY SCHOOL STUDENT-TEACHERS TO TEACH GEOMETRY WITH GEOGEBRA: COMPARING OUTCOMES FOR RUSSIAN AND AMERICAN PARTICIPANTS

Irina Lyublinskaya, Svetlana Tikhomirova

This study analysed experiences of elementary school student-teachers participating in a semester-long international collaborative project between Russian and US public universities to integrate GeoGebra into teaching geometry. The analysis of results showed that while Russian student-teachers outperformed Americans in geometry, American student-teachers demonstrated more positive attitudes towards using computers in teaching. Analysis of lesson videos suggested that participants from both countries developed Technological Pedagogical Content Knowledge (TPACK) at different levels with similar distributions. This project proposes a model of innovative international collaboration between mathematics education faculty that could promote transformative changes in teaching and learning mathematics with technology.

Research Report 5.2 (Moulin Rouge)

COGNITIVE MOTIVATION AS A CRUCIAL FACTOR IN MATHEMATICS EDUCATION

Diana Bogoyavlenskaya, Anna Nizovtsova

The article relates the leading determinants of giftedness to the specific example of mathematical giftedness. Students and post-graduates of mathematical specialities at prestigious Moscow universities (n=100) are the participants of the current research. Giftedness is diagnosed with a technique designed in the frame of the Creative Field Method using mathematical material. The findings are compared with the results of techniques that examine intellect and personality. It has been demonstrated that the general intellect correlates to successfully mastering mathematical activity, but it cannot definitely predict mathematical giftedness. The manifestation of the latter depends on cognitive motivation and the so-called “worldview activeness”.

Research Report 6.1 (Extropolis)

ROLE OF THE TOOL FOR TEACHING TOWARDS A MODELLING PERSPECTIVE ON DIFFERENTIAL EQUATION SYSTEMS

Mette Susanne Andresen

This paper reports on a study in progress of the role played by various ICT tools for students' formation of mathematical concepts. In the study experienced teachers (14 in all) documented their modelling by differential equations of a system. Their reports were analysed with regard to signs of concept formation and tool use. The aim, data and method of the inquiry is presented together with an excerpt from the analysis and reflections upon the study so far.

Research Report 6.2 (Mouline Rouge)

SEMANTIC ALIGNMENT ACROSS WHOLE-NUMBER ARITHMETIC AND RATIONAL NUMBERS: EVIDENCE FROM A RUSSIAN PERSPECTIVE

Yulia Tyumeneva, Galina Larina, Ekaterina Alexandrova, Melissa DeWolf, Miriam Bassok, Keith James Holyoak

Solutions of mathematical word problems are moderated by the semantic alignment of real-world relations with mathematical operations. The current study examined evidence for semantic alignments in Russia in comparison to the USA and South Korea. Textbook analyses revealed semantic alignments for arithmetic word problems, but not for rational numbers. However, Russian college students showed semantic alignments both for arithmetic operations and for rational numbers. Since Russian students exhibit semantic alignments for rational numbers in the absence of exposure to examples in school, such alignments likely reflect people's everyday experience with and natural understanding of mathematical representations of real-world situations.

Research Report 7.1 (Extropolis)

MATHEMATICS SELF-EFFICACY OF SECONDARY SCHOOL STUDENTS IN THE U.K.: THE ROLE OF PARENTAL SUPPORT AND PERCEIVED TEACHING PRACTICES

Ka Hei Lei, Maria Pampaka

Drawing on data from a large study of secondary school students in the UK which looked into the relationship between teaching practices and students' mathematics learning outcomes, we investigate mathematics self-efficacy. We are particularly interested in parental support and perceived teaching practice and further explore how these relationships are affected when considering the individual characteristics of students and other affective variables. Our methodological approach includes a validation stage with the use of the Rasch model and a modelling stage with multiple linear regression. Results with the responses of 13643 11 to 16 years old students start illuminating the complex interrelationships of variables with MSE. We discuss these results in regards to their implications for mathematics education practice.

Research Report 7.2 (Mouline Rouge)

FROM PROTOTYPICAL PHENOMENON TO DYNAMIC FUNCTIONAL SYSTEM: EYE-TRACKING DATA ON THE IDENTIFICATION OF SPECIAL QUADRILATERALS

Anna Shvarts, Dmitry Chumachenko, Anna Drenyova, Anatoly Krichevets

In the paper we consider the characteristics of the perceptive system as a possible basis for the well-known prototypical phenomenon in geometry. Analysis of eye-tracking data revealed intense involvement of extrafoveal processes in the categorical identification of squares and rectangles in canonical orientation, while rotated orientation required stronger foveal processing. Also, pronounced individual differences were found in perceptual strategies. Identification tasks that relied on an inclusion relation between squares and rectangles required more time but not fixations, pointing to logical rather than perceptual difficulty. The results are interpreted in light of the culture-historical approach to categori-

cal identification as a functional system of extrafoveal, foveal and logical processes.

Research Report 8.1 (Extropolis)

SCHOOL PUPILS' INTELLECTUAL DEVELOPMENT DURING MATHEMATICAL TEACHING: THE ROLE OF EDUCATIONAL TEXTS

Emanuila Gelfman, Marina Kholodnaya

The main purpose of the research is to show the role of psychodidactic approach in modern school mathematical education and to present the psychodidactic typology of development-focused educational texts for students of grades 5 to 9. Each type of text creates conditions for the enrichment of the main components of the mental experience of students (cognitive, conceptual, metacognitive, and intentional) as a factor of their intellectual growth and the prerequisites for a high level of understanding of mathematical material.

Research Report 8.2 (Mouline Rouge)

EYE MOVEMENTS DURING GEOMETRY PROBLEM SOLVING LESSONS WITH AND WITHOUT COMPUTERS

Markku S. Hannula, Miika Toivanen, Enrique Garcia Moreno-Esteva

This study examines student eye movements during collaborative geometry problem solving. Specifically, we are analysing the differences in fixation durations when working on paper versus working with GeoGebra. We examined eight students' fixation durations in four classrooms. We found that use of technology influenced the duration of gaze fixations. The use of GeoGebra resulted in slightly more short fixations, less medium length fixations, and clearly more long fixations. A more detailed analysis suggested that the long fixations are related both to instrument manipulation and cognitive processes.

Research Report 9.1 (Extropolis)

EXAMINING SECONDARY MATHEMATICS TEACHERS' NOT-KNOWING IN THE PROCESS OF PROBLEM SOLVING

Kevin Fierro, Mourat Tchoshanov, Gulshat Shakirova

Not-knowing is an underexplored concept defined by an individual's ability to be aware of what they do not know as a means to plan and more effectively face complex situations. This qualitative study focuses on analyzing students' ability to express their "not-knowing" while completing tasks and reflecting periodically. It becomes evident rather quickly that the students have difficulty expressing their not-knowing. Through transcription analysis, reflection coding, and interviews, four recurring themes emerge that could possibly determine why students have difficulty expressing their not-knowing. These four themes are deflection, student pressure, lack of heuristic sense, and fractured knowledge. Each one of these themes will be discussed addressing challenges in relation to students' ability to express not-knowing.

Research Report 9.2 (Mouline Rouge)

ORIENTATION TOWARDS GIVEN KNOWLEDGE: CONCEPTUAL BASIS AND RESEARCH PERSPECTIVES

Anastasia Sidneva, Elena Vysotskaya

In the literature we can find description of two groups of factors which influence effective learning (EL): psychological and pedagogical. Based on the Activity Approach designed by Russian psychologists, we consider that the main predictor of EL is a child's goal-oriented activity, which should be organized. The teacher should choose appropriate actions, give students the method for their actions, encourage students to use it, and organize stage-by-stage formation. What about a student who learns effectively? To what extent does he or she use these factors? We suppose that the important predictor of EL is orientation towards given knowledge (OGK) — the inclusion of the given knowledge in the student's new actions as their method. Our main aim is to discuss the nature of OGK, to suggest some methods for it's diagnostics and to present a research project of the differences between fourth graders from different educational systems.

Social program

March 18, 18:30–20:30

Welcoming reception

Conference welcome Reception will be held at Extropolis foyer.

The format is a cocktail party (including a buffet).

Only Conference participants can attend this event.

March 19, 14:00–18:00

Bus excursion around Moscow

This is a classic bus tour. Visitors will learn about Moscow's main sightseeing spots and will get an idea of the city as a whole. You will learn interesting and little-known facts about the history of Moscow, see some of the city's ancient and modern architecture, and get a chance to spot unique architectural landmarks.

For joining the tour, please register on March 18 at the infodesk and meet the guide there on March 19, at 14:00 sharp. After the excursion is finished you will be taken to your hotel.

Approximate route:

- Down Tverskaya Street – Moscow's main thoroughfare.
- Tverskoy and Nikitsky Boulevards, Arbatskaya Square.
- Znamenka and Mokhovaya — the city's most famous streets.
- Red Square – Russia's main square where you can enjoy a wonderful view of the Kremlin towers, the State Department Store, the History Museum and St. Basil's Cathedral.
- The Bolshoi Theater and the Lenin Library.
- House on the Embankment — you'll learn some interesting facts about its construction.

- A walk around the Cathedral of Christ the Saviour and across Patriarshy Bridge, which offers one of the best views of the historic center.
- Novodevichy Convent.
- Lomonosov Moscow State University, and the Vorobyovy Gory view point — a location famous for its wonderful architecture and amazing view of the city.
- The Mosfilm film studio.
- Poklonnaya Gora and the beautiful Triumphal Arch.
- Moscow City International Business Center — a perfect spot to make photos.

March 20, 18:30–22:30

Conference dinner

The Conference dinner will be held at Shaggy Restobar: Lva Tolstogo street, 5/1, 2 min walking distance from Extropolis.

Same as the welcoming reception, it is only available for conference participants. The format is a cocktail party (including a buffet).

Index of Presenters and Chairs

	Name	Presenter	Chair
1	Abrahamson, Dor	PL4	
2	Abramson, Yakov	OC 1.1	
3	Alvidrez, Mariana	OC 5.1	
4	Andresen, Mette	RR 6.1	RR 5.1
5	Arsalidou, Marie	PP1, OC 3.2, PL5	
6	Barbosa, Ana	PP3, OC 3.1	RR 6.1
7	Bergen, Samantha	OC2	RR 1.2
8	Bikner-Ahsbahs, Angelika	OC 1.1	RR 2.2, OC 4.2
9	Bini, Giulia Giovanna	RR 1.2	
10	Borovskikh Alexey	OC 4.2	
11	Bukusheva Aliya	OC 3.1	
12	Burmistrova, Natalya	PP8	
13	Bytchkov, Sergey	RR 3.2	
14	Cabrita, Isabel	PP3	
15	Charkhabi, Morteza	OC 3.2	RR 4.1
16	Chumachenko, Dmitry	RR 7.2	RR 8.2
17	Crawford, Taylor	PP6	
18	Dullius, Maria	PP18	
19	Ergene, Özkan	OC 4.1	
20	Gelfman, Emanuila	RR 8.1	RR 7.1
21	Golishnikova Elena	PP7	
22	Haja-Becker, Shajahan	OC 3.1	
23	Hannula, Markku S.	PP4, RR 8.2	RR 7.2
24	Kaplunovich, Ilya	OC 5.2	
25	Kaplunovich, Svetlana	OC 5.2	
26	Kapuza, Anastasia	PP19	
27	Kholodnaya, Marina	RR 8.1	
28	Kigel, Tatiana	PP5	

29	Kondratieva, Margo	OC 4.1	OC 5.1
30	Konopkina, Ksenia	PP1	
31	Kotov, Alexey	OC 3.2, PP16	RR 6.2
32	Krichevets, Anatoly	RR 7.2	
33	Kulikova, Sofya	PP1	
34	Kuzmina, Yulia	RR 4.1	
35	Kuznetsov, Andrey	OC 3.2	
36	Larina, Galina	PP19, RR 6.2	
37	Lau, Wing Fat	OC 1.2	RR 9.1
38	Lazareva, Elena	OC 3.2	
39	Lebedeva, Natasha	PP14	
40	Lei, Ka Hei	RR 7.1	RR 8.1
41	Leikin, Roza		OC 3.2
42	Lerman, Steve	PL2	
43	Lobanova, Anastasia	RR 2.1, PP17	OC 1.1
44	Lyublinskaya, Irina	OC2, RR 5.1	OC 3.1
45	Matiulko Irina	PP1	
46	Maytarattanakhon, Athit	PP20	
47	Meier, Antje	PP4	
48	Mellone, Maria	OC 4.2	
49	Meyer, Michael	OC2	RR 1.1
50	Mishra, Kumar Gandharv	PP11	
51	Mugallimova, Svetlana	OC 1.2	
52	Ozen-Kus, Mehtap	OC 3.1	
53	Pandit, Ekaraj	OC 1.2	
54	Pavlova, Oksana	PP13	
55	Pecherkina, Anna	OC 3.2	
56	Pekgoz, Seyma	PP12	
57	Poddiakov, Alexander	RR 2.2	
58	Podkhodova, Natalia	RR 3.1	
59	Polotskaia, Elena	PP10, OC 4.2	RR 9.2
60	Pozdniakov, Sergei	PL3	

61	Presmeg, Norma	PL1	
62	Robutti, Ornella	RR 1.2	OC 4.1
63	Safuanov, Ildar	RR 4.2, PP15	RR 3.2
64	Saxe, Geoffrey B.	RR 1.1	OC2
65	Seifert, Irina	OC2	
66	Shakirova, Gulshat	RR 9.1	RR 3.1
67	Shvarts, Anna	RR 7.2	
68	Sidneva, Anastasia	RR 9.2	OC 5.2
69	Silvanovich, Olga	OC2	
70	Snegurova, Victoria	RR 3.1	
71	Sudorgina, Yulia	PP16	
72	Tchoshanov, Mourat	OC 4.1, OC 5.1, RR 9.1	OC 1.2
73	Tikhomirova, Svetlana	RR 5.1	
74	Tyumeneva, Yulia	RR 6.2	
75	Ustinova, Irina	PP9, OC 3.2	
76	Vale, Isabel	PP3, OC 3.1	
77	Vasilyeva, Marina	OC 1.1, OC 3.2	RR 2.1
78	Veraksa, Aleksander	OC 3.2, OC 1.1	
79	Vilkova, Ksenia	PP14	
80	Vysotskaya, Elena	RR 2.1, PP17, RR 9.2	
81	Yanischevskaya, Mariya	RR 2.1, PP17	
82	Yazıcı, Ersen	PP21	
83	Zagorianakos, Andonis	OC 5.1	
84	Zaytsev, Evgeny	RR 3.2	RR 4.2
85	Zvonova, Elena	OC 5.2	

Program at a glance

	March 18	March 19	March 20	March 21
09:00		09:00	09:00	09:00
	Registration	Plenary 2: Steve Lerman	Plenary 3: Sergey Pozdniakov	Plenary 5: Marie Arsalidou
10:00		10:00	10:00	10:00
	Opening	Coffee + Poster presentation	Coffee	Coffee
11:00		11:00	11:00	11:00
	Plenary 1: Norma Presmeg		Research reports 5	Oral communica- tions 4
12:00		12:00	12:00	12:00
	Research reports 1	Oral communica- tions 2	Oral communica- tions 3	Research reports 7
13:00		13:00	13:00	13:00
	Lunch	Lunch	Lunch	Research reports 8
14:00		14:00	14:00	14:00
	Oral communica- tions 1	Excursions	Research reports 6	Oral communica- tions 5
15:00		15:00	15:00	15:00
	Research reports 2		Plenary 4: Dor Abrahamson	Research reports 9
16:00		16:00	16:00	16:00
	Coffee		Coffee	Coffee
17:00		17:00	17:00	17:00
	Research reports 3		Plenary Discus- sion Technology in math educa- tion	Plenary Discus- sion: Math edu- cation research in Russia and in the World
18:00		18:00	18:00	18:00
	Research reports 3			Conference closing
19:00		19:00	19:00	19:00
	Welcoming Reception		Conference dinner 18:30-22:30	
20:00		20:00	20:00	20:00

