ICME-14

The 14th International Congress on Mathematical Education

Program Brochure

SHANGHAI · CHINA
JULY 11–18, 2021

ICME-14 Timetable

UTC	UTC + 8	Sunday July. 11th	Monday July. 12th	Tuesday July. 13th	Wednesday July. 14th	Thursday July. 15th	Friday July. 16th	Saturday July. 17th	Sunday July. 18th	UTC + 8	UTC
0:30-1:00	8:30-9:00		Early Career Researcher Day: Parallel Workshops							8:30-9:00	0:30-1:00
1:00-1:30	9:00-9:30									9:00-9:30	1:00-1:30
1:30-2:00	9:30-10:00									9:30-10:00	1:30-2:00
2:00-2:30	10:00-10:30		Break				Excursion			10:00-10:30	2:00-2:30
2:30-3:00	10:30-11:00		Early Career Researcher Day: Parallel Workshops							10:30-11:00	2:30-3:00
3:00-3:30	11:00-11:30									11:00-11:30	3:00-3:30
3:30-4:00	11:30-12:00									11:30-12:00	3:30-4:00
4:00-4:30	12:00-12:30		Lunch & Break							12:00-12:30	4:00-4:30
4:30-5:00	12:30-13:00									12:30-13:00	4:30-5:00
5:00-5:30	13:00-13:30							Poster		13:00-13:30	5:00-5:30
5:30-6:00	13:30-14:00	Registration	Early Career Researcher Day: Plenary Session						Poster	13:30-14:00	5:30-6:00
6:00-6:30	14:00-14:30					Thematic Afternoon		Break		14:00-14:30	6:00-6:30
6:30-7:00	14:30-15:00			TSG A	Lectures of Awardees (parallel)			TSG B	Break	14:30-15:00	6:30-7:00
7:00-7:30	15:00-15:30		Break		Break		Invited Lectures (parallel)		Invited Lectures (parallel)	15:00-15:30	7:00-7:30
7:30-8:00	15:30-16:00		ECRD: Parallel Discussions		National Presentations/ ICMI Studies/ Affi.Org. (parallel)				Break	15:30-16:00	7:30-8:00
8:00-8:30	16:00-16:30		ECRD: Panel Discussion	Break		Break	Break	Break	Survey Teams (parallel)	16:30-17:00	8:00-8:30
8:30-9:00	16:30-17:00			Plenary Lecture (Gu)		Plenary Lecture (Jorgensen)	Plenary Lecture (Kazima)	Invited Lectures (parallel)		17:00-17:30	8:30-9:00
9:00-9:30	17:00-17:30									17:30-18:00	9:00-9:30
9:30-10:00	17:30-18:00									18:00-18:30	9:30-10:00
10:00-10:30	18:00-18:30		Dinner and Break							18:30-19:00	10:00-10:30
10:30-11:00	18:30-19:00									19:00-19:30	10:30-11:00
11:00-11:30	19:00-19:30									19:30-20:00	11:00-11:30
11:30-12:00	19:30-20:00	Welcome Reception	Opening Ceremony	TSG B	TSG A	Chinese Art and Cultural Performance	Plenary Panel 2	Interact. with Plen. Lect.	Plenary Panel 3	20:00-20:30	11:30-12:00
12:00-12:30	20:00-20:30							Interact. with Awardees		20:30-21:00	12:00-12:30
12:30-13:00	20:30-21:00			Break	Break		Break	Break	Break	21:00-21:30	12:30-13:00
13:00-13:30	21:00-21:30		Break	Plenary Panel 1	Discussion Groups/ Workshops (parallel)		TSG B	TSG A	Closing Ceremony	21:30-22:00	13:00-13:30
13:30-14:00	21:30-22:00		Plenary Lecture (Villani)							22:00-22:30	13:30-14:00
14:00-14:30	22:00-22:30									22:30-23:00	14:00-14:30
14:30-15:00	22:30-23:00										

Address of Welcome

As the Congress chair of ICME-14, I cordially invite you to participate in the Congress to be held in Shanghai from July 11th to 18th, 2021.

As an ancient country with a 5,000-year history of civilization, China boasts a brilliant tradition of mathematics and mathematics education. In recent 100 years, the introduction of western mathematics and mathematics education and their integration with traditional Chinese culture and education have fostered new achievements in mathematics education of modern China. Shanghai, a well-known metropolis in the Far East, is a powerful engine for the economic and social development of China and a window of China's opening-up policy. In addition, it is also the cradle of modern Chinese mathematics and mathematics education and the birthplace of the Chinese Mathematical Society. East China Normal University is one of the top universities in China and takes the lead in the development of teacher education in China. The mathematics education team of ECNU has a great influence both at home and abroad. Taking consideration of all these facts, I am quite sure that the 14th International Congress on Mathematical Education (ICME-14) in 2020 could provide a chance for all international scholars in mathematics and mathematics education to come to Shanghai, China.

Unfortunately, due to the pandemic of COVID-19, the Congress has been postponed for a whole year, and has to adopt a hybrid mode of participation to avoid contagion and to ensure the safety for all. Because of this, many overseas participants missed the opportunity to visit this wonderful city. However, the people of China and Shanghai will always warmly welcome each of you to this beautiful land, and the Chinese academic circle of mathematics and mathematics education will keep anticipating the physical reunion with you very soon.

Let’s wish a great success to this special ICME, and a brand-new future for the world and for the mathematics education without COVID-19!

Jianpan WANG


華東師範大學

Content

General Information

Hosting Organizations

Chinese Mathematical Society

As a member of International Mathematical Union (IMU) and a member of International Commission on Mathematical Instruction (ICMI), the Chinese Mathematical Society (CMS) is the bidding and hosting body of ICME-14 in Shanghai.

Founded in 1935 in Shanghai, the Chinese Mathematical Society (CMS) is a national academic association for Chinese mathematicians and mathematical educators. CMS aims to unite mathematicians and mathematical educators to promote the research and popularization of mathematics in China and enhance both the development of science and technology and the modernization of the country.

The Chinese Mathematical Society has a long tradition of caring about and supporting the research and practice of mathematical education. Early in 1980, Professor Lokeng Hwa, a world-famous Chinese mathematician and then president of the Chinese Mathematical Society, attended at invitation the 4th International Congress on Mathematical Education (Berkeley, CA, U.S.A.) and gave a plenary lecture. Nowadays affiliated to the Society, there are several committees related to mathematics education, such as the Committee of Popularization, the Committee of Mathematics Olympic Competitions, the Committee of Math Education. Besides the mathematics research journals such as Acta Mathematica Sinica, Acta Mathematicae Applicatae Sinica, and Advances in Mathematics (China), the Society also publishes journals serving mathematics education such as Shuxue Tongbao (Mathematics Bulletin) and Zhongxuesheng Shuxue (Mathematics for Secondary School Students).

East China Normal University

East China Normal University (ECNU) takes the main responsibility of organizing ICME-14.

Aiming to cultivate thousands of qualified teachers for the new-born republic, ECNU was founded in Shanghai in October 1951 through a merger of several then well-known private or Christian universities such as Great China University, Kwanghua University, and St. John's University. After 70 years of development, particularly after the recent 43 years of rapid development benefited from the China’s reform and opening-up policies, ECNU now is a comprehensive research university. ECNU boasts two State Key Labs, one National Engineering Research Center, one National Field Observation and Research Station, as well as a great number of key labs and research bases approved by the Ministry of Education or Shanghai Municipality, including the Key Lab of Mathematics and Application and the Research Base of School Mathematics, both approved by the Shanghai Municipality. Currently, the university employs 4,422 staffs, academic and non-academic, and enrolls 35,471 students, among them 18,573 being

graduate students. Keeping in mind its original goal, ECNU still pays great attention to teacher education and education research, and it is commonly regarded as one of the leading powers of teacher education in China.

Having two campuses located in Minhang and Putuo Districts with a total area of over 207 hectares, ECNU has long been reputed as a Garden University for its beautiful campus scenes.

Shanghai Mathematical Society

Established in 1950, the Shanghai Mathematical Society (SMS) is a local academic organization of mathematicians and mathematical educators in Shanghai. The Society provides a platform for academic exchanges for mathematicians and mathematical educators in Shanghai, allowing them to enhance the level of mathematical research and education in Shanghai, as well as to vitalize the economy of Shanghai and to promote the quality of Shanghai citizens.

SMS enjoys good reputation nationally and internationally. It makes great contributions in the fields of pure mathematics, applied mathematics, applications of mathematics, and mathematics education. Chaohao Gu, an academician of Chinese Academy of Science and a former president of SMS was awarded the State Supreme Science and Technology Award in 2009, and the Minor Planet Center of the International Astronomical Union named the Minor Planet 171448 after his name. The Society publishes research journals such as Chinese Annals of Mathematics.

Focusing on mathematical education is an important task of the SMS. For example, it deeply involves in the school mathematics curriculum reform. The society also holds a spare-time school of mathematics, and organizes mathematics competitions for school and college students. All these have made very positive influence on the society.

With regard to international academic exchanges, the society not only encourages its members to be more active in relevant activities, but also organizes important academic events. For example, in recent years, the “Chinese-French Symposium on Applied Mathematics”, the “International Conference on Dynamical Systems and Differential Equations”, the “International Conference on Representation Theory”, and the “Sino-US Symposium on Mathematics” have been held in Shanghai with the direct support of the Shanghai Mathematical Society. What’s more, to organize ICME-14 together with East China Normal University is another important international academic event for SMS and it will make all efforts for it.

Committees

International Program Committee

Chair:

Jianpan WANG (ICME-14 Congress Chair, China)

Members:

Jill ADLER (ex-officio member, ICMI Ex-president, South Africa)

Abraham ARCAVI (ex-officio member, ICMI Ex-secretary General, Israel)

Jiansheng BAO (ICME-14 LOC Co-chair, China)

Daniel CHAZAN (USA)

Faïza CHELLOUGUI (Tunisia)

Marta CIVIL (USA)

Alicia DICKENSTEIN (Former Vice-President of IMU, Argentina)

Jean-Luc DORIER (ex-officio member, ICMI Secretary General, Switzeland)

Yufeng GUO (China)

Anjum HALAI (Pakistan)

Gabriele KAISER (ICME-13 IPC Chair, Germany)

Caroline LAJOIE (Canada)

Frederick K. S. LEUNG (ex-officio member, ICMI President, Hong Kong SAR, China)

Celi Espasandin LOPES (Brazil)

Thomas LOWRIE (Australia)

Maria Alessandra MARIOTTI (Italy)

Takeshi MIYAKAWA (Japan)

Frode RØNNING (Norway)

Ewa SWOBODA (Poland)

Luc TROUCHE (France)

Catherine VISTRO-YU (Philippines)

Binyan XU (ICME-14 LOC Co-chair, China)

Ivan YASHCHENKO (Russia)

Local Organizing Committee

Co-Chairs:

Binyan XU (East China Normal Universty)

Jiansheng BAO (East China Normal University)

Secretary General:

Yingkang WU (East China Normal University)

Members:

Yiming CAO (Beijing Normal University)

Jun CHAI (East China Normal University)

Yifei CHEN (Chinese Mathematical Society)

Yuelan CHEN (East China Normal University)

Jing CHENG (East China Normal University)

Lianghuo FAN (East China Normal University)

Zhigang FENG (Shanghai High School)

Fuzhou GONG (Chinese Mathematical Society)

Yijie HE (East China Normal University)

Hua HUANG (Teaching Research Department, Shanghai Municipal Education Commission)

Qiping KONG (East China Normal University)

Honghong LI (East China Normal University)

Di LIU (East China Normal University)

Xiaoli LU (East China Normal University)

Ming NI (East China Normal University Press)

Naiqing SONG (Southwest University)

Shengli TAN (East China Normal University)

Jialu WANG (East China Normal University)

Xiaoqin WANG (East China Normal University)

Bin XIONG (East China Normal University)

Yijun YAO (Shanghai Mathematical Society)

Jianyue ZHANG (People's Education Press)

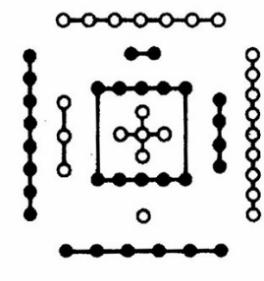
Jinyu ZHANG (Minhang Institute of Education, Shanghai)

Yan ZHU (East China Normal University)

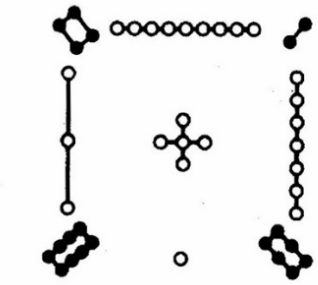
Jiachen ZOU (East China Normal University)

The Logo

The basic idea of the logo comes from *Hetu* (The River Map) in ancient China. *Hetu*, together with *Luoshu* (The Luo Writing), is commonly regarded as the origin of the Chinese civilization. *The Book of Changes* (*I Ching*) indicated that "The Yellow River gave forth the Map, the Luo River produced the Writing, and from them Saint Fuxi got the idea of the trigrams." Many notions in Chinese traditional culture such as *Taiji*, Eight Trigrams, *Fengshui* may all originate from them. *Hetu* and *Luoshu* include mathematical contents such as the classification of numbers by their parity, the arrangements of numbers with equal differences or equal sums, as well as magic squares. They are essentially the plain understandings of mathematics by people at that time. *Hetu* is also drawn as a round-styled picture, as shown on the left part of the ancient pot in the right picture.



Hetu



Luoshu

Ancient pot with *Hetu* and *Luoshu*

The original design of the logo is shown in the upper-right corner of this page. The logo has been used for years.

The round-styled Hetu is used as the mould for the logo. In the logo, the chordal graph in the center replaces the five points in the center of the Hetu. The circle outside the chordal graph stands for the circle with ten dots in the Hetu. The two helix-shaped cantilevers in blue and red respectively circumscribed to the circle represent the ranges of yin numbers (even numbers, 2, 4, 6, 8) and yang numbers (odd numbers, 1, 3, 7, 9) rotating clockwise starting from the south (up) direction and north (down) direction respectively. Here, we only highlight and draw the yin dots representing number 2 and the yang dots representing number 7 in the south (up) direction.

The chordal graph is a perfect proof of the Gougu Theorem (known as Pythagorean Theorem in the west) proposed by Zhao Shuang, a mathematician during the Three Kingdoms period. It is now the logo of Chinese Mathematical Society. Therefore, it represents both the tradition of Chinese mathematics and mathematics education, and Chinese Mathematical Society, the hosting body of the Congress.

The two cantilevers symbolize that China is opening her arms to embrace participants from all over the world. It also shows China's opening-up attitude.

The product of 2 and 7 is 14, indicating the series number of this Congress.

At the lower right corner of the centerpiece picture under the "ICME-14" four Chinese traditional trigrams (guas) are used to write down number 3744 in octal system, which is 2020 in decimal system, indicating the year in which the Congress ought to be held. In addition, the binary code of "2020" can be read from the four trigrams: (0)11111100100. The octal system and the binary system connect the brilliant civilization of ancient China with modern science and technology.

Mathematical elements are extensively disseminated in the logo: the Gougu Theorem, even and odd numbers, the octal number system and the binary system, and so on. They are not only the achievement of ancient China, but also the content of teaching in modern elementary and secondary schools. The design is very geometric, particularly the centerpiece picture that consists of circles and helixes is centrally symmetric.

The use of helixes also represents the concept of spiral rise in modern teaching theory.

The centerpiece picture assumes the shape of "S", meaning Shanghai, the city where the Congress will be held. Its momentum of moving forward indicates our proactive attitude.

Due to the pandemic of COVID-19, ICME-14 had to be postponed from 2020 to 2021, and was changed from a complete physical conference to a hybrid conference. For this reason, we changed the bottom line of the rightmost trigram from "Break" to "Connect", and indicated in red to emphasize that this was a necessary change. In this way, the four trigrams in the lower right corner of the new logo represent the octal 3745, or the binary (0)11111100101, which thus representing 2021 instead.

Congress Venue

G: Gymnasium
A: Auditorium
T: Tian Jiabing Building
W: Wenshi Building
D: Dinning Hall
H: Hospital
S: Shaw Building
I: International Exchange Service Center

E_1: Main Entrance
E_2: Gymnasium East Entrance
E_3: North Entrance
E_4: North-west Entrance
E_5: South-west Entrance
E_6: South Entrance

*G1: 1st Floor, Gymnasium; G2: 2nd Floor, Gymnasium

DAILY AGENDA

Abbreviations of Various Activities:
PL: Plenary Lectures
PP: Plenary Panels
AW: Lectures of Awardees
ST: Survey Team
IL: Invited Lectures
IS: ICMI Studies
AO: ICMI Affiliate Organizations
NP: National Presentations
TA: Thematic Afternoon
TSG: Topic Study Groups
DG: Discussion Group
WS: Workshop
ECRD: Early Career Researcher Day
CAP: Chinese Art and Culture Performance

For the abbreviations of locations, please refer to Page 7- Congress Venue

ICME-14 Daily Agenda: July 11, 2021

Location	13:30-19:30			19:30-21:30		
G1	Registration/ Helpdesk (13:30-21:30)					
Dinning Hall				Welcome Reception		
G2						
A						
S						
T225						
T219						
T223						
T319						
T323						
T419						
T423						
T519						
T523						
T116						
T218						
T316						
T418						
T120						
T124						
T128						
T132						
T222						
T226						
T230						
T234						
T302						
T305						
T306						
T309						
T313						
T202						
T205						
T206						
T209						
T210						
T213						
T102						
T105						
W201						
W215						
W301						
W315						
W203						
W211						
W303						
W313						
W107						
W101						
W111						

ICME-14 Daily Agenda: July 12, 2021

Location	8:30-12:00	13:30-15:15	15:45-16:30	16:30-18:00	19:30-21:30	22:00-23:00
G1	Registration/ Helpdesk (7:30-23:30)					
G2					Opening Ceremony	PL (Cédric Villani)
A						
S						
T225						
T219						
T223						
T319						
T323						
T419						
T423						
T519						
T523						
T116						
T218						
T316						
T418						
T120						
T124						
T128						
T132						
T222						
T226						
T230						
T234						
T302						
T305						
T306						
T309						
T313						
T202						
T205						
T206						
T209						
T210						
T213						
T102						
T105						
W201	ECRD WS 1	ECRD Plenary Session	ECRD Discussion 1	ECRD Panel Discussion		
W215	ECRD WS 2		ECRD Discussion 2			
W301	ECRD WS 3		ECRD Discussion 3			
W315	ECRD WS 4		ECRD Discussion 4			
W203	ECRD WS 5		ECRD Discussion 5			
W211	ECRD WS 6		ECRD Discussion 6			
W303	ECRD WS 7		ECRD Discussion 7			
W313	ECRD WS 8					
W107	ECRD WS 9					
W101						
W111						

ICME-14 Daily Agenda: July 13, 2021

Location	14:30-16:30	17:00-18:00	19:30-21:00	21:30-23:00
G1	Registration/ Helpdesk (13:00-21:30)			
G2		PL (Lingyuan Gu)		Plenary Panel 1
A				
S				
T225	TSG 17		TSG 18	
T219	TSG 22		TSG 22	
T223	TSG 25		TSG 16	
T319	TSG 55		TSG 28	
T323	TSG 33		TSG 54	
T419	TSG 37		TSG 38	
T423	TSG 27		TSG 12	
T519	TSG 59		TSG 34	
T523	TSG 9		TSG 52	
T116	TSG 31		TSG 2	
T218	TSG 5		TSG 4	
T316	TSG 35		TSG 26	
T418	TSG 23		TSG 30	
T120	TSG 7		TSG 8	
T124	TSG 49		TSG 14	
T128	TSG 57		TSG 58	
T132				
T222	TSG 53			
T226	TSG 28		TSG 23	
T230	TSG 18		TSG 5	
T234			TSG 9	
T302				
T305				
T306				
T309				
T313				
T202				
T205	TSG 45		TSG 60	
T206			TSG 62	
T209	TSG 51			
T210				
T213			TSG 50	
T102				
T105				
W201	TSG 1		TSG 36	
W215	TSG 13		TSG 42	
W301	TSG 29		TSG 6	
W315	TSG 41		TSG 20	
W203	TSG 11		TSG 56	
W211	TSG 3		TSG 44	
W303	TSG 19		TSG 32	
W313	TSG 39		TSG 40	
W107	TSG 15		TSG 10	
W101	TSG 47		TSG 46	
W111	TSG 61		TSG 24	

ICME-14 Daily Agenda: July 14, 2021

Location	14:30-15:30	16:00-18:00	19:30-21:00	21:30-23:00
G1	Registration/ Helpdesk (13:00-21:30)			
G2	AW (Gert Schubring)			
A	AW (Tommy Dreyfus)			
S	AW (Terezinha Nunes)	ICMI Studies		
T225	AW (Trena L. Wilkerson)	NP (Andean Region)	TSG 17	WS 25
T219	AW (Deborah Ball)	NP (France)	TSG 16	WS 24
T223		NP (Hungary)	TSG 25	WS 23
T319		NP (Sweden)	TSG 55	WS 22
T323		AO (ERME)	TSG 33	WS 21
T419		AO (CIEAEM)	TSG 37	WS 1
T423			TSG 27	WS 2
T519		AO (ICTMA)	TSG 59	WS 3
T523		AO (ISDDE)	TSG 9	WS 4
T116		AO (IOWME)	TSG 31	WS 5
T218		AO (MCG)	TSG 4	WS 6
T316		AO (PME)	TSG 35	WS 7
T418			TSG 23	WS 8
T120		AO (AFRICM)	TSG 7	WS 9
T124		AO (CIBEM)	TSG 49	WS 10
T128		AO (MERGA)	TSG 57	WS 11
T132				WS 12
T222			TSG 53	WS 13
T226			TSG 2	WS 14
T230			TSG 5	WS 15
T234			TSG 12	WS 16
T302				WS 17
T305				WS 18
T306				WS 19
T309				WS 20
T313				WS 26
T202				WS 27
T205			TSG 45	DG 1
T206			TSG 21	DG 2
T209			TSG 51	DG 3
T210				
T213			TSG 43	DG 4
T102				
T105				DG 15
W201			TSG 1	DG 8
W215			TSG 13	DG 5
W301			TSG 29	DG 14
W315			TSG 41	DG 7
W203			TSG 11	DG 9
W211			TSG 3	DG 10
W303			TSG 19	DG 11
W313			TSG 39	DG 12
W107			TSG 15	
W101			TSG 47	DG 13
W111			TSG 61	DG 6

ICME-14 Daily Agenda: July 15, 2021			
Location	**14:00-16:30**	**17:00-18:00**	**19:30-22:30**
G1	Registration/ Helpdesk (12:00-19:30)		
G2		PL (Robyn Jorgensen)	CAP
A	TA13 Forum on Standards of School Mathematics Curriculum in China Mainland		
S	TA2 The Making of a 3-D Mathematic Adaptive Learning System		
T225	TA8 Mathematics Experiment: A Transformation of Mathematics Learning in Chinese Primary and Middle Schools		
T219	TA5 From “Telling” to “Showing”: A Zhejiang Mathematics Professional Development Model for Novice Teachers’ Learning from Master Teachers		
T223			
T319	TA10 How is the Nature of ‘Teaching and Learning Mathematics’ Changed During the Pandemic in Shanghai?		
T323	TA12 Mathematical Modeling inside and outside Classrooms		
T419	TA4 12-year Integrated Mathematics Textbook of Bnup: Promoting Well-rounded Student Development		
T423	TA9 The Practice of Teaching Improvement from "Comprehending" to "Exploring"		
T519			
T523	TA7 The Chinese Characteristics of Normal Students Training on Primary School Mathematics		
T116	TA6 Reform and Development of Mathematics Curriculum and Teaching for Ethnic Minorities in China		
T218	TA1 Demonstration and Discussion of a Plane Geometry Lesson: Teaching “Determination and Properties of Parallel Lines” as a Whole		
T316	TA11 Chinese Mathematics Curriculum, Teaching and College Entrance Examination		
T418	TA3 Domesticating Practice of Primary Mathematics Education in China		
T120			
T124			
T128			
T132			
T222			
T226			
T230			
T234			
T302			
T305			
T306			
T309			
T313			
T202			
T205			
T206			
T209			
T210			
T213			
T102			
T105			
W201			
W215			
W301			
W315			
W203			
W211			
W303			
W313			
W107			
W101			
W111			

ICME-14 Daily Agenda: July 16, 2021

Location	15:30-16:30	17:00-18:00	19:30-21:00	21:30-23:00
G1	Registration/ Helpdesk (14:30-21:30)			
G2		PL (Mercy Kazima)	Plenary Panel 2	
A	IL (Yiming Cao)			
S	IL (Xinrong Yang)			
T225	IL (Di Liu)			TSG 18
T219	IL (Takuya Baba)			TSG 22
T223	IL (Nicolas Balacheff)			TSG 16
T319	IL (Kim Beswick)			TSG 28
T323	IL (Jill Brown)			TSG 54
T419	IL (Chew Cheng Meng)			TSG 38
T423	IL (Alison Clark-Wilson)			TSG 12
T519	IL (Pietro Di Martino)			TSG 34
T523	IL (Jaguthsing Dindyal)			TSG 52
T116	IL (Ahmad Fauzan)			TSG 2
T218	IL (Keiko Hino)			TSG 4
T316	IL (Roberta Hunter)			TSG 26
T418	IL (Houssam Kasti)			TSG 30
T120				TSG 8
T124				TSG 14
T128				TSG 58
T132				TSG 31
T222				TSG 53
T226				TSG 25
T230				TSG 27
T234				TSG 35
T302				
T305				
T306				
T309				
T313				
T202				
T205				TSG 60
T206				TSG 62
T209				TSG 48
T210				
T213				TSG 50
T102				
T105				
W201	IL (Tinne Hoff Kjeldsen)			TSG 36
W215	IL (Oleksandr Kryzhanovskiy)			TSG 42
W301	IL (Ngan Hoe Lee)			TSG 6
W315	IL (Shuk-kwan Leung)			TSG 20
W203				TSG 56
W211	IL (Francis Edward Su)			TSG 44
W303	IL (Anna Chronaki)			TSG 32
W313	IL (Rahim Kouki)			TSG 40
W107	IL (Ladislav Kvasz)			TSG 10
W101				TSG 46
W111				TSG 24

ICME-14 Daily Agenda: July 17, 2021

Location	13:00-14:00	14:30-16:30	17:00-18:00	19:30-20:15	20:15-21:00	21:30-23:00
G1	Poster			Registration/ Helpdesk (12:00-21:30)		
G2				Interact. with Plen. Lect. (Lingyuan Gu)	Interact. with Awardees (Gert Schubring)	
A			IL (Lianghuo Fan)	Interact. with Plen. Lect. (Cedric Villani)	Interact. with Awardees (Tommy Dreyfus)	
S			IL (Zhongru Li)	Interact. with Plen. Lect. (Robyn Jorgensen)	Interact. with Awardees (Terezinha Nunes)	
T225		TSG 18	IL (Jun Li)	Interact. with Plen. Lect. (Mercy Kazima)	Interact. with Awardees (Trena L. Wilkerson)	TSG 17
T219		TSG 22	IL (Richard Barwell)		Interact. with Awardees (Deborah Ball)	TSG 38
T223		TSG 16	IL (Robert Q. Berry III)			TSG 25
T319		TSG 28	IL (Patricio Felmer)			TSG 55
T323		TSG 54	IL (Claudia Regina Flores)			TSG 33
T419		TSG 38	IL (Rongjin Huang)			TSG 37
T423		TSG 12	IL (Rachel Lui)			TSG 27
T519		TSG 34	IL (Mirko Maracci)			TSG 59
T523		TSG 52	IL (Salomé Martínez)			TSG 9
T116		TSG 2	IL (Vilma Mesa)			TSG 31
T218		TSG 4	IL (Marguerite Miheso-O'Connor)			TSG 5
T316		TSG 26	IL (Reidar Mosvold)			TSG 35
T418		TSG 30	IL (Nguyen Chi Thanh)			TSG 23
T120		TSG 8				TSG 7
T124		TSG 14				TSG 49
T128		TSG 58				TSG 57
T132		TSG 59				
T222		TSG 49				TSG 53
T226		TSG 33				
T230		TSG 37				
T234		TSG 17				
T302						
T305						
T306						
T309						
T313						
T202						
T205		TSG 60				TSG 45
T206		TSG 62				TSG 21
T209		TSG 48				TSG 51
T210						
T213		TSG 50				TSG 43
T102						
T105						
W201		TSG 36	IL (Núria Planas)			TSG 1
W215		TSG 42	IL (Jerome Proulx)			TSG 13
W301		TSG 6	IL (Ana Isabel Sacristán)			TSG 29
W315		TSG 20	IL (Marilyn Strutchens)			TSG 41
W203		TSG 56	IL (Mónica E. Villarreal)			TSG 11
W211		TSG 44	IL (Michal Yerushalmy)			TSG 3
W303		TSG 32	IL (Maisie Gholson)			TSG 19
W313		TSG 40	IL (Fernand Malonga Moungabio)			TSG 39
W107		TSG 10				TSG 15
W101		TSG 46				TSG 47
W111		TSG 24				TSG 61

ICME-14 Daily Agenda: July 18, 2021

Location	13:30-14:30	15:00-16:00	16:30-18:00	19:30-21:00	21:30-22:30
G1	Poster				
G2				Plenary Panel 3	Closing Ceremony
A		IL (Bin Xiong)	Survey Team 1		
S		IL (Chunlian Jiang)	Survey Team 2		
T225		IL (Dor Abrahamson)	Survey Team 3		
T219		IL (Po-Hung Liu)	Survey Team 4		
T223		IL (Megan Franke)			
T319		IL (Judit Moschkovich)			
T323		IL (Susanne Prediger)			
T419		IL (Veronica Sarungi)			
T423		IL (Björn Schwarz)			
T519		IL (Baruch B. Schwarz)			
T523		IL (Aimé Dafon Segla)			
T116		IL (Ahmed Semri)			
T218		IL (Hyunyong Shin)			
T316		IL (Moustapha Sokhna)			
T418		IL (Sophie Soury-Lavergne)			
T120					
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T209					
T210					
T213					
T102					
T105					
W201		IL (Konstantinos Tatsis)			
W215		IL (Hamsa Venkat)			
W301		IL (Debbie Marie B. Verzosa)			
W315					
W203		IL (Zulkardi Zulkardi)			
W211		IL (Alphonse Uworwabayeho)			
W303					
W313					
W107					
W101					
W111					

OPENING & CLOSING CEREMONIES

ICME-14 OPENING CEREMONY

Location: G2

July 12, 19:30 – 21:30

Presider: Jianpan Wang (ICME-14 Congress Chair, East China Normal University)

AGENDA

Warm-up video

1 Greeting addresses by National/Local Government Officials

2 Greeting address by the President of International Mathematical Union: Carlos Kenig

3 Greeting address by the President of International Commission on Mathematical Instruction: Frederick Leung

4 Greeting address by the President of East China Normal University: Xuhong Qian

5 Greeting address by the President of Chinese Mathematical Society: Gang Tian

6 Welcoming the flag of ICME-14 and declaring the opening of the Congress

Music: Erhu and Piano (Horse Racing)

7 Award ceremony for 2017 Awardees, chaired by Jill Adler, Ex-president of ICMI
Felix Klein Awardee: Deborah Ball; Hans Freudenthal Awardee: Terezinha Nunes
Chair of Awards Committee: Anna Sfard

8 Award ceremony for 2019 Awardees, chaired by Frederick Leung, President of ICMI
Felix Klein Awardee: Tommy Dreyfus; Hans Freudenthal Awardee: Gert Schubring
Chair of Awards Committee: Anna Sfard
Emma Castelnuovo Awardee: NCTM (represented by Trena Wilkerson)
Chair of Award Committee: Konrad Krainer

9 Introduction of ICME-14 by LOC Co-chair: Binyan Xu

Music: Flute and Band (Running a Dry Boat)

10 Announcement of the end of Opening Ceremony

ICME-14 CLOSING CEREMONY

Location: G2

July 18, 21:30 – 22:30

Presider: Yingkang Wu (Secretary General of LOC)

AGENDA

1 Summary of ICME-14 by the Co-chair of LOC: Jiansheng Bao

2 Report by the Secretary General of ICMI: Jean-Luc Dorier

3 Presentation of ICME-15

4 Closing remarks by the Congress Chair: Jianpan Wang

SCIENTIFIC ACTIVITIES

PL

The plenary activities are those components of the scientific programme that address all Congress participants at the same time. For ICME-14 there will be two types of plenary activities, including 4 plenary lectures and 3 plenary panel discussions.

PL1: Mathematics in the Society

July 12, 22:00–23:00 **Location: G2**

Cédric Villani (Institut Henri Poincaré, France)

Mathematics is an art as old as civilization. Most of the time hidden and respected, sometimes appearing in bright light, mathematicians have always had a privileged role in society, as problem solvers, guardians of an art, deeply attached to values of intellectual freedom and opinion challenge. "The essence of mathematics lies in its freedom », said Georg Cantor. But mathematicians are also accountable to society, which is in need of keeping a link to its most singular and respected science, especially at a time of algorithmic transformation. I was lucky enough to experience the role of mathematician as a public spokesperson, advocating for mathematical sciences as both an art and a technology creator. Later, as a member of Parliament, then head of the Scientific Parliamentary Office, I experienced the intensity and complexity of science in politics, at a time when public action needs to rest on science and when human factors are more challenging than ever.

PL2: 45 Years: An Experiment on Mathematics Teaching Reform

July 13, 17:00–18:00 **Location: G2**

Lingyuan Gu (East China Normal University; Shanghai Academy of Educational Sciences, China)

This is an experimental report on a mathematics teaching reform conducted in an urban-rural fringe area in the west of Shanghai. From 1977 to 2022, this 45-year experiment witnessed a significant change of Chinese society going from Reform and Opening up to educational modernization. This experiment consists of three stages. First, from1977 to 1992, starting low, it improved the quality of education generally and dramatically. Going through several different phases, namely, investigation of current situation, screening experiences, conducting experiment systematically, and popularization and application, we found a feasible way to improve the quality of the education under the most common educational conditions, and came up with four teaching principles including affection, progression, attempt and feedback. Second, from 1992 to 2007, we prioritized comprehension so as to break through the bottleneck of high cognition. On the one hand, we derived, via factor analysis based on the data from our first large-scale test, two main latent factors of memorizing and understanding, in which the factor of understanding scored much lower and became the bottleneck; on the other hand, we explored and optimized traditional experiences, and figured out an approach of *experiencing variation*, which has gained international reputation as “Chinese experience”. Meanwhile, results of the second large-scale test indicated that students scoring higher in comprehension remained almost at the same level in inquiry. Third, from 2007 to 2022, we perfected teaching research to promote inquiry and creativity. Taking the advantage of “action education”, we carried out school-based teaching research activities to update teachers’ education concepts and improve their teaching practices. Results of the third large-scale test indicated that students had made satisfactory progress in inquiry. An analysis made among different groups of students showed that the key measures to enhance students’ creativity comprise two aspects primarily: using mathematical tasks with high cognitive demand and emphasizing various thinking activities including connecting, deliberate processing and reflecting.

PL

PL3: Equity in Mathematics: What Does It mean? What Might It Look like?

July 15, 17:00–18:00 **Location: G2**

Robyn Jorgensen (University of Canberra, Australia)

For more than 50 years, mathematics education researchers have recognised that there is a considerable separation of learners in mathematics based on the backgrounds rather than some purported innate quality. Over this period, many different theories, projects, interventions and ideologies have permeated the discourses and practices of how to redress these observations. The ramifications of lack of success in mathematics can be profound in school, as well as in later life for the individual and the society. But 50 years on, as a field we still struggle with what is equity and how can it be addressed. In this presentation, I initially reflect on the field of equity in mathematics and the various trends across the field and across time. I use the metaphor of a jigsaw. I then draw on the outcomes of a very large project that sought to better understand what works in some of the most marginalised contexts. The findings of this project have brought to the fore the need for a multi-faceted approach to thinking about and doing equity in mathematics education.

PL4: Mathematical Work of Teaching in Multilingual Context

July 16, 17:00–18:00 **Location: G2**

Mercy Kazima (University of Malawi, Malawi)

In this presentation, I discuss the mathematical work of teaching in multilingual classrooms using Malawi context as an illustrative example. I make two assumptions. The first is that it is well established that teaching mathematics in multilingual classrooms, where the language of teaching and learning is not the students' home language, presents challenges. The second assumption is that it is also well established that there are various knowledge demands on teaching mathematics, and that teachers face some tasks that constitute mathematical work of teaching. I explore the two and conceptualise the mathematical work of teaching in multilingual contexts following three guiding questions: (i) what lessons can we draw from research on teaching and learning mathematics in multilingual contexts? (ii) What lessons can we draw from research on mathematical work of teaching and mathematical knowledge for teaching? (iii) How can these inform conceptualisation of mathematical work of teaching in multilingual context?

Drawing on the lessons from research on teaching mathematics in multilingual contexts in southern Africa, and from my research in Malawi, I highlight professional knowledge for teaching mathematics in multilingual contexts like Malawi. I then use the professional knowledge to conceptualise the knowledge demands on teaching and then the mathematical work of teaching. My conceptualisation yields four types of mathematical work of teaching, namely, identifying resources in home language, identifying obstacles in home language, identifying obstacles in English and identifying strategies. I illustrate each of these types using examples from Malawi context. I conclude with remarks highlighting the importance of discussing these including implications for teacher education.

Interaction with Plenary Lecturers

July 17, 19:30–20:15

Interact. with Cedric Villani	**Location: A**
Interact. with Lingyuan Gu	**Location: G2**
Interact. with Robyn Jorgensen	**Location: S**
Interact. with Mercy Kazima	**Location: T225**

PP1: Actors for Math Teacher Education: Joint Actions versus Conflicts

July 13, 21:30–23:00
Chair: Angel Ruiz (Costa Rica)

Location: G2
Team members: Frédéric Gourdeau (Canada), Despina Potari (Greece), Chunxia Qi (China), Mikhail Sluch (Russia)

21:30 Opening Speech

Angel Ruiz (University of Costa Rica, Costa Rica; Inter-American Committee of Mathematics Education)

Description: In this presentation we indicate which are the actors in the preparation of mathematics teachers that are privileged in this panel. The emphasis that was chosen around the dichotomy: Conflict or Collaboration, it is indicated. Thereafter: We define the fundamental aim of the panel. And finally, the speakers participating in this panel will be mentioned.

21:35 Panelist 1: Collaboration and Conflicts between Mathematicians and Mathematics Educators: A Case Study in China

Chunxia Qi (Beijing Normal University, China)

Description: This speech includes three major parts. First is an introduction of a related research on collaboration between mathematicians and mathematics educators in pre-service teacher education. Secondly, the contributions of mathematicians on in-service teacher education in China will be elaborated. Finally, this speech will present a case study regarding co-instructing a graduate course by a mathematician and a mathematics educator in Beijing Normal University.

21:45 Panelist 2: The Process and the Outcomes of Collaboration among Different Actors in Different Contexts

Despina Potari (National and Kapodistrian University of Athens, Greece)

Description: I will address issues related to the process and the outcomes of collaboration of different actors concerning prospective and practicing mathematics teachers. I will focus on the collaboration in the setting of field experiences and in designing and enacting mathematics courses in initial education. I will also bring examples where mathematicians, mathematics education researchers and teachers collaborate in developing curriculum resources.

21:55 Panelist 3: Collaboration between Professional Communities

Frédéric Gourdeau (Université Laval, Canada)

Description: Mathematicians and mathematics educators belong to different professional communities, with some differing cultural norms. This creates obstacles and opportunities for collaborative work. Drawing from Canadian and international experience, I will focus on conditions that enable the development of collaborations, including the emergence and the importance of brokers in sustaining collaboration between the two communities.

22:05 Speech 4: The System for Identification and Support of Gifted School-children in the Framework of Mathematics Education in Russia

Mikhail Sluch (Educational Center “Sirius” for Gifted High School Students, Russia)

Description: I am going to talk about the collaboration between mathematicians and math educators and teachers in the context of Russian mathematical schools and the system of revealing young talents and working with them, and also to talk about mathematical scientists and their role in Russian mathematical education.

22:15 Reactions by Selected Scholars

Barbara Jaworski (United Kingdom), Hyman Bass (United States) and Yuriko Baldin (Brazil) will react to the First-round presentations of the panel.

22:30–22:42 The Second Round

The purpose of the second participation of the panelists is to expand or complement the issues presented in the First-Round of interventions and respond to the contributions of the invited scholars.

22:30 **Panelist 5**
Despina Potari (National and Kapodistrian University of Athens, Greece)

22:34 **Panelist 6**
Frédéric Gourdeau (Université Laval, Canada)

22:38 **Panelist 7**
Mikhail Sluch (Educational Center “Sirius” for Gifted High School Students, Russia)

22:42 **Panelist 8**
Chunxia Qi (Beijing Normal University, China)

22:46 **Discussion**

22:55 **Closure**
Angel Ruiz (University of Costa Rica, Costa Rica; Inter-American Committee of Mathematics Education)

PP2: Mathematics Education Reform Post 2020: Conversations towards Building Back Better

July 16, 19:30–21:00

Location: G2

Chair: Mellony Graven (South Africa)

Team members: Marcelo Borba (Brazil), Eva Jablonka (Germany), Danny Martin (USA), Ravi Subramaniam (India)

PP

21:30 Welcome and Introduction to Panel, Panelists and Respondents

Panel Chair: Professor Mellony Graven (South African Numeracy Chair, Faculty of Education, Rhodes University, Makhanda, South Africa)

21:40 Panelist 1: What is the Role of Media and Things in Mathematics Education Post-2020?

Professor Marcelo Borba (Graduate Program in Mathematics Education, Mathematics Department, São Paulo State University (UNESP), Rio Claro, Brazil)

21:50 Panelist 2: How can Mathematics be Used in Communicating and Urgent Need for Action?

Professor Eva Jablonka (Department of Education and Psychology, Freie Universität Berlin, Germany)

22:00 Panelist 3: Is the Future of Mathematics Education Black?

Professor Danny Bernard Martin (College of Education; Department of Mathematics, Statistics, and Computer Science, University of Illinois at Chicago, USA)

22:10 Panelist 4: Can Mathematics Education Help Reduce Inequality?

Professor K. Subramaniam (Ravi) (The Homi Bhabha Centre for Science Education, Tata Institute of Fundamental Research, Mumbai, India)

22:20 Respondent 1: Lessons Learned from ICMI Study 24: Challenges, Changes and Opportunities

Professor Yoshinori Shimizu (The University of Tsukuba, Japan)

22:26 Respondent 2: Reflections from ICMI Study 24: School Mathematics Curriculum Reforms around the World

Professor Renuka Vithal (The University of Fort Hare, South Africa)

22:32 Real Time Questions Posed to the Four Panelists

Panel Chair **Prof Mellony Graven**

22:35 Real Time Responses by Panelists

Professors Marcelo Borba, Eva Jablonka, Danny Martin and **K. Subramnaim**

22:55 Thanks and Closing Comments

Panel Chair **Prof Mellony Graven**

PP3: Pandemic Times: Challenges, Responsibilities and Roles for Mathematics and Mathematics Education Communities

July 18, 19:30–21:00 **Location: G2**

Co-chairs: Michèle Artigue (France) and Ingrid Daubechies (USA)

Team members: Timothy Gowers (UK), Jean Lubuma (South Afirica), Nelly León (Venezuela) and David Wagner (Canada)

PP

19:30 Introduction: Presentation of the Panel and of the Four Panelists

Michèle Artigue (Université de Paris, France, Ingrid Daubechies, Duke University, USA)
Description: In this presentation we indicate which are the actors in the preparation of mathematics teachers that are privileged in this panel. The emphasis that was chosen around the dichotomy: Conflict or Collaboration, it is indicated. Thereafter: We define the fundamental aim of the panel. And finally, the speakers participating in this panel will be mentioned.

19:40 Questions to the Four Panelists and Answers

Questions to Jean M-S Lubuma (University of Pretoria, South Africa)
Part of your mathematical research has been focused on questions related to epidemiology. How would you describe the role of mathematicians in this field? Does the current pandemic present particular challenges? If so, how are your colleagues and yourself dealing with them? Which of these do you find most difficult?
Questions to Nelly León (Universidad Pedagógica Experimental Libertador, Venezuela)
The pandemic has forced most teachers to make a very sudden transition to remote teaching; at present, mathematics teaching is still done remotely, or at best in some hybrid mode in many countries.
What are the principal challenges this situation has brought in your country, and more generally your region? How have these challenges been met? Which lessons for the future would you distill from this experience?
Questions to David Wagner (University of New Brunswick, Canada)
You are a researcher in mathematical education. How would you describe the role and the responsibilities of the mathematical education research community in the context of the current pandemic?
You are co-editor of a special issue of the journal Educational Studies in Mathematics centered on the pandemic and its challenges. What are the main messages you have taken away from this experience?
Questions to Timothy Gowers (University of Cambridge, UK)
The pandemic has put mathematics in the spotlight, and the media have solicited mathematicians, even those not experts in epidemiology. You have long been committed to communicating mathematical concepts to a wide audience.
Can you comment on challenges that are specific to the pandemic context?
What can we learn from initiatives realized by the mathematical community?
Question to all panelists
What do you think of the interaction, in this particular context, between the different mathematical communities – researchers in mathematics, in mathematics education, teachers, teacher educators? Has the pandemic led to interesting contacts or synergies?

20:30 Interaction Session

Panelists are invited to react to the contributions of the other panelists and raise some additional questions, then the discussion is opened to the panel audience.

20:55 Final Words by the Chairs of the Panel

The Executive Committee of the International Commission on Mathematical Instruction (ICMI) has created three awards in mathematics education research. At the opening ceremony of ICME-14, the medals and certificates of these ICMI awards given during 2016-2020 will be presented. In addition, the awardees are invited to present special lectures at the Congress.

July 14, 14:30–15:30

The Felix Klein Award

Understanding the Power of Teaching and Its Role (in)Justice

Location: T219

Deborah Loewenberg Ball (University of Michigan, USA)

This lecture focuses on teaching. Teaching is the central practice of education. It has tremendous power in students' learning, sometimes for good but also often for harm. Yet understanding of the work involved remains elusive. Because of this, societal and systemic racial injustice is troublingly reinforced through normative patterns of teaching practice. Over 40 years, I have taught, studied teaching, taught teaching, and learned about teaching from others. In this lecture, I examine key tensions in developing a robust understanding of teaching's power, manifest in its practice, in and across moments, in classrooms and beyond. I explore how research and practice might better contribute to a nuanced and explicit articulation of the "work of teaching," one situated in the contingent, contextual, and discretionary nature of practice, and yet sensitively precise and theoretically useful.

Construction of Knowledge in Classrooms

Location: A

Tommy Dreyfus (Tel Aviv University, Israel)

Students' construction of mathematical knowledge has usually been investigated in small groups of two to three students. However, students typically learn in much larger classroom communities. In this talk, I will report on attempts to combine two theoretical frameworks, Abstraction in Context and Documenting Collective Activity, in order to research the emergence of mathematical ideas and practices in inquiry-based mathematics classrooms. Abstraction in Context has successfully been used for investigating processes of construction of mathematical knowledge by small groups and individual students. Documenting Collective Activity has successfully been used for investigating how knowledge becomes normative in classroom communities. Networking the two frameworks empirically and theoretically facilitates investigations of how mathematical ideas and practices emerge, possibly in small groups, and later begin to function as if shared in the classroom community.

The Hans Freudenthal Award

From Thinking in Action to Mathematical Models. A View from Developmental Psychology

Location: S

Terezinha Nunes (University of Oxford, Great Britain)

Developmental psychologists agree that intelligent action precedes language in children's development and that language transforms children's thinking. In this lecture I will explore the ways in which children's thinking in action is transformed by learning to use conventional mathematical signs to represent quantities and relations between quantities. Numbers have two types of meaning: a referential meaning, which connects numbers to quantities, and an analytical meaning, which is intrinsic to the conventional systems of signs. This dual nature of numbers means that, from the psychological perspective, numbers are models of the world. The referential meaning of numbers is based on children's use of schemas of action to establish relations between quantities; it is at the core of quantitative reasoning. The analytical meaning rests of the rules that define relations between numbers in a conventional system and provides the basis for arithmetic. In this talk I will present research that illustrates how teaching can build a bridge between thinking in action and mathematical models by promoting the coordination of quantitative reasoning with number knowledge.

AW

The Research Programme for History of Mathematics Teaching and Learning

Location: G2

Gert Schubring (Universidade Federal do Rio de Janeiro, Brazil)

In a first part, I will tell how I became involved in this research are, what instigated and what influenced me and what led me to elaborate a specific research programme. The role of the then recently founded IDM (*Institut für Didaktik der Mathematik* of the Bielefeld University) with its broadly conceived approaches as well as the interdisciplinary research spirit of this quite new university were decisive.
As a second part, I will discuss the methodological challenges I had to face for overcoming traditional modes of rather superficial descriptions of administrative decisions and decrees for curricula, and reporting of sequences of textbooks adopted for teaching, and instead aiming at approaching more to analyse historical reality of mathematics teaching and learning. This afforded, on the one hand, to abandon to be kept within the educational system of one's own country, being no more bound to accept all characteristic of this country as evident and natural, and to be able to rather questioning all the matters of course of this system and to thus detect them as historical variables. And it afforded, on the other hand, to work in an interdisciplinary manner, assessing and adapting methods and resources form neighbouring disciplines, not only from mathematics and education, but in particular from history as a science, especially from social history, from sociology and epistemology.
In a third part, I will present examples of revealing research, realised with this methodology and broadening to cooperative international approaches. Various projects as well as international conferences will be reported.
In the closing session, I will present ongoing research on the impact of global constellations of coloniality versus decoloniality upon the conceptions and realities of mathematics teaching and learning at a local level.
And giving an outlook to future perspectives.

The Emma Castelnuovo Award

Advocating for High Quality Mathematical Access for Each and Every Child: Our Collective Work, Our Passion, and Our Future.

Location: T225

Trena L. Wilkerson (National Council of Teachers of Mathematics, President)

It is an imperative that we advocate for the highest quality mathematics for each and every student. All students must have access to mathematical learning experiences that will prepare them for success not only in the classroom but that prepares them to lead our world in the future. The National Council of Teachers of Mathematics (NCTM) is honored to receive the International Commission on Mathematical Instruction (ICMI) Emma Castelnuovo Award for Excellence in the Practice of Mathematics Education. Her pioneering work aimed at a way of teaching that actively engaged students marked a key point in history for teaching and learning mathematics that fostered a discovery learning environment for all students from elementary through university. NCTM is honored to continue to build on this legacy so that each and every student has an engaging, high-quality experience in learning mathematics.

NCTM's Catalyzing Change (2018, 2020 a, b) offers four key recommendations that serve as a catalyst for change to launch each and every student on a successful life-long journey with mathematics (p. 9, 2020a): Broaden the Purposes of Learning Mathematics, Create Equitable Structure in Mathematics; Implement Equitable Mathematics instruction; and Develop Deep Mathematical Understanding. In considering the recommendations it is essential that we engage in critical conversations to move to actions that will provide and support powerful mathematical learning spaces to support access and equity for all. Currently there are many marginalized students who are not receiving equitable learning experiences and thus limiting their future opportunities. We have an opportunity to change this by working together in mathematics education. To be effective and impactful we must advocate both individually and collectively across local, national and international levels. This gathering at ICME-14 is a unique opportunity to engage in reflection and collaboration to address advocacy efforts in mathematics education. We must challenge existing inequities in structures and practices related to teaching and learning mathematics. Together we can do this.

What does it mean to advocate for high-quality teaching and learning and support teachers, teacher educators, and researchers in this effort? What does it mean to advocate for students to support their development of a positive mathematics identity? How can we frame advocacy in mathematics education? How can we build collaborative partnerships in advocacy? What are potential structures, tools and resources to support students and teachers in advocating for themselves in their own mathematics education? In this session we will share background on current issues and challenges of access, examples of work being done in varied contexts to support access, and effective ways of advocating, collaborating, and supporting each other in mathematics education.

Interaction with Awardees

July 17, 20:15–21:00

Interact. with Deborah Ball	**Location: T219**
Interact. with Tommy Dreyfus	**Location: A**
Interact. With Terezinha Nunes	**Location: S**
Interact. with Gert Schubring	**Location: G2**
Interact. with Trena L. Wilkerson	**Location: T225**

Continuing with practice of previous ICMEs, four Survey Teams (ST) have been set up. The organization of these teams is intended to strengthen the emphasis on new developments and progress in the area of each theme or issue since the last three or four ICMEs. Each Survey Team will work all the way till the opening of ICME-14 to survey the state-of-the-art with respect to a certain theme or issue, with particular concern in identifying and characterizing important new knowledge, recent developments, new perspectives, and emergent issues.

The survey teams will have 90 minutes to present their work at ICME-14 in a kind of sub-plenary format and will present their work in parallel.

ST1: Research on University Mathematics Education

July 18, 16:30–18:00 **Location: A**

Chair: Chris Rasmussen (USA)
Team members: Marianna Bosch (Spain), Reinhard Hochmuth (Germany), Oh Nam Kwon (Korea), Birgit Loch (Australia), Mike Thomas (New Zealand), María Trigueros (Mexico)
IPC Liaison: Anjum Halai (Pakistan)

16:30 Opening Speech

Chris Rasmussen (San Diego State University, USA)
Description: In addition to providing an overall orientation to the session, the opening will summarize the survey process and resulting themes on advances and gaps in university mathematics education.

16:35 Speech 1: Instructional Practices: Advances in Research

Oh Nam Kwon (Seoul National University, South Korea)
Description: This portion of the presentation will highlight advances in the research on instructional practices. Research related to this topic regards two categories: active and inquiry-oriented learning, and undergraduate mathematics teaching and classroom practices.

16:45 Speech 2: Professional Development of University Teachers: Advances in Research

Birgit Loch (La Trobe University, Australia)
Description: Much of the research on the professional development of university teachers has closely examined lecturer practice, either in traditional presentations or more student-centred modes, and has sometimes considered the effect on student learning. This portion of the presentation will highlight advances in these domains.

16:55 Speech 3: Service Courses in University Mathematics Education: Advances in Research

Reinhard Hochmuth (University of Hannover, Germany)
Description: This portion of the presentation will highlight advances in the research on maths for non-maths students. Expanding research on the use of mathematics in empirical sciences as well as at the workplace and linking the corresponding findings with systematic research on research-based teaching and learning activities is one of the most promising developments for the future, as is knowledge about obstacles to learning and a wealth of suggestions for optimising teaching and learning.

17:05 Speech 4: Theories and Methods: Gaps in Research

Reinhard Hochmuth (University of Hannover, Germany)
Description: While there have been considerable theoretical and methodological advances, there is a distinct lack of a shared discourse on meta-level learning with the abundance of frameworks not necessarily compatible or even commensurable. Developing a shared and explicit discourse for the informal/meta-level content of collegiate mathematics education is a crucial component in any effort to improve pedagogy at this level.

17:15 Speech 5: Linking Research and Practice: Gaps in Research

María Trigueros (Instituto Tecnológico Autónomo de México, Mexico)
Description: This portion of the presentation will highlight gaps in linking research and practice. In particular three different categories will be highlighted: Classroom practices and the link between research

and practice; adopting research-based instructional strategies; and interrelation between didactical logos and praxis.

17:25 Speech 6: Professional Development of University Teachers: Gaps in Research
Chris Rasmussen (San Diego State University, USA)
Description: While there has been some progress in the research on the professional development of teachers, much more is still needed. One of the several gaps that will be highlighted in this session is the scarcity of organised, developmental research into university teachers' pedagogical knowledge and its development through formalized education.

17:35 Speech 7: Curriculum: Advances and Gaps in Research
Marianna Bosch (IQS, Universitat Ramon Llull, Spain)
Description: Curriculum is an entity present but rarely taken as a unit of analysis in research in undergraduate mathematics education. Curricular questions are obviously at the center of all study and examination regulations of mathematics degree programs. However, their treatment rarely relies on specific research. This portion of the presentation will highlight advances and gaps in the research on curriculum.

17:45 Speech 8: Interdisciplinarity: Gaps in Research
María Trigueros (Instituto Tecnológico Autónomo de México, Mexico)
Description: This portion of the presentation will highlight gaps in the intersection between mathematics and other disciplines. Gaps exist on many different levels and with regard to several perspectives. Discussion of gaps will proceed from the outside to the inside, from the more general to the more specific.

17:55 Concluding Remarks
Oh Nam Kwon (Seoul National University, South Korea)
Description: The conclusion will reflect on the findings of the survey team and point to future directions for the field.

ST2: Early Childhood Mathematics Education (Up to Age 7)

July 18, 16:30–18:00 **Location: S**

Chair: Elia Iliada (Cyprus)
Team members: Anna Baccaglini-Frank (Italy), Nosisi Feza (South Africa), Esther Levenson (Israel), Nanae Matsuo (Japan)
IPC Liaison: Anjum Halai (Pakistan)

16:30 Opening Speech
Panel Chair: Iliada Elia (Department of Education, University of Cyprus, Cyprus)

16:35 Lecture Part 1: Trends and advances in content-oriented themes

Speech 1: Geometry Education
Iliada Elia (Department of Education, University of Cyprus, Cyprus)
Discription: An extensive literature review about geometry education in early childhood between 2012 and 2020 has highlighted some of the major themes in which recent research on this field is concerned, including, spatial skills, shape knowledge and understandings, semiotic and embodied approaches, teaching and interventions in early geometry. This speech will focus on the main findings in each of these themes.

Speech 2: Number Sense and Whole Number Development
Nosisi Feza (Research Unit, University of Venda, South Africa)
Description: This speech is based on a qualitative analysis of published peer reviewed literature on number sense of young children from 2012 to 2020. The review revealed three types of themes: pedagogical approaches, innate numerical abilities, cognitive and non-cognitive influences. Findings and identified research gaps for these themes will be elaborated and discussed.

Speech 3: Children's Competences in Other Content Domains
Nanae Matsuo (Department of mathematics, Faculty of Education, Chiba University, Japan)
Description: This speech draws on a qualitative synthesis of the literature on young children's competences in other content domains beyond the domains of number and geometry for the past 8 years. Findings and implications are emphasized with respect to the following content domains: patterns and structure, measurement, statistical reasoning, functional thinking, spatial ability, and others.

17:05 Lecture Part 2: Trends in the use of technology

Speech 4: The Role of Technology in Mathematics Teaching and Learning

Anna Baccaglini-Frank (Department of Mathematics, University of Pisa, Italy)
Description: Recent literature includes studies on various uses of technology in early years mathematics. Based on a qualitative synthesis of this body of research between 2012 and 2020, this speech will focus on the main findings in five major themes: design features, use of technological tools in mathematics learning, pedagogical issues, mathematics taught/learned through technological tools and affective/social issues involved in learning/teaching with technology.

17:15 Lecture Part 3: Cognitive skills and special education of young children

Speech 5: Cognitive Abilities and Mathematical Performance

Anna Baccaglini-Frank (Department of Mathematics, University of Pisa, Italy)
Description: Based on an extensive literature review in mathematics education and also in the disciplines of developmental and cognitive psychology, this speech identifies the abilities that have been found to be predictive of or associated with mathematical performance, including domain general abilities, domain specific abilities and abilities related to the socio-cultural dimension and language.

Speech 6: Cognitive Abilities for Mathematics Learning: Assessment and Curriculum Design

Iliada Elia (Department of Education, University of Cyprus, Cyprus)
Description: An important strand of research on cognitive skills involved in mathematical learning focuses on the assessment of cognitive abilities for mathematics learning and curriculum design in light of sets of abilities or skills to strengthen. The major findings and relevant future directions based on a review of this body of research are elaborated and discussed in this speech.

Speech 7: Special Education

Nanae Matsuo (Department of Mathematics, Faculty of Education, Chiba University, Japan)
Description: This speech focuses on the reviewed research in special education within early childhood mathematics education, which involves two major directions: a) mathematical capabilities and their development in young children with special needs and b) ways to support and improve mathematics learning of children with special needs. For both directions, findings reveal a greater emphasis on researching low-attaining children than high-achievers.

17:35 Lecture Part 4: Developments and trends in teacher-related issues

Speech 8: Early Childhood Teachers' Knowledge, Education and Affective Issues in Mathematics

Esther Levenson (Department of Mathematics, Science, and Technology Education, Tel Aviv University, Israel)
Description: This speech presents a synthesis of results of recent studies on early childhood teachers' knowledge, education and affective issues in mathematics. In reviewing this body of research, what comes to light is the emphasis on children. The major trends of most studies on these teacher-related issues are also revealed, while specific needs for additional research are identified.

17:45 Concluding Remarks

Iliada Elia (Department of Education, University of Cyprus, Cyprus)

17:50 Interaction Session: Questions and Discussion about the Survey

ST3: Teachers' Collective Work as a Regular School Practice for Teacher Development

July 18, 16:30–18:00 **Location: T225**

Chair: Birgit Pepin (Netherlands)
Team members: Jehad Alshwaikh (Palestine), Hiroyuki Ninomiya (Japan), Gérard Sensevy (France), Yudong Yang (China)
IPC Liaison: Anjum HALAI (Pakistan)

16:30–16:40 Opening and Introduction

Prof. Dr. Birgit Pepin (Eindhoven University of Technology, The Netherlands)

16:40—16:50 Speech 1: Mathematics Teachers' Collective Work as a Regular School Practice for Teacher Development: First Results

Prof. Dr. Birgit Pepin & Dr. Zeger-Jan Kock (Eindhoven University of Technology, The Netherlands)
Description: In this presentation, we present the first results from our international survey of the literature regarding mathematics teachers' collective work in schools. In particular, we tentatively answer the four following research questions based on our extensive literature search:
1. What is the nature of mathematics teachers' collective work as regular school practice, and how does this relate to situation, culture and context?
2. Who is engaged in such school-based collective work, what are the roles of those people involved, and how do they relate to each other in the different communities? In particular, what is the nature of the relationship between teachers and researchers?
3. What kinds of learning can be observed in school-based teacher collective work? How does teacher collective learning happen in teacher collectives at school, what is the evidence for their learning? What do teachers say? How does teacher learning relate to the collective aspect, context and goal of the work? How (and what) do researchers learn in these collectives?
4. Which methodological and theoretical perspectives are used to guide and inform school-based teacher collective work, and teacher learning in such teams?
In addition, we conducted a survey (with questionnaires) in selected countries where we asked mathematics teachers about their collaborative professional development practices at school level. Results will be compared and juxtaposed with those found in the literature.

16:50—16:55 Short Break

Birgit Loch (La Trobe University, Australia)
Description: Much of the research on the professional development of university teachers has closely examined lecturer practice, either in traditional presentations or more student-centred modes, and has sometimes considered the effect on student learning. This portion of the presentation will highlight advances in these domains.

16:55—17:10 Speech 2: Japanese Teachers' Collective Work as a Regular School Practice

Prof. Dr. Hiro Ninomiya (Saitama University, Japan)
Description: Japanese teachers have been doing their voluntary in-service training, not only at the official Lesson Study activities but also within their daily teaching practices. Lesson Study has been one of important activities for Japanese teachers' professional development for more than 100 years, and at the same time, teachers' collective work as a regular school practice has been accumulated. In this presentation, Japanese teachers' collective work as a regular school practice will be reported on and portrayed, based on articles in journals of the Japan Society of Mathematical Education. Even though all papers were written in Japanese, the existence of such cumulative work is likely to provide important information for all of mathematicseducators in the world. It is noteworthy that the Japan Society of Mathematical Education is the biggest mathematics education society in Japan, which has more than 100 years of history.

17:10—17:25 Speech 3: Chinese Lesson Study and Its Features: A Historical Institutionalism Perspective

Prof. Dr. Yudong Yang (Shanghai Academy of Educational Sciences, China)
Description: In this presentation the main features of Chinese Lesson Study will be described andportrayed from a historical institutional perspective and from an insider's perspective. Interms of the history of institutions, Chinese Lesson Study could be explained as 'lessonenhancement' based on activities in the Teaching Research Group, an established school based practice in China. At micro-level, 'lesson enhancement' is a fundamental practice of Chinese Lesson Study. At meso-level, the Teaching Research Group is an institutional condition for Chinese Lesson Study.

17:25—17:50 Discussion

Chair: Prof. Dr. Jehad Alshwaikh (Birzeit University, West Bank, Palestine)

17:50—18:00 Plenary & Closing

Prof. Dr. Birgit Pepin (Eindhoven University of Technology, Netherlands)

ST4: On the Teaching and Learning of Mathematical Modelling and Interdisciplinary Mathematics Educations

July 18, 16:30–18:00 **Location: T219**

Chair: Gloria Stillman (Australia)
Team members: Jussara de Loiola Araújo (Brazil), Angeles Dominguez (Mexico), Toshikazu Ikeda (Japan), Stanislaw Schukajlow (Germany)
IPC Liaison: Gabriele Kaiser (Germany)

16:30 Opening Welcome

Panel Chair: Associate Prof. Gloria Stillman (Faculty of Education and Arts, Australian Catholic University (Ballarat campus), Australia)

16:35 Speech 1: Nature of the Survey

Associate Prof. Gloria Stillman (Faculty of Education and Arts, Australian Catholic University (Ballarat campus), Australia)
Description: Our survey team has reviewed the current state-of-the-art on the teaching and learning of mathematical modelling under specific consideration of interdisciplinary aspects. In particular, the importance of a well understood relation between mathematics and the real world has been in focus. Our methodology and our main findings and the relevance of these in the context of STEM will be highlighted.

16:50 Speech 2: The Importance of a Well Understood Relation between Mathematics and the Real World

Prof. Toshikazu Ikeda (College of Education, Yokohama National University, Japan)
Description: A well understood relation between mathematics and the real world underpins interdisciplinary work in mathematics education. Mathematical modelling produces an outcome, a model, that is the structure connecting the elements useful to describe a real world situation. This is basically interdisciplinary work to produce useful artifacts in the non-mathematical world as well as to foster modelling competencies or construct mathematical knowledge.

17:05 Speech 3: Interdisciplinary Teams in Mathematics Education Research and Practice related to the Real World

Prof. Dr Stanislaw Schukajlow (Department of Mathematics, University of Münster, Germany)
Description: Working in interdisciplinary teams is one of the characteristic features of research in mathematical modelling. Members of the teams can represent very different disciplines (e.g., mathematics, science, pedagogy, psychology or statistics), cultural backgrounds (East or West) or methodological approaches which contribute to the overall success of the joint work.

17:20 Speech 4: Modelling, Interdisciplinary and the Real World in Mathematics Education

Prof. Jussara de Loiola Araújo (Department of Mathematics, Federal University of Minas Gerais, Brazil)
Description: In modelling activities, students search for solutions to real world problems through mathematics. Thus, modelling can establish dialogues between mathematics and the real world and mobilize other disciplines such as physics, biology, economics, etcetera, leading to an interdisciplinary approach. Theoretical relationships among modelling, mathematics, the real world and interdisciplinarity will be discussed and exemplified.

17:35 Speech 5: Mathematical Modelling as a High-leverage Topic Critical for Mathematical Depth in STEM Integration

Associate Prof. Jonas Ärlebäck (Department of Mathematics, Linköping University, Sweden)
Description: The success of productively exploring opportunities and tackling challenges of STEM integration rest on strong, broad and deep mathematical knowledge that can be applied and drawn upon when engaged in mathematical modelling. In this context, we discuss mathematical modelling as the substrate of STEM that facilitates the integration of the disciplines as well as motivates and supports learning within each other discipline.

17:50 Interaction Session: Interaction Topic – Future Directions

The invited lectures will be given by prominent researchers in mathematics education from different parts of the world who are invited by the International Program Committee. The lectures will cover a wide spectrum of topics, themes and issues, and will be presented in parallel. The duration of the session is 60 minutes with 45 minutes of lecture time plus 15 minutes of discussion.

The list below contains the names and countries/regions of persons who have already accepted the invitations. For abstracts, please visit https://www.icme14.org/static/en/news/36.html?v=1622107706405 to download the pdfs.

Slot I

July 16, 15:30–16:30

Openness of Problem Solving in the 21st Century: Mathematical or Social?

Location: T219

Takuya Baba (Hiroshima University, Japan)

The Transition from Mathematical Argumentation to Mathematical Proof, A Learning and Teaching Challenge

Location: T223

Nicolas Balacheff (Univ. Grenoble Alpes, France)

What do Teachers of Mathematics Know? Insights and Issues from Attempts to Measure Mathematics Teachers' Knowledge

Location: T319

Kim Beswick (University of New South Wales, Australia)

Challenging Tasks: Real-world, Digital Technologies, Affordances – Opportunities for Learning

Location: T323

Jill P Brown (Deakin University, Australia)

Chinese Mathematics Curriculum Reform for Compulsory Education in the 21st Century

Location: A

Yiming Cao (Beijing Normal University, China)

Online Cognitive Diagnostic Assessment with Ordered Multiple-choice Items for Year Four Topic of Time

Location: T419

Chew Cheng Meng, Chin Huan (Universiti Sains Malaysia, Malaysia)

Mathematics Dis|Appearance In Cultures, Spaces, Times: Thinking about Life and Reason for the (Non)Citizen at Times of Crisis

Location: W303

Anna Chronaki (Malmö University, Sweden & University of Thessaly, Greece)

(Re)Assessing Mathematics Education in the Digital Age

Location: T423

Alison Clark-Wilson (University College London, UK)

Beyond Procedural Skills: Affordances of Typical Problems for the Teaching of Mathematics

Location: T523

Jaguthsing Dindyal (Nanyang Technological University, Singapore)

The Roles of Learning Trajectory in Teaching Mathematics Using RME Approach

Location: T116

Ahmad Fauzan (Universitas Negeri Padang, Indonesia)

Students' Learning Pathways in Structured Problem Solving as a Context for Productive Discussion in Mathematics Professional Development
Location: T218
Keiko Hino (Utsunomiya University, Japan)

Developing Mathematical Practices within Communities of Mathematical Inquiry
Location: T316
Roberta Hunter (Massey University, New Zealand)

The Ladder and Slide Framework for Visualizing the Integration of Technology by Mathematics Teachers in Their Classes
Location: T418
Houssam S. Kasti (Haigazian University Beirut, Lebanon)

What Can History Do for the Teaching of Mathematical Modelling in Scientific Contexts: Why and How?
Location: W201
Tinne Hoff Kjeldsen (University of Copenhagen, Denmark)

The Relevance of Taking into Account the Semantic, Syntactic, Semiotic, Epistemological and Praxeological Dimensions in Didactic Studies: Case of High School Algebra and the Local Approximations at the Beginning of the University
Location: W313
Rahim Kouki (University Tunis El Manar, Tunisia)

Teaching Maths in Secondary (Middle and High) Schools: Complex Strategy and Its Successful Implementation
Location: W215
Oleksandr Kryzhanovskiy (Academic Gymnasium No.45, Ukraine)

Principles of Genetic Constructivism
Location: W107
Ladislav Kvasz (Charles University, Czech)

A Constructivist Approach Towards Teaching and Learning Mathematics in Singapore: Rationale, Issues, and Challenges
Location: W301
Ngan Hoe Lee (Nanyang Technological University, Singapore)

Math Problem Posing: Students' Learning, Teachers' Professional Growth and Parental Involvement
Location: W315
Shuk-kwan S. Leung (Sun Yat-sen University, Taiwan, China)

Using Virtual Manipulatives and Explicit Instruction to Teach Mathematical Concepts to Students with Autism Spectrum Disorders
Location: T225
Di Liu (East China Normal University, China)

Attitudes in Mathematics Education
Location: T519
Pietro Di Martino (Università di Pisa, Italy)

Mathematics for Human Flourishing
Location: W211
Francis Edward Su (Harvey Mudd College, USA)

Relationship between Teacher Knolwedge and Teacher Noticing: A Cross-lagged Analysis of a Two-Wave Study
Location: S
Xinrong Yang (Southwest University, China)

Slot II

July 17, 17:00–18:00

Why Language Diversity Matters in Mathematics Education

Location: T219

Richard Barwell (University of Ottawa, Canada)

Seeking Social Justice in Mathematics Teaching and Learning

Location: T223

Robert Q. Berry, III, Ph.D. (University of Virginia, USA)

Textbook Transformation as a Form of Textbook Development: Approaches, Issues and Challenges from a Social and Cultural Perspective

Location: A

Lianghuo Fan (East China Normal University, China)

Promoting Active Learning via Problem Solving for Teachers and Students

Location: T319

Patricio Felmer (University of Chile, Chile)

Experimentations in Mathematics Education with Art and Visuality

Location: T323

Cláudia Regina Flores (Federal University of Santa Catarina, Brazil)

Recognizing the Invisibilized Relational Labor of Black Learners in the U.S.: Conceptualizing Racialized and Gendered Work of Mathematics Learning

Location: W303

Maisie Gholson (University of Michigan, USA)

Chinese Lesson Study in Mathematics: A Local Practice or a Global Innovation?

Location: T419

Rongjin Huamg (Middle Tennessee State University, USA)

A Study on the Characteristics of Teacher-student Interaction in Mathematics Classroom of Chinese Senior High Schools in the Information Technology Environment

Location: S

Zhongru Li and Chaoran Gou (Southwest University, China)

Fostering Student Agency in learning Mathematics: Perspectives from Expert Teachers in Shanghai

Location: T225

Jun Li (East China Normal University, China), XingFeng Huang (Shanghai Normal University, China), Hua Huang (Shanghai Municipal Education Commission, China)

Effects of Instructional Videos on Students Learning

Location: T423

Rachel Ka Wai Lui (The University of Hong Kong, Hong Kong SAR, China)

On the Notion of Mathematical Competence

Location: T519

Mirko Maracci (University of Pavia, Italy)

The Power of Mathematical Tasks for Teacher Training

Location: T523

Salomé Martínez (Universidad de Chile, Chile)

Mathematical Instruction and Textbook Use in Post-secondary and Tertiary Contexts: A Discussion of Methods

Location: T116

Vilma Mesa (University of Michigan, USA)

IL

Proposed Pedagogical Content Knowledge Tool for Assessing Teachers' Proficiency in Mathematical Knowledge for Teaching
Location: T218
Marguerite K. Miheso-O'Connor (Kenyatta University, Kenya)

Interdisciplinarity for Mathematics and Science Education: Complexity and Didactical Issues
Location: W313
Fernand Malonga Moungabio (Université Marien NGOUABI, Republic of CONGO)

Trends, Emphases, and Potential Shifts in Research on Discussion in Mathematics Teaching
Location: T316
Reidar Mosvold (University of Stavanger, Norway)

Information Technology in Teaching Mathematics at High Schools in Vietnam
Location: T418
Nguyen Chi Thanh (Vietnam National University, Vietnam)

Further Questions about the Language as Resource Approach to Multilingual Mathematics Learning
Location: W201
Núria Planas (Universitat Autònoma de Barcelona, Spain)

Investigating Mental Mathematics' Solving Processes: The Development of a Research Program
Location: W215
Jérôme Proulx (Université du Québec à Montréal, Canada)

Digital Technologies, Cultures and Mathematics Education
Location: W301
Ana Isabel Sacristán (Cinvestav, Mexico)

Developing Caring and Socio-politically Aware Beginning Teachers of Mathematics
Location: W315
Marilyn E. Strutchens, Brea Ratliff (Auburn University, USA)

Modelling and Digital Technologies: Experiences and Challenges for Teacher Education
Location: W203
Mónica E. Villarreal (Universidad Nacional de Córdoba, Argentina)

Learning Analytics to Support Student in the Context of Mathematical Inquiry
Location: W211
Michal Yerushalmy (University of Haifa, Israel)

Slot III

July 18, 15:00–16:00

Embodied Design: Bringing Forth Mathematical Perceptions

Location: T225

Dor Abrahamson (University of California Berkeley, USA)

Learning from Variability in Students' Mathematics Classroom Participation

Location: T223

Megan Franke (University of California, USA)

Examining Interchangeability of Three Mathematics Tests in the College Entrance Examinations in China

Location: S

Chunlian Jiang (University of Macau, Macao SAR, China)

Are you Really Teaching Mathematics? What Education Can Learn from History

Location: T219

Po-Hung Liu (Chin-Yi University of Technology, Taiwan, China)

Language and learning mathematics: A socio-cultural approach to academic literacy in mathematics

Location: T319

Judit N. Moschkovich (University of California, USA)

Enhancing Language as a Catalyst for Developing Robust Understanding – A Topic-specific Research Approach

Location: T323

Susanne Prediger (TU Dortmund University & IPN Leibniz Institute Kiel, Germany)

Professional Development of Mathematics Teachers: Perspectives and Experience from East Africa

Location: T419

Veronica Sarungi (Aga Khan University, Pakistan)

Influence of University-based Learning Opportunities on the Professional Development of Future Mathematics Teachers

Location: T423

Björn Schwarz (University of Vechta, Germany)

Advances in Argumentation and Mathematics Education

Location: T519

Baruch B. Schwarz (The Hebrew University of Jerusalem, Israel)

The Affecting of the Traditional Numeration System by Western Currency Introduced after Coastal Contact with Africa: A Case Study of Mental Arithmetic Procedures of the Yoruba-Idaasha of Benin Republic (West Africa)

Location: T523

Aimé Dafon Segla (Université d'Abomey-Calavi Benin Republic, Benin)

Learning Transversal Knowledge through Research Situations: Example of Discrete Mathematics Experimentation on the Problem of Packing Equal Circles

Location: T116

Ahmed Semri (Université des Sciences et de la Technologie Houari Boumedienne, Algeria)

Mathematics: Code for Interdisciplinary Dialogues

Location: T218

Hyunyong Shin (Korea National University of Education, Korea)

Culture and Mathematics or Mathematics in the Service of a Universal Civilization

Location: T316

Moustapha Sokhna (Université Cheikh Anta Diopde Dakar, Senegal)

IL

Duos of Artefacts, A Model to Study the Intertwining of Tangible and Digital Tools in Mathematic
Location: T418
Sophie Soury-Lavergne (University Grenoble Alpes, France)

Language in Mathematics Education: Issues and Challenges
Location: W201
Konstantinos Tatsis (University of Ioannina, Greece)

What Matters for Effective Mathematics Educator: Preservice or In-service Training?
Location: W211
Alphonse Uworwabayeho (University of Rwanda, Rwanda)

Capacity Building While Scaling Up: A Model for Rollout of Mental Mathematics Teaching in South Africa
Location: W215
Hamsa Venkat (University of the Witwatersrand, South Africa)

Challenging Deficit Perspectives in Developing Countries: Teachers' Explanations of Fraction Concepts
Location: W301
Debbie Marie B. Verzosa (University of Southern Mindanao, Philippines)

Gifted Students Education in China——Introduction of Chinese Mathematical Competitions
Location: A
Bin Xiong and Yijie He (East China Normal University, China)

IL

Freudenthal Ideas Continues In Indonesia: From ICME 1994 to ICME14 In Shanghai
Location: W203
Zulkardi Zulkardi (Universitas Sriwijaya, Indonesia)

A major ICMI program is the series of ICMI Studies. This set of activities was launched in the mid-1980s and has acquired a growing importance and influence on the field. It contributes to a better understanding and resolution of the challenges that face multidisciplinary and culturally diverse re-search and development in mathematics education. Each Study focuses on a topic or issue of promi-nent current interest in mathematics education. Built around an international conference, it is directed towards the preparation of a published volume intended to promote and assist discussion and action at the international, regional or institutional level. Several ICMI studies, which have already held their study conference, will present their results at ICME-14.

July 14, 16:00–18:00 **Location: S**

Session Chair: Prof Jill Adler (Immediate Past President, ICMI, and ex-officio member of the IPC for each of Studies 24 and 25)

16:00-16:10 **Introduction and welcome**

Prof Frederick Leung, ICMI President (in person)
Prof Jill Adler – immediate past ICMI President (online, in real time)

16:10–16:55 **Recorded and online presentation of ICMI Study 24**

Introduction and overview
Yoshinori Shimizu (University of Tsukuba, Japan)
Renuka Vithal (University of Fort Hare, South Africa)
Presentation of key themes (5 theme leaders listed below)
Marianna Bosch (Universitat Ramon Llull, Spain)
Will Morony (past CEO, AAMT, Australia)
Angel Ruiz (University of Costa Rica, Costa Rica)
Max Stephens (University of Melbourne, Australia)
Ferdinando Arzarello (University of Torino, Italy)
Key messages and lessons learners
Yoshinori Shimizu (University of Tsukuba, Japan)
Renuka Vithal (University of Fort Hare, South Africa)
Q&A
Prof Frederick Leung, ICMI President
Prof Jill Adler – immediate past ICMI President

17:00–17:45 **Recorded and online presentation of ICMI Study 25**

Introduction and overview
Despina Potari (University of Athens, Greece)
Hilda Borko (Stanford University, U.S.A.)
Presentation of key themes (5 of the following theme leaders to be confirmed)
Shelley Dole (The University of Queensland, Australia)
Cristina Esteley (National University of Córdoba, Córdoba, Argentina)
Rongjin Huang (Middle Tennessee State University, U.S.A.)
Ronnie Karsenty (Weizmann Institute of Science, Tel Aviv, Israel)
Takeshi Miyakawa (School of Education, Waseda University, Tokyo, Japan)
João Pedro da Ponte (Instituto de Educação, Universidade de Lisboa, Lisbon, Portugal)
Ornella Robutti (Dipartimento di Matematica, Università di Torino, Torino, Italy)
Luc Trouche (French Institute of Education Ecole normale supérieure de Lyon, France)
Q&A
Prof Frederick Leung, ICMI President
Prof Jill Adler, immediate past ICMI President

ICMI Study 24
School Mathematics Curriculum Reforms: Challenges, Changes, and Opportunities

ICMI Study 24 on School Mathematics Curriculum Reforms was announced at ICME 14 in Hamburg, Germany in 2016. The International Program Committee finalized the Discussion Document in 2017 for the ICMI Study 24 Conference, which took place from 25-30 November 2018 in Japan. The study focuses on school mathematics curriculum reforms that have taken place in the past, are currently taking place and on emerging future changes across diverse nations and regions of the world. The five themes identified in the Discussion Document and around which the Conference Proceedings were organized, are also preserved in the structure of the ICMI Study 24 volume. In brief, the themes respond to a series of questions in respect of school mathematics curriculum reforms: historically; their coherence and relevance; their implementation; globalisation and internationalisation impacts; and the agents and processes of reforms. The study volume includes papers from keynotes and plenary panels, several of which are authored by mathematics educators who have led or participated in macro level school mathematics curriculums nationally or regionally, as well as contributions from reactors and commentators. In this presentation, each of the theme leaders will present major conclusions arising from their respective sections of the volume and the editors will conclude with some of the key messages and lessons from the study for school mathematics curriculum reforms practice and research.

ICMI Study 25
Teachers of Mathematics Working and Learning in Collaborative Groups

The primary aims of ICMI Study 25 are to report the state of the art in mathematics teacher collaboration with respect to theory, research, practice, and policy; and to suggest new directions of research that take into account contextual, cultural, national and political dimensions. The Study Conference and the Study Volume are organized around four themes: 1) Theoretical perspectives on studying mathematics teacher collaboration; 2) Contexts, forms and outcomes of mathematics teacher collaboration; 3) Roles, identities and interactions of various participants in mathematics teacher collaboration; and 4) Tools and resources used/designed for teacher collaboration and resulting from teacher collaboration. The ICMI Study 25 Conference took place from 3-7 February 2020 in Lisbon, Porgugal, after the beginning of the COVID-19 pandemic but before the world was aware of its nature and the rapidity with which it would spread. Because several countries had already begun to implement travel restrictions, we arranged for virtual as well as in-person participation. This experience, although not what we envisioned or would have preferred, presented the opportunity for our group to reflect on and learn from an additional form of collaboration. We share some of those reflections throughout the Study Volume. The Study Volume includes chapters by the plenary speakers and reactors, theme working groups, and commentators. The chapters have been drafted, and we anticipate publication in 2022. In the session, key ideas addressed in the theme chapters of the Study Volume will be discussed.

CIEAEM (Commission for the Study and Improvement of Mathematics Teaching)

July 14, 16:00–18:00 **Location: T419**

Gilles Aldon (University of Lyon, S2HEP, France)
Marcelo Bairral (Universidade Federal Rural do Rio de Janeiro, Brazil)
Lisa Björklund Boistrup (University of Malmö, Sweden)
Michaela Kaslova (University Charles, Praha, Czech Republic)
Andreas Moutsios-Rentzos (National and Kapodistrian University of Athens, Greece)
Cristina Sabena (Università di Torino, Italy)

16:00-16:15 **Presentation of the CIEAEM by commission members**

16:15–16:30 **Questions to be discussed: introduction**

16:30–17:30 **Work in groups (one group in Shangaï, other groups through break out rooms in visio conference)**

17:30–17:50 **Reports and general discussion**

17:50–18:00 **Conclusion by the president of CIEAEM**

Abstract

Since the ICME 13 congress in Hamburg, the commission has organised four conferences, including one online and published at least 8 Newsletters that can be seen on line on the CIEAEM website: https://www.cieaem.org/index.php/en/resources-en/cieaem-newsletter.
During the conferences, discussions have focused on mathematics education and its relation to the world today. The presentation of the CIEAEM will focus both on the issues that have been discussed in these conferences and on the methods put forward to try to obtain answers that are coherent with the world in which we live, while maintaining an epistemological and ethical vigilance on the fundamental humanistic values that have presided over the creation and development of the CIEAEM:

- creating links between scientific knowledge and craft wisdom,
- reinforcing the collaboration of mathematics education research and practice.

During the session, participants will be asked to share their experience and will be involved in discussing live issues related to mathematics education in the 21st century, in a way similar to the working groups during the CIEAEM conferences.
We will draw on the proceedings of previous conferences as well as on the publications resulting from the work of the committee:
Aldon, G., Hitt, F., Bazzini, L., Gellert, U. (Eds.) (2017). *Mathematics and technology*, Springer Gellert, U., Gimenez Rodriguez, J., Hahn, C., Kafoussi, S. (Eds.) (2015). *Educational paths to mathematics*, Springer

AO

HPM (International Study Group on the Relations between the History and Pedagogy of Mathematics)

July 14, 16:00–18:00 **Location: T423**

Snezana Lawrence (chair HPM) (Middlesex University, London)
Prof. Ysette Weiss (chair TSG 27) (Mathematical Institute, Johannes Gutenberg University, Mainz)
Prof. David Guillemette (Department of mathematics, Université du Québec à Montréal)
Prof. Alexander Karp (co-chair TSG 55) (Teachers College, Columbia University, New York)
Desiree van den Bogaart (co-chair TSG 27) (Centre for Applied Research in Education, Amsterdam University of Applied Sciences)

16:00-16:15 **Presentation of history of HPM, its relation to ICMI and some of its most recent activities (Ysette Weiss)**

16:15–16:30 **Some theoretical perspectives of HPM (David Guillemette)**

16:30–16:45 **The history of mathematics education: news from recent years (Alexander Karp)**

16:45–17:00 **History of mathematics in the classroom (Desiree van den Bogaart)**

17:00–18:00 **Interactive session with participants. What do they think is the relevance of HPMs topics and research questions? How does it relate to their own research interests and/or TSG's?**

Abstract

HPM is the International Study Group on the Relations between the History and Pedagogy of Mathematics, affiliated to the International Commission on Mathematical Instruction (ICMI).
By combining the history of mathematics with the teaching and learning of mathematics, HPM is the link between the past and the future of mathematics. The HPM study group aims to investigate different conceptions and views of mathematics. Its members study different eras, mathematicians, regional and national mathematical schools, mathematical textbooks, and many other topics from the rich history of mathematics. They seek to connect the history of mathematics as a discipline, its roles in education, and the roles that it continues to have in developing mathematical instruction and the curricula around the globe.
Among the members of this group we find researchers in mathematics education, mathematicians, historians of mathematics, teachers of mathematics and curriculum developers.
The session will be held in online modus only.

ICTMA (International Study Group for Mathematical Modelling and Applications)

July 14, 16:00–18:00 **Location: T519**
Gabriele Kaiser (Organiser) (University of Hamburg)

16:00-16:15 **Educational studies in mathematics (Stanislaw Schukajlow, Gabriele Kaiser)**

16:15–16:30 **Mathematical thinking and learning (Gloria Stillman, Stanislaw Schukajlow, Gabriele Kaiser)**

16:30–17:00 **Report on mathematical modelling challenges (Jill Brown, Alfred Cheung)**

17:00–17:15 **Report on the planning for ICTMA20 in 2021 and 2022 (Hans Stefan Siller)**

17:15–18:00 **Results of a systematic literature survey on modelling competencies and possible consequences for ictma (Gabriele Kaiser, Mustafa Cevikbas)**

Abstract

The International Study Group for Mathematical Modelling and Applications (ICTMA) has been in existence since 1983. It meets biennially, usually in odd numbered years. The mission of ICTMA is to promote Applications and Modelling in all areas of mathematics – primary and secondary schools, colleges and universities. Members of ICTMA have developed innovative curricular activities aiming to foster applications and modelling at all educational levels and established according research to evaluate the effectiveness of these approaches.
In the planned session, the president of ICTMA, Gabriele Kaiser, will give an overview on the current activities. Special focus will be on the edition of two special issues in Educational Studies in Mathematics and Mathematical Thinking and Learning. Gloria Stillman and Stanislaw Schukajlow will support this presentation. Furthermore, Jill Brown and Alfred Cheung will describe activities from the International Mathematical Modelling Challenges. Hans Stefan Siller, the chair of ICTMA20, will report on the

planning for ICTMA20, which will be postponed from 2021 to 2022 due to the Covid-19-pandemic. The session will close with a talk by Gabriele Kaiser and Mustafa Cevikbas, in which briefly the results of a systematic literature survey on modelling competencies and possible consequences for ICTMA will be discussed. All members of ICTMA and interested scholars are highly welcome.

ISDDE (International Society for Design and Development in Education)

July 14, 16:00–18:00 **Location: T523**

Professor Geoff Wake (University of Nottingham, U.K.)
Lynne McClure (Director) Cambridge Mathematics, U.K.)
Professor Susan McKenney (University of Twente, Netherlands)
Professor Geoff Wake (University of Nottingham, U.K.)
Lynne McClure (Director) Cambridge Mathematics, U.K.)

16:00-16:30 **What is ISDDE? Who are its members and what do they do together? (Professor Geoff Wake, Lynne McClure)**

16:30–17:15 **Presentation: Educational designer (Professor Susan McKenney)**

17:15–18:00 **Plenary (Professor Geoff Wake, Lynne McClure)**

Abstract

ISDDE, the International Society for Design and Development in Education has a strategic goal – to improve the impact on education of the design and development of educational materials in mathematics and related STEM disciplines.
In seeking to advance the development of a coherent, mutually-supportive and self-critical professional design and development community in mathematics education the work of the society's membership spans many issues in terms of research and practice: pedagogy, curriculum, assessment, professional development to name a few. Also fundamental to our aims is our desire to develop the theoretical and conceptual infrastructure of the field.
In this session we hope to give a sense of our interests and work. There will be an opportunity to gain an understanding of some of the breadth of this as we showcase our recent online international conference bringing together educational designers from across the world with a particular focus on designing for equity and diversity.
The session will be entirely online and give an insight into key issues in educational design as well as an opportunity to find out more from members of the Executive Committee. Members attending the session will be Professor Geoff Wake, University of Nottingham, U.K., Lynne McClure, Director Cambridge Mathematics, U.K. and Professor Susan McKenney University of Twente, Netherlands.

IOWME (International Organisation of Women in Mathematics Education)

July 14, 16:00–18:00 **Location: T116**

Jennifer Hall, Monash (University, Melbourne, Australia)
Eva Norén (Stockholm University, Sweden)
Vanessa Neto (Universidade Federal de Mato Grosso do Sul, Campo Grande, Brazil)

No.1 **Welcome and opening of the meeting (Eva Norén)**

No.2 **Lecture (Innovations in 'gender issues' research) (Jennifer Hall)**

No.3 **Quadrennial meeting**
- **Start of meeting**
- **Report from 2016 – 2021**
- **Election of two conveners for 2021 – 2024 (suggested are Jennifer Hall and Vanessa Neto)**

- **Other issues raised by members**
- **Closing of the meeting**

Abstract

The organization is an international network of individuals and groups who share a commitment to achieving equity in education and who are interested in the links between gender and the teaching of learning of mathematics. In our meeting at ICME 14 we will have one presentation and giving a perspective on gender issues in mathematics education. We will also deal with the quadrennial election of convenors.

MCG (International Group for Mathematical Creativity and Giftedness)

July 14, 16:00–18:00 **Location: T218**

Jennifer Hall, Monash (University, Melbourne, Australia)
Eva Norén (Stockholm University, Sweden)
Vanessa Neto (Universidade Federal de Mato Grosso do Sul, Campo Grande, Brazil)

16:00-16:15 **TBA**

16:15–16:30 **TBA**

16:30–17:00 **TBA**

17:00–17:15 **TBA**

17:15–18:00 **TBA**

Abstract

Mathematical Creativity and Giftedness (MCG) is an exciting topic that draws the attention of more and more educators around the world. Many countries have made a substantial effort in supporting research and practice. Yet, more effort is still necessary in order to support the development of creativity and giftedness at different educational levels in and beyond the school settings. And this effort needs to be supported by research data on existing and novel practices in teaching and learning. Several challenges educators face, particularly during a pandemic time, need to be collectively addressed to find new ways of interaction and communication with students, with teachers and with educational researchers.
The International Group for MCG (https://www.igmcg.org/) brings together mathematics educators, mathematicians, researchers, and others who are inspired to nurture and support the development of mathematical creativity and the realization of mathematical promise and mathematical giftedness.
Our group aims to promote and encourage research and to develop educational practices in the field of MCG. Moreover, the group supports dissemination of information concerning the role of teacher knowledge and teacher's education in order to fulfill realization of student's mathematical potential and develop their mathematical creativity. Open to everyone interested in our work, we particularly welcome emergent researchers and practitioners who wish to join our group and to whom we will offer guidance and support in the MCG-related areas. Our overarching goal is to stimulate national and international collaboration among researchers and practitioners to promote the aims and the ideas of the Group.
Bi-annual MCG conferences since the origin of MCG in 1999 in Muenster, Germany, have contributed to the foundation of the Group itself and are vital to stimulate sharing knowledge and to boost international collaborations with people from different backgrounds and from all over the world.
Despite the continuing pandemic, which forces many conferences to be postponed or cancelled, we are cautiously optimistic in announcing the next MCG conference which will be held in Las Vegas, USA:
September 25-28, 2022
Alexis Park All Suite Resort and Conference Center, Las Vegas, NV, USA
Our team is engaged in preparing this conference and we're looking forward to seeing people on-site, not only virtually. Meeting in person with colleagues and friends, making new friends, learning and discussing

together will help us to promote further development of gifted and creative students all over the world. For more information, we invite you to visit our website at www.igmcg.org!
Warm greetings to you all and stay healthy!

PME (International Group for the Psychology of Mathematics Education)

July 14, 16:00–18:00 **Location: T316**
Markku Hannula (PME president) (University of Helsinki)
Einat Heyd-Metzuyanim (vice-president) (Technion, Israel Institute of Technology)
Jydy Anderson (secretary) (University of Sydney)

16:00-16:40 **Video-presentation**

16:40–18:00 **Online discussion (chaired by Hannula)**

Abstract

The International Group for the Psychology of Mathematics Education (PME) is a well-established scientific organization focusing on research in mathematics education. The name of the organization reflects its origins in the psychological study of mathematical thinking and learning, yet currently the scientific perspectives have grown wider and the yearly conferences bring together people using, for example, educational, sociological, or neuropsychological theories and methods.
The session will give an overview of scientific and organizational activities of PME. A yearly conference is our main activity, the 44th conference taking place soon after ICME-14. Due to uncertainties with travel, the PME 44 will be a fully online event. In addition to the yearly regular conferences, PME has supported regional conferences (one in Chile, one in Russia) to make access to PME easier for researchers from underrepresented countries in these regions. In 2022 our yearly conference will be in Alicante, Spain. PME supports underprivileged researchers in various ways: an early bird submission system connects a novice researcher with an experienced mentor to support their conference submission preparation, Skemp Fund provides grants for conference participants, and Early Researcher day and seminars provide targeted programs for beginning researchers. PME has recently been accepted as a Charitable organization under UK law, and we welcome ICME participants to discuss the possible future activities that would support mathematics education around the world.

AO

AFRICME (African Regional Congress on Mathematical Education)

July 14, 16:00–18:00 **Location: T120**
Contact Person: Fredrick Mtenzi, Alphonse Uworwabayeho

TBA

CIBEM (Congresso Iberoamericano de Educação Matemática / Iberoamerican Congress of Mathematics Education)

July 14, 16:00–18:00 **Location: T124**
Contact Person: Almeida Bairral, Agustín Carrillo de Albornoz Torres

TBA

ERME (European society for Research in Mathematics Education)

July 14, 16:00–18:00 **Location: T323**
Carl Winsløw (President of ERME)

16:00-16:10 **A general presentation of ERME**

16:10–16:20 **A presentation of activities of YERME (early career scholars of ERME)**

16:20–16:30 **A presentation of and invitation to CERME12 (Bolzano, Italy, Feb. 2-6, 2021)**

16:30–18:00 **A panel of 5-6 representatives of ERME will interact with the audience, taking questions and comments in view of participants' future communication, collaboration and cooperation in and with ERME.**

Abstract

The European society for Research in Mathematics Education was founded in 1997 by representatives from 16 European countries. The Society aims to enable communication of information to enhance the visibility and availability of European research on mathematics education (in Europe and all over the world). Media of communication include proceedings, journals, newsletters, books, the internet, web sites, video Congress, interactive CD-ROMs, virtual groups. The most important meeting points of the ERME are the biannual CERME congresses.
The Society supports graduate students and early career researchers in a variety of ways, including summer schools, webinars and channels that permit interaction and networking. These activities are organized in the YERME branch of ERME ("Y" indicating "young")
The Society also supports other activities that help to achieve the objectives of communication, cooperation and collaboration between members, such as activities within emerging research communities and cooperation with other academic societies.

AO

MERGA (Mathematics Education Research Group of Australasia)

July 14, 16:00–18:00 **Location: T128**
TBA

No.1 **Introduction to MERGA: President, Prof. Catherine Attard**

No.2 **Overview of MERGA Journals: Prof. Peter Grootenboer, Editor in Chief, Mathematics Education Research Journal (MERJ)**
Assoc. Prof. Tracy Muir, Editor, Mathematics Teacher Education Development (MTED)

No.3 **Launch of Research in Mathematics Education in Australasia 2015-2019 – Assoc. Prof. Jenni Way**

Abstract

This session will showcase the journals and conferences of the Mathematics Education Research Group of Australasia (MERGA). During the session MERGA will also launch the tenth edition of the 4-yealy review of 'Research in Mathematics Education in Australasia 2016-2019' published by Springer. Delegates are invited to attend this session to find out more about the research achievements and dissemination activities of the Australasian mathematics research community.

A National Presentation at ICME-14 of Mathematics Education in France

July 14, 16:00–18:00 **Location: T219**

Organisers: Edwige Godlewski (Sorbonne Université – President of CFEM), **Michèle Artigue** (Université de Paris – in charge of international relations at CFEM) CFEM Commission Française pour l'Enseignement des Mathématiques - French commission for mathematics teaching

Description: We propose to provide a global and synthetic description of the French educational context, making clear which specificities of this context directly influence mathematics education, and reflecting on its main strengths and weaknesses. The presentation will begin by a short introduction to the CFEM, the French sub-commission of ICMI, and then it will be structured around five themes representing important aspects of this educational context (current state and future directions), while of interest for the international community of ICME participants: (i) recent curricular evolutions; (ii) teacher education; (iii) research in mathematics education; (iv) the 50-year old original network of research institutes on mathematics teaching (IREM), an essential component of the mathematics education landscape in France; (v) popularization and enrichment activities, the number and variety of which regularly increases.

For each theme, there will be a focus on some recent evolutions or achievements. Moreover, we will try to emphasize the many international collaborations that the French community of mathematics education increasingly develops all around the world.

Regional Presentation of Andean Countries: Peru, Bolivia, Ecuador and Colombia

July 14, 16:00–18:00 **Location: T225**

Organisers: María del Carmen Bonilla (International Study Group on Ethnomathematics-Peru), **Victoria Mamani Choque** (Pedagogical University-Bolivia), **Eulalia Calle Palomeque** (University of Cuenca-Ecuador), **Huber Castro** (Centro Indígena de Investigaciones Interculturales de Tierradentro-Colombia), **Aldo Parra** (University of Cauca-Colombia)

Description: Peru, Bolivia, Ecuador, and Colombia are characterized by a multicultural, multiethnic, and multilingual reality. All of them converge in manifestations that express the development of science and mathematics, based on local rationalities and worldviews. These characteristics make possible several and particular understandings of the natural world and of the human being. The vast territory of the Andes has been the cradle of great civilizations, as old as those of the old world, with a permanent cultural development until the Spanish invasion. At that time, there was a cultural collapse, in which the Andean culture had the worst part; most of its tangible and intangible cultural heritage was wiped out. As a result of this destruction, the identity of the native Andean peoples has long been marginalized. The great scientific and technological development that is expressed in monumental architectural constructions, irrigation canals, metallurgical, agricultural, genetic development, domestication of plants and animals, as well as their ability to identify with the natural environment was made invisible. Science and mathematics developed with astonishing effectiveness and efficiency. Much Andean-Amazon sociocultural knowledge has been lost, or has been made invisible by the official culture, a situation that has been tried to overcome through governmental educational policies that recognize, revalue, and claim such legacy.

Mathematics Education in Hungary

July 14, 16:00–18:00 **Location: T223**

Organisers: Márta Barbarics (Budapest Semesters in Mathematics Education), **Eszter Bóra** (ELTE Doctoral School of Mathematics - Didactical Program, Szent István Gimnázium), **Csaba Csapodi** (Mathematics Education Centre of Eötvös Loránd University, Budapest), **Katalin Gosztonyi** (Mathematics Education Centre of Eötvös Loránd University, Budapest), **Péter Juhász** (Alfréd Rényi Institute of Mathematics), **Anna Kiss** (Mathematics Education Centre of Eötvös Loránd University, Budapest), **István Lénárt** (Eötvös Loránd University, Budapest), **Réka Szász** (Budapest Semesters in Mathematics Education), **Ödön Vancsó** (Mathematics Education Centre of Eötvös Loránd University, Budapest), **Eszter Varga** (ELTE Doctoral School of Mathematics - Didactical Program, Bornemisza Péter Gimnázium)

Description: The aim of our presentation session is to present the specific traditions of mathematics education in Hungary, and ways these are blended with present international trends to face the goals and challenges of the 21st century.

We will start with an overview of the institutional frames of mathematics education in Hungary: its structure and characteristics on the primary, secondary, and higher level, including teacher training and research. Then we will describe the Hungarian tradition of teaching by guided discovery whose most internationally known representative is György (George) Pólya, and two key trends in this tradition: Tamás Varga's concept building through games and manipulatives (Gosztonyi, 2018) and Lajos Pósa's discovery and problem solving through intertwined problem threads (Győri & Juhász, 2017). Finally we will describe how the Hungarian approach is used hand in hand with current educational trends.

Sweden – A National Presentation

July 14, 16:00–18:00 **Location: T319**

Organisers: Johan Prytz (Uppsala University), **Ida Bergvall** (Uppsala University)

NP

Description: The presentation is focused on the mathematics education in Sweden in school years one to twelve. First, there is a section on the history of Swedish mathematics education (1850–2021), which highlights the content of the curricula, but also organisational, sociological and cultural issues. The aim is to provide a context of Swedish mathematics education of today. We continue to a brief section on the current organization of the Swedish school system. This is followed by a lengthier section on teaching methods and philosophies of teaching in the last 25 years. This is a turbulent period in the Swedish school system. It began with a very deep economic crisis and at the same time the school system was decentralised in new ways, which included implementation of new public management, free school choice and a general voucher system. During the 20 first years of the same period of time, the Swedish results in TIMSS and PISA plummeted. The aim of this section is to describe the main trends in Swedish mathematics teaching during this period of time. After that there is a section on the mathematics syllabus and teaching material of today. The content of the current syllabi is described more thoroughly along with a more general description of textbooks. The development of the textbook market is also considered. The presentation ends with a brief discussion about the future and how Swedish mathematics can or should develop. This includes also more recent and general challenges related to for instance a major shortage of teachers and a relatively great number newly arrived immigrants.

TA1: Demonstration and Discussion of a Plane Geometry Lesson: Teaching "Determination and Properties of Parallel Lines" as a Whole

July 15, 14:00–16:30 **Location: T218**

Organiser: Secondary Mathematics Teaching Branch of Chinese Society of Education

Underlying Ideas:

Chinese mathematicians and mathematics teachers generally agree that there is no substitute for a plane geometry curriculum in developing students' spatial concepts and improving their reasoning skills. This lesson seeks to demonstrate a new exploration of a plane geometry curriculum reform. Using basic and simple plane figures as a carrier, the overall teaching design of the unit forms a series of mathematical activities to help students better and more easily understand geometric knowledge and ways to study geometric problems, so that students can develop inductive and abstract skills through geometric concept learning, develop the ability to discover the properties of figures through geometric property exploration, develop logical thinking and the ability to reason through geometric proposition reasoning activities (inferential argumentation), etc. The students will develop logical thinking and reasoning skills through reasoning activities.

Aims:

(1) To promote international academic communication in mathematics classroom teaching and professional learning of in–service teachers.

(2) To demonstrate the important role played by the Chinese teaching research system and teaching and research activities in ensuring the quality of classroom teaching and promoting teachers' professional development, and to enable international mathematics educators to understand the mathematics teaching and research activities in China.

(3) To explore the reform of plane geometry teaching.

Planned Activities & Working Format & Responsible Person

14:00–14:10	**General Introduction of the Activity** Micro Report (Jianyue Zhang)
14:10–15:00	**Video Lesson Demonstration and Self–explanation: "Determination and Properties of Parallel Lines"** Demonstration of the lesson (Jianhao Chen)
15:00–15:10	**Halftime**
15:10–15:40	**How an Excellent Lesson is Made? Also on the Characteristics of the Four–level Teaching Research System in China** Report (Da Liu, Caifeng Xiao, Shuangshuang Chen, Xiaodong Mu)
15:40–16:10	**Chinese Geometry Teaching Characteristics: Pursuing the Integration of Intuition and Logic with Holistic Teaching** Comments on the lesson (Zengsheng Wu, Xuan Zheng, Yudong Yang)
16:10–16:25	**Q&A**
16:25–16:30	**Summary** (Jianyue Zhang)

TA2: The Making of a 3-D Mathematic Adaptive Learning System

July 15, 14:00–16:30 **Location:** S

Organiser: Xiaoqing Gu, Yan Zhu, Chanjin Zheng, Aiming Zhou
Shanghai Institute of AI in Education, East China Normal University

Description:

This session will present various aspects of a mathematic adaptive learning system developed by Shanghai Institute of AI in Education at East China Normal University. Prof Yuan, the direction of the Institute, will introduce the general blueprint of this system and give a demonstration of a beta version of this system. Then three presenters will further explain the three main elements of this system. Specifically, Prof Zhou

from computer science will present the AI techniques including the algorithms for learning material recommendation, learning path planning, vision recognition etc. Prof Kong, an expert in math learning and teaching, will explicate the instructional design for this system in which the knowledge, cognitive and affective aspects of the math learning (the three dimensions) are considered. Lastly, Prof Zheng, a scholar on computerized adaptive testing and cognitive diagnostic assessment, will talk about the design, techniques and implementation of various assessments in the system.

Planned Activities & Working Format & Responsible Person

14:00–14:30 **The Math Adaptive Learning System Demo**
Speech (Prof. Xiaoqing Gu)

14:30–15:00 **AI behind the Math Adaptive Learning System**
Speech (Prof. Aiming Zhou)

15:00–15:30 **The Instructional Design for the 3–dimensional Math Adaptive Learning System**
Speech (Prof. Yan Zhu)

15:30–16:00 **Adaptive Assessments Math Adaptive Learning System**
Speech (Prof. Chanjin Zheng)

16:00–16:30 **Questions/Discussion**
Discussion (all the presenters)

TA3: Domesticating Practice of Primary Mathematics Education in China

July 15, 14:00–16:30 **Location: T418**

Organiser: The Primary Mathematics Teaching Committee of the Chinese Society of Education

Description:

The Primary Mathematics Teaching Committee of the Chinese Society of Education was established in March 1982. It is the first professional organization focusing on primary mathematics education in China, and it has grown to be the largest professional organization of its kind. The committee strives to advance knowledge about primary mathematics education, to encourage scholarly inquiry related to primary mathematics education, and to promote the use of research to improve primary mathematics education and better serve the public good.

The Primary Mathematics Teaching Committee of the Chinese Society of Education provides this symposium to showcase our practical achievement and to share our Chinese Mainland experience with colleagues across the world. The symposium invites outstanding primary mathematics educators, researchers, and teachers to examine the Chinese primary mathematics teaching from a variety of perspectives: reflecting the unique characteristics of Chinese mathematics education to showcase the teaching reform of older generation; examining research and practice on deep learning, problem posing , mathematics understanding to showcase the innovative practice of primary mathematics education in China; presenting adaptable teaching demonstrations and classroom activities with focus on the four domains in primary mathematics to showcase the Chinese classroom teaching practices; reflecting on the reform–oriented approaches to outline the future Chinese primary mathematics practice.

The symposium aims to integrate theories into practice, to share first–hand teaching cases for reflection, to present alternative solutions, interpretations, and to showcase years of exploration and experiences in the primary mathematics teachings in China.

Planned Activities & Working Format & Responsible Person

14:00–14:20 **Inheriting the Classics—Chinese Elementary Mathematics Education for Generations**
Panel/Paper discussion
The Origin and Development of “Attempting Teaching Method” in Primary Mathematics Education (Qiu, XueHua (Dean of Attempting Education Institution))

Maxinlan Teaching Method Centred on “Mathematical Thinking Development” (Ma, XinLan/Sun, JiaWei (Xinghe Laboratory Elementary school Chaoyang, Beijing))

14:20–15:00 **Empowering Innovation—Chinese Primary Mathematics Education Oriented by Students’ Wellbeing**
Panel/Paper discussion
Creating “Delicious and Nutritious” Math Education for Children (Wu, ZhengXian (Beijing Academy of Educational Sciences))
The Teaching Reform of “Deep Learning” in Primary Mathematics Education (Ma, YunPeng (Northeast Normal University))
Primary Mathematic Teaching Practice Guided by Children’s Questions (Zhang, Dan (Beijing Academy of Educational Sciences))
Primary Mathematic Practice to Promote Mathematical Understanding (Li, XiaoMei (Liaoning Institute of Education))

15:00–15:50 **Lesson Demonstration—Mathematic Teaching in Chinese Elementary Classrooms**
Working Group Roundtable: teaching demonstration + discussion
Developing Students’ Number Sense through Recognition of 11–20 (Ni, Fang (Chaoyang Laboratory Elementary School, Beijing))
Developing Volume Sense through “Volume and Capacity” (Wang, LiBing (Jingzhou Elementary School, Hangzhou, Zhejiang))
“Understanding Percent” through Emphasizing Data Analysis (Liu, RengXuan (Qingdao Academy of Educational Sciences, Shandong), Xu, YunHong (Shandong Academy of Educational Sciences))
Mini Action Research “How big is 100 Million” (Liu, Li (Hubei Academy of Educational Sciences))

15:50–16:10 **Promising Future— Primary Mathematics Reforms in China**
Panel Discussion
Artificial Intelligent and the Primary Mathematics Education Reform in China (Kong, QiPing (East China Normal University))
Curriculum Standards Development and Primary Mathematics Reform in China (Sun, XiaoTian (Minzu University of China))

16:10–16:30 **Questions and Discussion**
Discussant: NorthEast Normal University
Professor : Ma, Yunpeng

TA4: 12–year Integrated Mathematics Textbook of BNUP: Promoting Well-rounded Student Development

July 15, 14:00–16:30 **Location: T419**

Organiser: Beijing Normal University Publishing Group

Description:
Chinese mainland started the eighth curriculum reform for basic education in 1999. In 2001 and 2003, *Mathematics Curriculum Standards for Compulsory Educaiton (Experiemental)* and *Mathematics Curriculum Standards for Senior High School (Experiemental)* were launched.

Entrusted by the Ministry of Education, the core members of the mathematics curriculum standards team formed a group to develop the 12–year integrated mathematics textbooks, which were published by Beijing Normal University Press, or BNUP Maths for short.

BNUP Maths were developed based on the students’ cognitive rules, and featured in developing basic knowledge and promoting future development. The textbooks were integratedly designed for primary school, junior high school and senior high school. They have a unique academic style and distinct Chinese mathematics education features which highlight the essence of Mathematics, develop students’ competence, cultivate students’ practical and innovative ability, and pay attention to the educational function of Mathematics. Each year, more than 30 million students use BNUP Maths to carry out mathematics learning activities, which makes our textbooks one of the most influential mathematics textbooks in Chinese mainland.

In this international congress, BNUP Maths development team and some of the excellent textbook users will introduce the overall design and features of the textbooks. Some typical cases from different learning periods will be demonstrated on topics like function, reasoning ability and mathematical modeling. We will show the experience of constructing the textbooks, discuss the schema for developing textbooks, and put forward some thoughts and prospects for the construction and development of our textbooks in the future.

Planned Activities & Working Format & Responsible Person

14:00–14:15 **Being People–oriented: BNUP Maths in Progressing**
Report (Dong Qi (Beijing Normal University); Lv Jiansheng (Beijing Normal University Publishing Group))

14:15–14:30 **The Construction Background of BNUP Maths**
Round–table Interview (Zhang Fei (Jiangsu Second Normal University); Liu Jian (Beijing Normal University); Kong Qiping (East China Normal University); Liu Xiaomei (Capital Normal University); Hu Fengjuan (Capital Normal University))

14:30–15:00 **Distinctive Academic Features of BNUP Maths**
Report (Liu Keqin (Zhongguancun No.3 Primary School); Guan Jian (High School Affiliated to BIT); Wang Jianbo (Beijing Normal University Publishing Group); Cheng Yanyun (Changjiang Middle School, Yichang, Hubei province); Zhang Birong (Chengdu Education Research Institute); Zhu Dejiang (Nanhu Teaching and Research Office, Jiaxing, Zhejiang province))

15:00–15:50 **Developing Students' Competence: Practice and Case Study on BNUP Maths**
Report (Bao Jiguang (Beijing Normal University); Li hong (Beijing No.22 Middle School); Zhang Dan (Beijing Academy of Educational Sciences); Zhao Yanhui (Primary School Attached to Northeast Normal University); Gu Jiling (Nanjing Normal University); An Zhijun (Qingdao Institute of Educational Sciences))

15:50–16:10 **Mechanism in of BNUP Maths Construction: Innovation with Vitality**
Round–table interview (Hu Yu (Beijing Normal University Publishing Group); Sun Jinghong (Beijing Haidian Teachers Training College); Bao Yinxia (Guangdong Academy of Education); Zhang Huiying (Shijiazhuang Institute of Educational Science); Li Yanlin (Capital Normal University); Chen Lihong (Jiangxi Teaching and Materials Research Office))

16:10–16:30 **Discussion**
Round–table discussion (Liu Jian (Beijing Normal University); Ma Fu (Nanjing Normal University); Wang Shangzhi (Capital Normal University))

TA

TA5: From "Telling" to "Showing": a Zhejiang Mathematics Professional Development Model for Novice Teachers' Learning from Master Teachers

July 15, 14:00–16:30 **Location: T219**

Organiser: SI Miao'er (Teaching & Research Institute of Zhejiang Education Department); YU Zhengqiang (The Affiliated Primary School to Jinhua Normal School in Zhejiang Province);YUAN Xiaoping (Hangzhou Xuejun Primary School);TANG Caibin (Hangzhou Shidai Primary School); LIU Minmin (Education Research and Training Center in Jingning She Autonomous County)

Description:
In recent years, an effective paradigm in which novice teachers learn from expert teachers has emerged in China's Zhejiang Province. The teaching researchers staff form a teaching and research community with a number of novice teachers and master teachers, and through the "three stages and ten steps" framework, the novice teachers quickly learn how to teach. In this model, novice teachers, teacher researchers, and master teachers form a teaching research community, where novices learn directly from masters how to teach via the collective and collaborative activities of "master teachers' observing and discussing a lesson, and then novice teachers' immediate revising and delivering the lesson again." In the entire process which lasts from two to three days, a number of novice teachers observe and learn, and several teacher

researchers and master teachers guide these novice teachers from the beginning to the end. Master teachers provide timely feedback for possible improvement and explain why certain improvement is needed for novice teachers. Due to time constraints, this session is devoted only to the presentation of the "on–the–spot lesson improvement" by novice teachers, with a focus on how to learn from experts and peers in classroom settings.

Planned Activities & Working Format & Responsible Person

14:00–14:30 **The Origin, Value and Essentials of "On–the–spot Lesson Improvement"**
(SI Miao'er)

14:30–14:50 **A Novice Teacher's Lesson Presentation**
(A novice teacher)

14:50–15:25 **On–the–site Interactive Discussion**
(Master teachers and Novice teachers)

15:25–15:45 **Demonstration Lesson Presented by a Master Teacher**
(A master teacher)

15:45–16:05 **Second Presentation of the Lesson by a Randomly Selected Novice Teacher**
(A randomly selected novice teacher)

16:05–16:30 **Master Teachers' Interpretation and Comments on the Lesson Followed by a Q&A Session**
(Professor Kong Qiping, Professor Zhang Qinqiong etc. + on–site teachers)

TA6: Reform and Development of Mathematics Curriculum and Teaching for Ethnic Minorities in China

July 15, 14:00–16:30 **Location: T116**

Organiser: Chairman: Professor Song Naiqing (Southwest University)
Vice Chairman: Associate Professor Li Zhongru (Southwest University)
Members: Professor Zhang Huirong (Southwest University); Professor Zhang Tingyan (Southwest University); Professor Chen Ting (Southwest University); Associate Professor Yang Xinrong, (Southwest University) ;Associate Professor Peng Aihui (Southwest University); Associate Professor Pei Changgen (Southwest University)
Secretary: Assistant Professor Li Xinlian (Southwest University)

Description:
This session is organized by the mathematics education research group from Southwest University in China, leading by Professor Song Naiqing.

China is a country with 56 ethnic groups. Mathematics education for ethnic minorities is an important part of mathematics education in China. However, due to issues related to language and culture, etc, the mathematics education for ethnic minorities in China faces challenges as well as opportunities, which call for further investigation.

The purpose of this session is to present what have achieved and to examine the mathematics teaching and curriculum of ethnic minorities in China. This session is to promote and invite participation from scholars in different countries and regions to understand, pay attention to and collaboratively explore the problems of mathematics education for ethnic minorities, exchange the latest research results of mathematics education for ethnic minorities, and then to improve the research of mathematics education for ethnic minorities in China and beyond.

This session is organized according to the following six themes:

1. Development and prospects of mathematics education for ethnic minorities;
2. Improvement of mathematics classroom teaching for ethnic minorities ;
3. Development of school–based mathematics curriculum for ethnic minorities ;
4. Transformation of the students with learning difficulties for ethnic minorities ;
5. Development and application of mathematics culture for ethnic minorities;
6. Information technology and mathematics education for ethnic minorities.

Planned Activities & Working Format & Responsible Person

14:00–16:00 **Three Presentations about the Mathematics Curriculum and Teaching Reform for Ethnic Minorities in China (40 Min for Each including Q & A)**
Presentations (Chen Ting, Peng Aihui, Pei Changgen, Zhang Tingyan)

16:00–16:30 **Demonstrate the Achievements of Mathematics Curriculum and Teaching Reform in Ethnic Minority Areas of China**
30 minutes videos (Li Zhongru, Zhang Huirong, Yang Xinrong, Li Xinlian)

TA7: The Chinese Characteristics of Normal Students Training on Primary School Mathematics

July 15, 14:00–16:30 **Location: T523**

Organiser: Jianyue Zhang, Xiaoli Liu, Shuhong Zhou, Zhigang Wang, Shuping Pu, Mingxiang Liu, Shien Zhao, etc.
Primary School Math Education Working Committee

Description:
The Normal Universities have gained a lot of rich experience. Our training purpose is "Consolidating mathematical foundation, Strengthening teaching skills, Emphasizing practical teaching and Promoting competence developing" and we have obtained significant results.

Planned Activities & Working Format & Responsible Person

14:00–14:10 **The Beginning of Primary School Mathematics Teacher Training**
VCR (Zhigang Wang)

14:10–14:40 **Introduction of Basic Information (Training Objectives, School System, Curriculum, Teaching Material)**
PPT (Mingxiang Liu, Shuping Pu)

14:40–15:30 **Introduction of Teaching Implementation**
PPT, VCR (Shuhong Zhou)

15:30–16:00 **Introduction of Teaching Achievements**
PPT, VCR (Xiaohui Liu)

16:00–16:30 **Interaction Time**
Question& Discussion (Zhigang Wang, Shuping Pu)

TA8: Mathematics Experiment: A Transformation of Mathematics Learning in Chinese Primary and Middle Schools

July 15, 14:00–16:30 **Location: T225**

Organiser: Linwei Dong[1, 2] ([1]Teaching and Learning Speciality Committee of Middle School Mathematics, the Chinese Society of Education, [2]Institute of Educational Science of Jiangsu Province)

Description:
This thematic afternoon is organized by Prof. Linwei Dong, the Vice Chairman of the Teaching and Learning Specialty Committee of Middle School Mathematics, the Chinese Society of Education. Prof. Dong was a high school mathematics teacher for nearly 20 years and, after that, a teaching and research advisor for 15 years. He is now the Editor–in–Chief of Junior High School Mathematics Textbook (Jiangsu Edition) and the Director of the Education Science Planning Office of Jiangsu province.

Prof. Dong and his team started researching mathematics experiment since the early 1990s. Entering the 21st century, the team started to explore mathematics experiments both theoretically and practically. So far, they have proposed a theoretical framework, wrote operation manuals, designed various patterns for teaching mathematics experiments, and developed series of experimental tools. They have also launched empirical studies to investigate the effectiveness of mathematics experiments. These efforts together constitute a systematic action plan for mathematics experiments. Studies have shown that mathematics experiment helps make abstract mathematical knowledge more vivid and, thus, enables students to better learn abstract concepts and generalize rules through direct experience. Besides, in the process of learning

mathematics concepts and rules, students gain methodological insights into how to learn and how to think mathematically.

The thematic afternoon will show in details the background, significance, development, and achievements of mathematics experiments, and it will also demonstrate the research results of mathematics experiments through specific cases.

Planned Activities & Working Format & Responsible Person

14:00–14:30 **Mathematics Experiment: A Transformation of Mathematics Learning in Chinese Primary and Middle Schools**
Keynote speech (Prof. Linwei DONG)

14:30–15:00 **A Case Study of Mathematics Experiment: Understanding Mathematical Concepts**
Presentation (Qingsong GUO et al)

15:00–15:30 **A Case Study of Mathematics Experiment: Exploring Mathematical Rules**
Presentation (Aiping ZHANG et al)

15:30–16:00 **A Case Study of Mathematics Experiment: Application of Mathematics Knowledge**
Presentation (Weikun ZHAO et al.)

16:00–16:10 **Research on the Educational Effects of Mathematical Experiments**
Presentation (Prof. Ping YU)

16:10–16:20 **Research on the Psychological Effects of Mathematical Experiments**
Presentation (Prof. Dingliang TAN)

16:20–16:30 **Prospects for Research on Mathematical Experiments**
Presentation (Detong XU)

TA9: The Practice of Teaching Improvement from "Comprehending" to "Exploring"

July 15, 14:00–16:30 **Location: T423**

Organiser: Qingpu Experiment Research Institute

Aims:
It shows the mathematics class teaching and research activities with Chinese characteristics and is school–based.

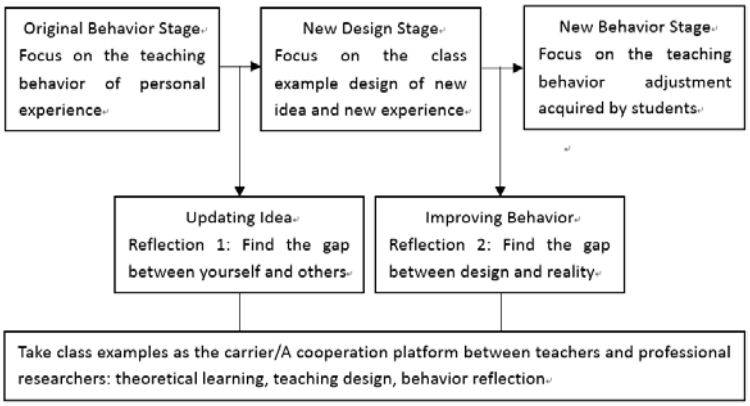
Significance:
Show the New Class of Qingpu Experiment — The Practice of Teaching Improvement from "Comprehending" to "Exploring"; Show Qingpu Experiment — The paradigm of school–based research in teachers' action education, promoting progress in teacher's professional development.

Activity Description:
The activities are generally divided into the following stages：

1. To establish a community of teachers, staff developers and professional researchers to cooperate in teaching improvement practice by lesson studies.

2. With the characteristics of "professional guidance" and "behaviour follow–up", carry out the teaching improvement practice of "three concerns and two reflections" which integrating theoretical learning, teaching design and behavioural reflection.

The "three concerns" consists of three stages: focus on the original behaviour stage of personal experience, the new design stage of the class example which is under the new concept, and the new behaviour stage acquired by students. "Two reflections" consists of two rounds of professionally–led cooperative reflections that connect the activities of the three stages: reflecting on the gap between existing behaviours and advanced concepts and experiences, and completing the leap of updating concepts; reflecting on the gap between ideal teaching design and students' actual acquisition, and completing the transfer from idea to behaviour. As shown in the picture.



3. Find and sort out key behaviours of teaching improvement by means of teaching behavior analysis, and generate opinions and suggestions.

4. Expert review.

Planned Activities & Working Format & Responsible Person

14:00–14:05 **Explain: The Practice of Teaching Improvement from "Comprehending" to "Exploring"**
Mini Talk (Zhu Lianyun)

14:05–14:58 **Video Demonstration: "The Properties and Application of Linear Function" Class Teaching Section and Student Modelling Activity Section**
Video (Qian Haiyan, Xu Xiankai)

14:58–15:18 **Expert review**
Review (Wang Jie、Xu Binyan)

15:18-16:00 **Popularize Video demonstration**
Video (Yu Wei)

16:00–16:15 **Expert Review**
Review (Wang Hua)

16:15-16:30 **Interactive question and answer**
Interactive question and answer (Wang Jie, Xu Binyan, Wang Hua, Xiao Caifeng, Ban Liya etc.)

TA

TA10: How is the Nature of 'Teaching and Learning Mathematics' Changed During the Pandemic in Shanghai?

July 15, 14:00–16:30 **Location: T319**

Organiser: Shanghai High School

Description:
All citizens in Shanghai were advised to self–isolate in a bid to control the spread of COVID–19, it was hypothesized that COVID–19 would impact on the teaching and learning mathematics in the 2020. This study reports secondary school students' experiences for learning mathematics and teachers' experiences for teaching mathematics during the COVID–19 pandemic era. 264 students completed a survey about the ways they have used to support their learning in mathematics. This study also collected data from 332 mathematics teachers in Shanghai. Semi–structured interviews were used to collect views of what these teachers thought about the COVID–19 effects on the mathematics performance of students.

Planned Activities & Working Format & Responsible Person

14:00–14:40 **Students' Individual Talks**
Ted Talk

14:40–14:50 **Video watching**
(Ma Feng)

14:50–15:30 **Teachers' Report on the Survey**

Lecture

15:30–16:10 **Students' Report on the Survey**
Lecture

16:10–16:30 **Q&A**
Interaction

TA11: Chinese Mathematics Curriculum, Teaching and College Entrance Examination

July 15, 14:00–16:30 **Location: T316**

Organiser: Mathematical Education Committee of Chinese Mathematical Society

Organizers:
The Chinese Mathematical Society was established in July 1935. The Mathematical Education Committee of Chinese Mathematical Society is committed to the development of mathematics education in primary, secondary and university schools. In 1936, the Chinese Mathematical Society founded and published the Journal of Mathematics (《数学通报》), which has published many important mathematics education research paper mainly focused on the mathematical education practice in primary and secondary schools.

This thematic afternoon is a collaboration among researchers from Mathematical Education Committee of Chinese Mathematical Society. Academic consultants (professor Ningzhong Shi and professor Junyi Guo) are responsible for the design and guidance of the overall activities. Yufeng Guo is responsible for the mathematics curriculum and teaching. Zizhao Ren is responsible for the activities about Mathematics College Entrance Examination.

Aims and underlying ideas
As the main research fields of mathematics education, curriculum, teaching and evaluation have attracted the attention of mathematics education researchers and mathematics teachers all over the world. This activity aims to show the main features of Chinese mathematics education in these three research fields which are Chinese mathematics curriculum (or Syllabus), teaching and college entrance Examination (Chinese Gaokao). About Chinese mathematics curriculum, historical evolution of mathematics curriculum standards, the latest high school mathematics curriculum standards and supporting textbooks will be introduced. About College Entrance Examination, the system and proposition ideas will be introduced. This activity can help people understand the reality and characteristics of Chinese mathematics education better.

Planned Activities & Working Format & Responsible Person

14:00–14:30 **Display of Mathematical Curriculum Standards and Mathematical Materials**
PowerPoint, picture and text showing (Yufeng Guo, Li Zhongru)

14:30–15:00 **Display of Characteristic Math Class and Students' Works**
PowerPoint, pictures, video and paper (Fengwen Yang)

15:00–16:00 **1.Introduce the Basic Situation of the College Entrance Examination**
2.The Mathematical Knowledge and Ability to Be Examined in the College Entrance Examination
3.The Structure of the Math Papers for the College Entrance Examination
4.Chinese Mathematical Tasks of College Entrance Examination
PowerPoint, pictures, video and paper (Zizhao Ren, Ji Guoxing, Song Chunwei)

16:00–16:30 **Q&A**
(Organizers and participants)

TA12: Mathematical Modeling Inside and Outside Classrooms

July 15, 14:00–16:30 **Location: T323**

Organiser: Alfred Cheung (NeoUnion ESC Organization); Solomon Garfunkel (COMAP)

Activity description:

(1) Reports and presentation: Outstanding Award and Meritorious teams will be invited to present their solution papers to the audience. They will also share their experience in IMMC and other mathematical modelling activities.

(2) Demonstrations: Other participating teachers and students will demonstrate their projects on mathematical modelling and its integration with STEM including publications and posters.

(3) Discussions: Local Chinse school teachers will be invited to present their pedagogy cases and research projects to the audience.

Planned Activities & Working Format & Responsible Person

14:00–15:15 **Reports by IMMC Awarded Teams**
Speeches (Alfred Cheung, Sol Garfunkel)

15:15–16:00 **Demonstration by Teachers/Students**
Posters and presentations (Alfred Cheung)

16:00–16:30 **Discussions**
Q&A (Alfred Cheung, Zhonghua Qiao)

TA13: Forum on Standards of School Mathematics Curriculum in China Mainland

July 15, 14:00–16:30 **Location: A**

Organiser: Revision Group on General Senior High School Curriculum Standards (2017, 2020) , Full–time Obligatory Education Mathematics Curriculum Standards (2021, On–going)

Aim:
(1) Highlighting and Explanation the Big Ideas of General Senior High School Curriculum Standards (2017, 2020);

(2) Introduction and Discussing the Revision of Full–time Obligatory Education Mathematics Curriculum Standards (2021, On–going).

Organizer:
(1) Shi, Ning–zhong, Co–chair of Revision Group on General Senior High School Curriculum Standards (2017, 2020); Co–chair of Revision Group on Full–time Obligatory Education Mathematics Curriculum Standards (2021, On–going); The former president of Northeast China Normal University.

(2) Wang, Shang–zhi, Co–chair of Revision Group on General Senior High School Curriculum Standards (2017, 2020)， Professor of Capital Normal University.

(3) Wang, Chang–ping, key member of Revision Group on General Senior High School Curriculum Standards (2017, 2020), key member of Revision Group on Full–time Obligatory Education Mathematics Curriculum Standards (2021, On–going); The president of Fujian Normal University.

(4) Cao, Yi–ming, Co–chair of Revision Group on Full–time Obligatory Education Mathematics Curriculum Standards (2021, On–going), professor of Beijing Normal University.

(5) Sun, xiao–tian, key member of Revision Group on Full–time Obligatory Education Mathematics Curriculum Standards (2021, On–going), professor of Minzu University of China.

Planned Activities & Working Format & Responsible Person
Chair: Cao, Yi–ming

14:00–14:50 **The Big Ideas of Revision on Standards of School Mathematics Curriculum**
(Shi, Ning–Zhong)

14:50–15:20 **Design on Subject Core Competencies and Goals**
(Sun, Xiao–Tian)

15:20–15:50 **Introduction on Elective Courses for Senior High School**
(Wang, Chang–Ping)

15:50–16:20 **Core Competence–based Assessment and Examination Development**
(Wang, Shang–Zhi)

16:20–16:30 **Discussion and Summary**

A Topic Study Group (TSG) is designed to gather a group of Congress participants who are interested in a particular topic in mathematics education. TSGs will promote the discussion of a variety of perspectives on the theme of the group. A TSG will serve as a mini-conference and display the progress of the discussion in the intervening years, which will consist of high-standard discussions enabling the newcomer to get a broad overview on the state-of-the-art and allowing the experts to lead discussions at a high level. The team will provide participants of their TSG not with a nationally framed insight into the strands of the discussion of the theme, but with an overall overview on the international discussion as broad as possible and allowing for insight into less well-known strands of the discussion from underrepresented countries.
As like previous ICMEs, in ICME-14, the TSG is the major arena for participation. There are 62 TSGs designed and divided into two classes, odd TSG numbers (TSG 1, TSG 3, …) in Class A, and even ones (TSG 2, TSG 4, …) in Class B, to run in different sets of timeslots. Every TSG should have three sessions with 300 minutes in total, while the number of sessions in some groups was modified according to specific circumstances. There are also two additional 60-minutes' timeslots for posters, shared by all TSGs.

A General View

Remark: T—Tian Building; W—Wenshi Building

TSG series number	Theme	July 13th 14:30-16:30	July 13th 19:30-21:00	July 14th 19:30-21:00	July 16th 21:30-23:00	July 17th 14:30-16:30	July 17th 21:30-23:00
TSG 1	Mathematics education at preschool level	W201		W201			W201
TSG 2	Mathematics education at tertiary level		T116	T226	T116	T116	
TSG 3	Mathematics education for gifted students	W211		W211			W211
TSG 4	Mathematics education for students with special needs		T218	T218	T218	T218	
TSG 5	Teaching and learning of number and arithmetic	T218	T230	T230			T218
TSG 6	Teaching and learning of algebra at primary level		W301		W301	W301	
TSG 7	Teaching and learning of algebra at secondary level	T120		T120			T120
TSG 8	Teaching and learning of geometry at primary level		T120		T120	T120	
TSG 9	Teaching and learning of geometry at secondary level	T523	T234	T523			T523
TSG 10	Teaching and learning of measurement		W107		W107	W107	
TSG 11	Teaching and learning of probability	W203		W203			W203
TSG 12	Teaching and learning of statistics		T423	T234	T423	T423	
TSG 13	Teaching and learning of calculus	W215		W215			W215
TSG 14	Teaching and learning of programming and algorithms		T124		T124	T124	
TSG 15	Teaching and learning of discrete mathematics	W107		W107			W107
TSG 16	Reasoning, argumentation and proof in mathematics education		T223	T219	T223	T223	
TSG 17	Problem posing and solving in mathematics education	T225		T225		T234	T225
TSG 18	Students' identity, motivation and attitudes towards mathematics and its study	T230	T225		T225	T225	
TSG 19	Mathematical literacy, numeracy and competency in mathematics education	W303		W303			W303
TSG 20	Learning and cognition in mathematics (including the learning sciences)		W315		W315	W315	
TSG 21	Neuro science and mathematics education/Cognitive Science			T206			T206
TSG 22	Mathematical applications and modelling in mathematics education	T219	T219		T219	T219	

TSG series number	Theme	July 13th 14:30-16:30	July 13th 19:30-21:00	July 14th 19:30-21:00	July 16th 21:30-23:00	July 17th 14:30-16:30	July 17th 21:30-23:00
TSG 23	Visualization in the teaching and learning of mathematics	T418	T226	T418			T418
TSG 24	The role and the use of technology in the teaching and learning of mathematics at primary level		W111		W111	W111	
TSG 25	The role and the use of technology in the teaching and learning of mathematics at lower secondary level	T223		T223	T226		T223
TSG 26	The role and the use of technology in the teaching and learning of mathematics at upper secondary level		T316		T316	T316	
TSG 27	The role of the history of mathematics in mathematics education	T423		T423	T230		T423
TSG 28	Preservice mathematical teacher education at primary level	T226	T319		T319	T319	
TSG 29	Preservice mathematical teacher education at secondary level	W301		W301			W301
TSG 30	In-service mathematical teacher education and mathematical teacher professional development at primary level		T418		T418	T418	
TSG 31	In-service mathematical teacher education and mathematical teacher professional development at secondary level	T116		T116	T132		T116
TSG 32	Knowledge in/for teaching mathematics at primary level		W303		W303	W303	
TSG 33	Knowledge in/for teaching mathematics at secondary level	T323		T323		T226	T323
TSG 34	Affect, beliefs, and identity of mathematics teachers		T519		T519	T519	
TSG 35	Knowledge and practice of mathematics teacher educator	T316		T316	T234		T316
TSG 36	Research on classroom practice at primary level		W201		W201	W201	
TSG 37	Research on classroom practice at secondary level	T419		T419		T230	T419
TSG 38	Task design and analysis		T419		T419	T419	T219
TSG 39	Language and communication in the mathematics classroom	W313		W313			W313
TSG 40	Research and development on mathematics curriculum		W313		W313	W313	
TSG 41	Research and development on textbooks and resources for learning and teaching mathematics	W315		W315			W315
TSG 42	Research and development in assessment in mathematics education		W215		W215	W215	
TSG 43	Research and development in testing (national and international) in mathematics education			T213			T213
TSG 44	Mathematics and interdisciplinary education		W211		W211	W211	
TSG 45	Mathematics for non-specialist/mathematics as a service subject at tertiary level	T205		T205			T205
TSG 46	Mathematical competitions and other challenging activities		W101		W101	W101	
TSG 47	Mathematics education in a multilingual environment	W101		W101			W101
TSG 48	Mathematics education in a multicultural environment				T209	T209	
TSG 49	Distance learning, e-learning, and blended learning of mathematics	T124		T124		T222	T124
TSG 50	Mathematics education in and for work; continuous mathematics education including adult education		T213		T213	T213	
TSG 51	Mathematics education for ethnic minorities	T209		T209			T209
TSG 52	Ethno-mathematics		T523		T523	T523	
TSG 53	Equity in mathematics education	T222		T222	T222		T222

TSG series number	Theme	July 13th 14:30-16:30	July 13th 19:30-21:00	July 14th 19:30-21:00	July 16th 21:30-23:00	July 17th 14:30-16:30	July 17th 21:30-23:00
TSG 54	Social and political dimensions of mathematics education		T323		T323	T323	
TSG 55	The history of the teaching and the learning of mathematics	T319		T319			T319
TSG 56	Philosophy of mathematics and mathematics education		W203		W203	W203	
TSG 57	Diversity of theories in mathematics education	T128		T128			T128
TSG 58	Empirical methods and methodologies in mathematics education		T128		T128	T128	
TSG 59	Mathematics and creativity	T519		T519		T132	T519
TSG 60	Semiotics in mathematics education		T205		T205	T205	
TSG 61	International education cooperation	W111		W111			W111
TSG 62	Popularization of mathematics		T206		T206	T206	

TSG1: Mathematics Education at Preschool Level

Chair: Marja van den Heuvel–Panhuizen (Utrecht University, Netherlands; Nord University, Norway)
Co–chair: Angelika Kullberg (Gothenburg University, Sweden)
Team members: Ineta Helmane (University of Latvia, Latvia), Xin Zhou (East China Normal University, China)
IPC Liaison Person: Marta Civil (USA)

Session I

July 13, 14:30–16:30 **Location: W201**

14:30–14:35 **Welcome**

14:35–14:45 **Xiaoting ZHAO**, Xiaohui XU (Capital Normal University, Beijing, China)
Application of Number Line Estimation Strategy for 5–6 Years Old Children: Effect of Reference Point Marking

14:45–14:55 **Marja van den Heuvel–Panhuizen[1]**, Iliada Elia[2] ([1]Utrecht University, the Netherlands, Nord University, Norway; [2]University of Cyprus, Cyprus)
Unraveling the Quantitative Competence of Kindergartners

14:55–15:05 **Yuly Vanegas[1]**, Carla Rosell[1], Joaquin Giménez[3] ([1]Universitat de Lleida, Spain; [2]Universitat de Barcelona, Spain)
Insights about Constructing Symmetry with 5–year–old Children in an Artistic Context

15:05–15:15 **Break**

15:15–15:25 **Joanne Mulligan**, Gabrielle Oslington (Macquarie University, Sydney, Australia)
Kindergartners' Use of Symmetry and Mathematical Structure in Representing Self–portraits

15:25–15:35 **Nicole Fletcher[1]**, Diego Luna Bazaldúa[2], Herbert P. Ginsburg[3] ([1]Fairfield University, CT, USA; [2]The World Bank Group, Washington D.C., USA; [3]Teachers College, Columbia University, USA)
Investigating Evidence of Girls' and Boys' Early Symmetry Knowledge through Multiple Modes of Assessment

15:35–15:45 **Fang Tian,** Jin Huang (Faculty of Education, East China Normal University, Shanghai, China)
4–year–olds Children's Understanding of Repeating Patterns: A Report from China

15:45–15:55 **Break**

TSG

15:55–16:05 **Insook Chung** (Saint Mary's College, Notre Dame, IN, USA)
Investigating How Kindergartners Represent Data with Early Numeracy and Literacy Skills through a Performance Task

16:05–16:30 **Discussion**

Session II

July 14, 19:30–21:00 **Location: W201**

19:30–19:35 **Welcome Session 2**

19:35–19:45 Dina Tirosh[1], Pessia Tsamir[1], **Ruthi Barkai**[1,2], Esther S. Levenson[1] ([1]Tel Aviv University, Israel; [2]Kibbutzim College of Education, Tel Aviv, Israel)
Counting Activities for Young Children: Adults' Perspectives

19:45–19:55 **Miriam M. Lüken**, Anna Lehmann (Bielefeld University, Germany)
Asking Early Childhood Teachers about Their Use of Finger Patterns

19:55–20:05 **Catherine Walter–Laager**[1], **Manfred R.Pfiffner**[2], Xin Zhou[3], Douglas H.Clements[4], Julie Sarama[4], Linh Nguyen Ngocs[5], Lars Eichen1 & Karoline Rettenbacher[1] ([1]Karl–Franzens University of Graz, Graz, Austria, [2]Zurich University of Teacher Education, Zurich, Switzerland, [3]East China Normal University, Shanghai, China, [4]University of Denver, Denver CO, USA, [5]National College for Education, Hanoi, Vietnam)
Performance Expectations in the Area of "Shapes and Spaces" of Early Childhood Educators in an International Comparison

20:05–20:15 **Break**

20:15–20:25 **Ronald Keijzer**[1], Marjolijn Peltenburg[2], Martine van Schaik[2], Annerieke Boland[1], Eefje van der Zalm[2] ([1]Hogeschool iPabo, Amsterdam, the Netherlands; [2]Hogeschool Marnix Academy, Utrecht, the Netherlands)
Mathematics in Play

20:25–20:35 **Oliver Thiel** (Queen Maud University College, Trondheim, Norway)
Does Preservice Teacher Training Change Prospective Preschool Teachers' Emotions about Mathematics?

20:35–21:00 **Discussion**

Session III

July 17, 21:30–23:00 **Location: W201**

21:30–21:35 **Welcome Session 3**

21:35–21:45 **Audrey Cooke**, Jenny Jay (Curtin University, Australia)
Bishop's (1988, 1991) Mathematical Activities Reframed for Pre–Verbal Young Children's Actions

21:45–21:55 **Jianqing Wen** (Shanghai Jing'an Anqing Kindergarten, China)
When Math Meets Games—The Active Construction of Children's Core Mathematics Experience in Games

21:55–22:05 **Birgitte Henriksen** (Aarhus University, Denmark)
Analysing a Danish Kindergarten Class Teacher's Instructional Support in Mathematics with the Tool Class

22:05–22:15 **Break**

22:15–22:25 **Øyvind Jacobsen Bjørkås**, Dag Oskar Madsen, Anne Grethe Baustad, Elisabeth Bjørnestad (Nord University, Bodø, Norway)
Mathematical Learning Environments in Norwegian ECEC Child Groups

22:25–22:35 **Ann LeSage**, Robyn Ruttenberg–Rozen (Ontario Tech University, Canada)
"More Gooder": Children Evaluate Early Numeracy Apps

22:35–23:00 **Discussion and Closing TSG 1**

TSG2: Mathematics Education at Tertiary Level

Chair: Ghislaine Gueudet (University of Western Brittany, France)
Co–chair: Irene Biza (University of East Anglia, UK)
Team members: Rongrong Cao (Qingdao University, China), Victor Giraldo (Universidade Federal do Rio de Janeiro, Brazil), Azimeh Khakbaz (Bu–Ali Sina University, Iran)
IPC Liaison Person: Frode Rønning (Norway)

Session I

July 13, 19:30–21:00 **Location: T116**

19:30–19:40 **Introduction to the Work of the TSG 2**

19:40–20:10 **Ignasi Florensa[1], Marianna Bosch[2]** ([1]Escola Universitària Salesiana de Sarrià, EUSS, Universita Autònoma de Barcelona, Spain; [2]IQS School of Management, Universita Ramon Llull, Spain)
Transition between Paradigms in the University: The Role Played by the Theoretical Framework

20:10–20:25 **Marjorie Sarah Kabuye Batiibwe** (Makerere University, Uganda)
The Quality of Mathematics Teacher Education at Tertiary Level in Uganda: Is It Relevant for 21rst Century Mathematics Teachers?

20:25–20:40 **Elena Nardi[1]**, Irene Biza[1], Bruna Moustapha–Corrêa[2], Evi Papadaki[1], Athina Thoma[1] ([1]University of East Anglia, UK; [2]Universidade Federal do Estado do Rio de Janeiro, Brazil)
From Student Scribbles to Institutional Script: Towards a Commognitive Research and Reform Programme for University Mathematics Education

20:40–20:50 **Antonio Salinas Layana[1]**, Sergio Celis[2], Farzaneh Saadati[2] ([1]Universidad de Chile, Chile; [2]Centro de Investigación Avanzada en Educación (CIAE), Chile)
From a "Strict and Scary" Class to the "Active and Favorite" Subject: A Long–Lasting Change in the Teaching of Mathematics at a First Year Military School in Chile

20:50–21:00 **Fei Xue[1]**, Robert Nanna[2] ([1]University of Hartford, USA; [2]Massachusetts Maritime Academy, USA)
Flipping a General Education Mathematics Course

Session II

July 14, 19:30–21:00 **Location: T226**

19:30–19:40 **Introduction to Session 2, Presentation of Posters**

19:40–19:55 **Alon Pinto**, Hadas Levi Gamlieli, Boris Koichu (Weizmann Institute of Science, Israel)
The Secondary–Tertiary Transition: An International Perspective on Where We Are and How to Move Forward

19:55–20:10 **Mariana Levin[1]**, John P. Smith III[2], Shiv S. Karunakaran[2], Valentin A.B. Küchle[2], Sarah Castle[2] ([1]Western Michigan University, [2]Michigan State University, USA)
Conceptualizing Agency and Autonomy in Tertiary Mathematics

20:10–20:20 **Jokke Häsä**, Johanna Rämö & Juulia Lahdenperä (University of Helsinki, Finland)
Comparing Two Self–Assessment Models in a Mathematics Course – An Exploratory Study

20:20–20:30 **Kimberly Cervello Rogers[1]**, Sean P. Yee[2], Jessica Deshler[3], Robert Petrulis[4] ([1]Bowling Green State University, USA; [2]University of South Carolina, USA; [3]West Virginia University, USA; [4]Evaluation, Policy, and Research in Education Consulting, USA)
Instructors, Mentors, and Students: A Cross–Comparison of Perceptions of Student–Centered Instruction

20:30–20:40 **James Sandefur**, Michael Raney, Erblin Mehmetaj, David Ebenbach (Georgetown University, USA)
Mentoring of Mid–Career and Early–Career Faculty

20:40–20:50 **Gloria Inés Neira Sanabria** (Universidad Distrital Francisco José de Caldas, Colombia)
An Approach to Transition of Mathematics of Secondary to Tertiary Level Mathematics

20:50–21:00 **Behailu Mammo[1]**, Signe E. Kastberg[2] ([1]Hofstra University, USA; [2]Purdue University, USA)
The Relational Nature of Supports for High Priority Mathematics Students

TSG

Session III

July 16, 21:30–23:00 **Location: T116**

21:30–21:40 **Introduction to Session 3, Presentation of Posters**

21:40–21:55 **Derek A. Williams**[1], Jonathan López Torres[2], Emmanuel Barton Odro[1] ([1]Montana State University, USA; [2]North Carolina State University, USA)
Characteristics of Collective Mathematical Activity Associated with States of Student Engagement

21:55–22:10 **Laura Watkins**[1], Irene Duranczyk[2], Vilma Mesa[3], April Ström[4] ([1]Glendale Community College, USA; [2]University of Minnesota, USA; [3]University of Michigan, USA; [4]Chandler–Gilbert Community College, USA)
Investigating Mathematical Knowledge for Teaching and Quality of Instruction in US Community Colleges.

22:10–22:20 **Kanita K. DuCloux**[1], Corey M. Wadlington[2] ([1]Western Kentucky University, USA; [2]West Kentucky Community and Technical College, USA)
A Comparison of Prospective Mathematics Teachers' Conceptualizations of Equity: Two Different Contexts

22:20–22:30 **Cydara Cavedon Ripoll**, Luisa Rodríguez Doering (UFRGS – Universidade Federal do Rio Grande do Sul, Brasil)
The Double Discontinuity in Teacher Education – How to Face It?

22:30–22:40 **Megan Wawro**[1], John Thompson[2], Kevin Watson[1] ([1]Virginia Tech, USA; [2]University of Maine, USA)
Student Reasoning about Eigenequations in Mathematics and Quantum Mechanics

22:40–22:50 Michelle Morgan, **Jeffrey J. King** (Western Colorado University, USA)
Bullseyes and Circles: Alternative Scoring Practices in Collegiate Mathematics Courses

22:50–23:00 **Philip Uri Treisman** (The University of Texas at Austin, USA)
Remediation Reform in United States Tertiary Education: From Scaling Innovations to Innovation at Scale

Session IV

July 17, 14:30–16:30 **Location: T116**

14:30–14:40 **Introduction to Session 4, Preparation for the Synthesis**

14:40–14:50 **Ajit Kumar**[1], S. Kumaresan[2] ([1]Institute of Chemical Technology, Mumbai, INDIA; [2]MTTS TRUST, Hyderabad, INDIA)
Success of Mathematics Training and Talent Search Programme in India

14:50–15:00 Max Hoffmann, **Rolf Biehler** (Paderborn University, Germany)
Geometry for Student Teachers – A Capstone Course in Mathematics with a Multitude of Links to School Mathematics

15:00–15:10 **Tika Ram Pokhrel**, Parames Laosinchai (Mahidol University, Salaya, Thailand)
An Innovative Hands–on Activity to Facilitate the Learning of Group of Symmetries in Abstract Algebra

15:10–15:20 **Andrea Cárcamo**, Claudio Fuentealba (Universidad Austral de Chile, Chile)
Errors of Engineering Students on the Vector Subspace Concept

15:20–15:30 **Helena Johansson**, Magnus Oskarsson, Hugo von Zeipel (Mid Sweden University, Sweden)
Engineering Students' Approach to Studying Mathematics and its Influence on their Achievement

15:30–15:40 **Robin Göller** (Leuphana University of Lüneburg, Germany)
First Year University Students' Goals and Strategies

15:40–15:55 **Zeger–Jan Kock**[1], Birgit Pepin[1], Domenico Brunetto[2] ([1]Eindhoven University of Technology, Eindhoven School of Education, The Netherlands; [2]Politecnico di Milano, Department of Mathematics, Milano, Italy)
How University Students Perceive the Importance of Resources to Study Calculus and Linear Algebra

15:55–16:10 **Lara Gildehaus**, Michael Liebendörfe (Paderborn University, Germany)
Gendered Patterns in University Students' Use of Learning Strategies for Mathematics

16:10–16:30 **Synthesis of the TSG2 Works and Conclusions**

TSG3: Mathematics Education for Gifted Students

Chair: Florence Mihaela Singer (University of Ploiesti, Romania)
Co–chair: Alex Friedlander (Weizmann Institute of Science, Israel)
Team members: Viktor Freiman (Université de Moncton, Canada), Alex Golovin (Saint Petersburg Lyceum 239, Russia), Qiusheng Li (The High School Affiliated to Renmin University of China, China)
IPC Liaison Person: Ivan Yashchenko (Russia)

Session I

July 13, 14:30–16:30 **Location: W211**

14:30–14:40 **Hiroko Kawaguchi Warshauer**, Michael Hicks, Max Warshauer (Texas State University, San Marcos, US)
Student Perceptions of Support Provided by a Summer Math Camp

14:50–15:10 **Atsushi Tamura** (Iwate Prefectural University, Takizawa, JP)
Derivation of Regression Equations Predicting Japan Mathematical Olympiad Preliminary Qualifiers from within Arbitrary Groups

15:10–15:30 **Florence Mihaela Singer**, Cristian Voica (Petroleum Gas University of Ploiesti, Romania)
How do Math Students Use Informal Representations? A Comparison Between Gifted and Not Gifted

15:30–15:40 **Viktor Freiman**, Jacques Kamba (Universite de Moncton, Moncton, CA)
Role of Peer and Teacher Recognition for Students Talents in STEM Projects

15:40–15:50 **Aleksandr Vasilevich Iastrebov** (Yaroslavl State Pedagogical University, Yaroslavl, RU)
School Stages of Educating the Mathematician–Investigator

15:50–16:00 **Odelya Uziel**, Miriam Amit (Ben–Gurion University of the Negev, Beer–Sheva, IL)
Problem Solving and Creativity among Talented Students from a Multi–Age Perspective

16:00–16:10 **Matthias Simon Brandl**, Attila Szabo, Elisabeth Mellroth, Ralf Benölken (University of Passau, DE)
Educating Prospective Teachers in the Field of Mathematical Giftedness–Comparing Experiences

16:10–16:20 **Sharon Whitton** (Hofstra University, Northport, US)
Pedagogy for Developing the Mathematical Talents and Creativity of Gifted Secondary Students

16:20–16:30 **Ralf Benoelken**, Daniela Assmus (University of Wuppertal, DE)
What do Prospective Teachers Express as to Mathematical Giftedness? An Exploratory Study

Session II

July 14, 19:30–21:00 **Location: W211**

19:30–19:50 **Marianne Nolte** (Faculty of Education, Hamburg, DE)
Questions about the Identification of Mathematically Gifted Students

19:50–20:10 **Patricia Edith Guillen Aparicio**, Norma Fuentes Supanta De Fukunaga (Universidad De San Martn De Porres, Lima, PE)
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

20:10–20:20 **Michael Kainose Mhlolo** (Central University of Technology, Bloemfontein, ZA)
Egalitarianism in Inclusivity: Thwarting the Intellectual Growth of Mathematically Gifted Students in South African Schools

20:20–20:30 **Mirjam Harkestad Olsen**, Anita Movik Simensen (UiT The Arctic University of Norway, Alta, NO)
Learning Opportunities for Mathematically Gifted Pupils in Inclusive Settings

20:30–20:40 **Xue Suyue** (Soochow University, Suzhou, CN)
Thoughts on the Elite Mathematics Education of Middle School in China

20:40–21:00 **Discussion**

Session III

July 17, 21:30–23:00 **Location: W211**

21:30–21:40 **Bostjan Kuzman**, Mojca Juriševič, Urška Žerak (University of Ljubljana, Ljubljana, SI)
Activities for the Mathematically Gifted and Their Evaluation in Slovenia

21:40–21:50 **Sara Hinterplattner**, Zsolt Lavicza, Marca Wolfensberger (JKU Linz, Linz, AT)
Using Interdisciplinary Problem Posing to Promote Gifted Students in the Regular Classroom

21:50–22:00 **Ban Har Yeap** (Pathlight School, Singapore, SG)
Mathematically Gifted Students: Challenges and Opportunities in the Primary Years

22:00–22:10 **Chan Xiangrui** (Northeast Yucai School, Shenyang, CN)
Discovering and Educating the Gifted Students with Excellent Problems

22:10–22:15 **Yanchun Liu** (Dezhou No.2 Experimental Primary School, CN)
Mathematical Culture and Teaching of Equation

22:15–22:20 **Hideyo Makishita** (Shibaura Institute of Technology, Tokyo, JP)
Study of Construction by Quadratic Curve Addition Method

22:20–22:25 **Alena Witte**, Franziska Strübbe (WWU Muenster, DE)
Intuitive Sense Constructions of Children with Mathematical Giftedness

22:25–22:30 **Lea Martina Schreiber**, Philipp Guillaume Girard, Yannick Ohmann, Julia Kaiser, Wiebke Auhagen, Friedhelm Käpnick (WWU Muenster, Dusseldorf, DE)
'LemaS'–A Joint Initiative of Government and Germanys Federal States to Foster High–Achieving and Potentially Gifted Pupils

22:30–22:35 **Mirela Vinerean Bernhoff**, Yvonne Liljekvist, Elisabet Mellroth (Karlstad University, Karlstad, SE)
University Students' Self–evaluation: Digital Solutions for Identifying Highly Motivated Students

22:35–22:40 **Yuwen Li** (Karlstad University, Karlstad, SE)
Experimental Study on Intellectual Development in Elementary School Students

22:40–23:00 **Discussion**

TSG4: Mathematics Education for Students with Special Needs

Chair: Michelle Stephan (University of North Carolina at Charlotte, USA)
Team members: Anette Bagger (University of Umeå, Sweden), Juuso Nieminen (University of Eastern Finland, Finland), Yanping Xin (Purdue University, USA)
IPC Liaison Person: Caroline Lajoie (Canada)

Session I

July 13, 19:30–21:00 **Location: T218**

19:30–19:35 **Welcome to the TSG**

19:35–20:00 (15min+ 10min discussion) **Gervasoni, A.**, Roche, A.
Long Oral Presentation 1: Mathematics Learning Difficulties? The Impact of a Constructivist Oriented Approach to Intervention for Young Learners Who Struggle the Most

20:00–20:10 **Xin, Y. P.**, Kim, S. J., Liu, B., Lei, Q., Wei, S., Wang, W., Richardson, S. E., Kastberg, S., & Chen, Y.
Short Oral Presentation 1: Conceptual Model–Based Problem–Solving Computer Tutor for Elementary Students Struggling in Mathematics

20:10–20:20 **Robyn Ruttenberg–Rozen**, Ann LeSage
Short Oral Presentation 2: Interventions in Micro–Spaces for Learners with Mathematics Difficulties

20:20–20:30 **Discussion of Short Orals**

20:30–20:40 **Haja–Becker, S.**
Short Oral Presentation 3: An Inclusive Child's Enactment to a Task in Dynamic Geometry Environment

20:40–20:50 **I. Polo–Blanco**, S. Van Vaerenbergh, M. J. González, A. Bruno
Short Oral Presentation 4: The Effect of Schema–based Instruction on the Resolution of Addition Problems by a Student with Autism Spectrum Disorder

20:50–21:00 **Discussion of Short Orals**

Session II

July 14, 19:30–21:00 **Location: T218**

19:30–19:40 **Armstrong, A.**
Short Oral Presentation 5: Emergent Technological Practices of Middle Year Students with Mathematical Learning Disabilities

19:40–19:50 **Nadine Da Costa Silva**
Short Oral Presentation 6: Introduction to Probability in an Inclusive Setting–insights by a Student with Learning Difficulties

19:50–20:00 **Sarah Van Ingen**, Samuel Eskelson, David Allsopp, Steffen Siegemund, Anna–Sophia Bock, Vera Lúcia Messias, Fialho Capellini, Ana Paula Pacheco Moraes Maturana, Di Liu
Short Oral Presentation 7: Preparing Teachers for Mathematics and Special Education Consultations. A Collaboration across Four Continents

20:00–20:15 **Discussion of Short Orals**

20:15–20:25 **Shemunyenge Taleiko Hamukwaya**
Short Oral Presentation 8: Criteria Used by Teachers to Identify Students with Difficulties in Learning Mathematics

20:25–20:35 **Juuso Nieminen**
Short Oral Presentation 9: Becoming a Mathematician: The Role of Learning Environments in the Identity Narratives of Mathematics Students with Learning Disabilities

20:35–20:45 **Patricia Baggett**
Short Oral Presentation 10: Tactile Drawings and 3–D Objects: Two Keys to Geometry for a Blind Student in an Inclusion University Course for Preservice K–8 Teachers

20:45–21:00 **Discussion of Short Orals**

TSG

Session III

July 16, 21:30–23:00 **Location: T218**

21:30–21:55 (15min+ 10min discussion) José Ignacio Cogolludo–Agustín, **Gil–Clemente E.**, Ana Millán Gasca
Long Oral Presentation 2: Arithmetical Achievements of Children with Trisomy 21 Supported on Geometrical Basis

21:55–22:05 **Jessica Hunt**, Kristi Martin
Short Oral Presentation 11: Intervention Based on Mathematical Thinking Improves Student Outcomes: Math Disabilities and Difficulties

22:05–22:15 **Anette Bagger**, Alexis Padilla, Paulo Tan
Short Oral Presentation 12: Beyond Ability Rankings: Educational Assessment as Relational Rigor and Accountability

22:15–22:25 **Discussion of Short Orals**

22:25–22:35 **Marcon Mello, E.**
Short Oral Presentation 13: Mathematics and Blind Students: The Problem of Representations

22:35–22:45 **Chi To Lui**, Ida Ah Chee Mok
Short Oral Presentation 14: Mathematics Difficulty of Students with Special Needs from the Perspective of Memory Theories

22:45–23:00 **Discussion of Short Orals**

Session IV

July 17, 14:30–16:30 **Location: T218**

14:30–14:55 (15min+ 10min discussion) Julie Vangsøe Færch, Signe Gottschau Malm, **Steffen Overgaard**
Long Oral Presentation 3: A Teacher's Attitude and Approaches to High and Low Achieving Students

14:55–15:05 **Christopher Kurz**
Short Oral Presentation 15: Mathematical Literacy Citizenship: Deaf and Hard–of–hearing Experience

15:05–15:15 **Caroline Hilton**
Short Oral Presentation 16: Using Fingers for Arithmetic Calculations in Children with Complex Hand Anomalies

15:15–15:25 **A. van Leendert**, M. Doorman, J. Pel, J. van der Steen
Short Oral Presentation 17: The Variety of Mathematical Braille Notations and Their Underlying Principles

15:25–15:40 **Discussion of Short Orals (15 min)**

15:40–16:10 **General Discussion of the Field**

16:10–16:30 **Conclusion of TSG 4**

TSG

TSG5: Teaching and Learning of Number and Arithmetic

Chair: Andrea Peter–Koop (Bielefeld University, Germany)
Co–chair: Arthur Powell (Rutgers University, USA)
Team members: Rui Ding (Northeast Normal University, China), Rose Griffiths (University of Leicester, UK)
IPC Liaison Person: Yufeng Guo (China)

Session I (a)

July 13, 14:30–16:30 **Location: T218**
Moderator: Arthur Powell

14:30–14:45 **Samantha Morrison** (University of the Witwatersrand, South Africa)
Representational Flexibility Linked to Higher Attainment in Early Number Learning

14:45–14:55 **Yuan Yuan**, Kuolong Chen (Chung Yuan Christian University, China)
A 3–year Study of the Number Estimation Ability of Early Child and Its Relationship to Number Sense

14:55–15:05 **Andrea Peter–Koop** (Bielefeld University, Germany)
School–readiness in Mathematics: Development of a Screening Test for Children Starting School

15:05–15:20 **Herman M. Tshesane** (Wits, South Africa)
South African Learner's Patterns of Performance on Additive Word Problems

15:20–15:30 **Discussion of Presented Papers**

15:30–15:40 **Sameera Hansa**, Hamsa Venkat (University of Witwatersrand, South Africa)
Identifying South African Primary Learners Doubling and Halving Reasoning through a Written Assessment

15:40–15:50 **Luciana Vellinho Corso**[1], Sula Cristina Teixeira Nunes[1], Évelin Fulginiti de Assis[2]
([1]Universidade Federal do Rio Grande do Sul, Brazil; [2] Porto Alegre, Brazil)
Flexible Mental Calculation: A Study with 2nd and 4th Grade Brazilian Students

15:50–16:00 **Évelin Fulginiti de Assis**[2], Sula Cristina Teixeira Nunes[1], Luciana Vellinho Corso[1]
([1]Universidade Federal do Rio Grande do Sul, Brazil; [2] Porto Alegre, Brazil)
The Flexibility in Mental Calculation: Characterizing the Profiles of a Group of Brazilian Elementary Students

16:00–16:10 **Beatriz Vargas Dorneles**, Camila Peres Nogues, Elielson Magalhães Lima (Universidade Federal do Rio Grande do Sul, Brazil)
Precursors of Problem–solving in Two Brazilian Cities: The Role of Social and Economic Differences

16:10–16:20 **Camila Peres Nogues**, Elielson Magalhães Lima, Beatriz Vargas Dorneles (Universidade Federal do Rio Grande do Sul, Brazil)
The Performance in Domain–specific Cognitive Abilities among Low and Typical Mathematical Achievers

16:20–16:30 **Discussion**

Session I (b)

July 13, 19:30–21:00

Location: T230
Moderator: Andrea Peter–Koop

21:30–21:45 **Ron Tzur** (University of Colorado Denver, USA)
Toward a Universal Cognitive Core: A Cross–Cultures (USA, China) Progression in Multiplicative Reasoning

21:45–22:00 **Ola Helenius**, Linda Marie Ahl (University of Gothenburg, Sweden; Kriminalvrden, Sweden)
The Case against Coherence in Mathematics Instruction

22:00–22:10 **Sandra Gleissberg, Li Ang**, Klaus–Peter Eichler (University of Education, Germany; Nord University, Norway)
The Offer of Tasks to Work on Multiplication in Grades 2 And 3 – A Comparison between Chinese and German Teaching Materials

22:10–22:20 **Discussion of Presented Papers**

22:20–22:30 **Karl Wesley Kosko** (Kent State University, USA)
The Influence of Visual Models for Assessing Children's Multiplicative Reasoning

22:30–22:40 **Mayamiko Malola** (The University of Melbourne, Australia)
The Use of Arrays in Solving Multiplication Word Problems in Grade 4

22:40–22:50 **Alina Galvao Spinillo,** Lianny Melo, Juliana Ferreira Gomes Da Silva (Federal University

TSG

of Pernambuco, Brazil)
How the Presentation of Problem–solving Situations Affects Combinatorial Reasoning in Children

22:50–23:00 **Discussion**

Session II

Location: T230

July 14, 19:30–21:00

Moderator: Rui Ding

19:30–19:45 **Coulange Lalina**, Gregory Train (University of Bordeaux, France)
Reasoning and Comparing Fractions

19:45–19:55 **Arthur Belford Powell**, Kendell V. Ali (Achva Academic College, Israel)
Proving Student Knowledge of Fraction Magnitude in the Early Grades

19:55–20:05 **Raisa Guberman**, Meital Galili (Universidad De San Martn De Porres, Lima, PE)
Insights from a Re–teaching Process: Comparing Fractions Using the Problem–solving

20:05–20:12 **Discussion of Presented Papers**

20:12–20:22 **Nor' Arifahwati Abbas**, Masitah Shahrill, Mohd Khairul Amilin Tengah, Nor Azura Abdullah (UBD, Universiti Brunei Darussalam, Brunei)
Conceptual and Procedural Understanding on Addition of Fractions among Year 5 Primary Children

20:22–20:32 **Rodrigo Vargas Farias**, Ruth Galindo Navarro (Universidad De Playa Ancha Campus San Felipe, Chile)
Mistakes and Opportunities in the Teaching Learning Process of Rational Number

20:32–20:42 **MarÍA Leticia RodrÍGuez GonzÁLez** (C CINVESTAV–IPN, Mexico)
Students Performance When Solving Word Problems Involving Fractions

20:42–20:52 **Özdemir Tiflis**, Gwen Ireson (Brunel University London, UK)
Errors in Ratio and Proportion: A Framework for Analysis

20:52–21:00 **Discussion of Presented Papers**

Session III

Location: T218

July 17, 21:30–23:00

Moderator: Arthur Powell

21:30–21:40 **Judy Sayers**, Jöran Petersson, Eva Rosenqvist, Paul Andrews (University of Leeds, UK)
English and Swedish Year–one Teachers Aims for the Teaching of Number: Culturally Situated Norms

21:40–21:50 **Krista Francis, Sharon Friesen**, Miwa Takeuchi, Armando Paulino Preciado Babb, Barb Brown (Werklund School of Education, University of Calgary, Canada)
Elementary Teacher Professional Learning to Explore and Extend Nuanced Meaning of Number

21:50–22:00 **Moshe M Phoshoko**, Ramashego Mphahlele (Department of Mathematics Education, South Africa)
Student Teachers' Representation of Numbers and Their Operations on a Number Line

22:00–22:10 **Xinyi Zhou**, Zikun Gong, Min Wang (Hangzhou Normal University, China)
A Comparative Study on Representations of Rationale of Fraction Division: Teachers' Choice between China and America

22:10–22:15 **Discussion of Presented Papers**

22:15–22:25 **Daniela Fernandes**, Jeanne Koudogbo (Universite De Sherbrooke, Canada)
Difficulties of Learning the Decimal Positional Numeration (DPN) System: The Principle of Exchange

22:25–22:35 **Jeanne Koudogbo** (University of Sherbrooke, Canada)
Decimal Number System in Quebec Mathematics Program and in Textbooks: What Knowledge and for Which Mathematical Education

22:35–22:45 **Anat Even–Zahav**, Philip Slobodsky (Talpiot College of Education, Israel; Halomda Educational Software, Israel)
Teaching Arithmetic and Fractions Based on Inherent Gamification: The Case of Domino–math Approach

22:45–22:55 **Xiaowen Cui**, Hiroko Kawaguchi Warshauer, M. Alejandra Sorto (Texas State University, USA)
Exploring the Thematic Coherence of a Chinese Lesson on the Topic of Unit–Fractions

22:55–23:00 **Discussion of Presented Papers**

TSG6: Teaching and Learning of Algebra at Primary Level

Chair: Jodie Hunter (Massey University, New Zealand)
Co–chair: Doris Jeannotte (Université du Québec à Montréal, Canada)
Team members: Ann Gervasoni (Monash University, Australia), Eric Knuth (The University of Texas at Austin, USA), Xiaoyan Zhao (Nanjing Normal University, China)
IPC Liaison Person: Caroline Lajoie (Canada)

Session I

July 13, 19:30–21:00 **Location: W301**

No.1 **Francesca Gregorio**
Mathematical Learning Disabilities in Algebra

No.2 **Yuriko Yamamoto Baldin**
The Pedagogical Journey from Arithmetic to Algebraic Reasoning in a Professional Development Project through the Theme of Fractions

No.3 **Strachota, Morton,** Torres, Stephens, Sung, Gardiner, Blanton, Stroud, Knuth
Generalizing about Odd and Even Numbers

No.4 **Jana Trgalova**, Mohammad Dames Alturkmani, Sophie Roubin
Toward a Common View of Algebraic Thinking through Design of Resources by Primary and Secondary Teachers

Session II

July 16, 21:30–23:00 **Location: W301**

No.1 **Passaro, Polotskaia**, Javaherpour Azadeh
Cognitive Routes of Algebraic Thinking in Pre–School and Elementary School: Literature Review

No.2 **Doris Jeannotte**, Hassane Squalli
Highlighting the Potential for Developing Early Algebraic Thinking: A Praxeological Framework of Reference

No.3 **Yoshiki Nisawa**
Poster Presentation

No.4 **Adam Ross Scharfenberger**
Poster Presentation

No.5 **Jeongsuk Pang**, Jin Sunwoo (Invited Presentation)
Development and Implementation of the Unit of Pattern and Correspondence to Foster Functional Thinking

Session III

July 17, 14:30–16:30 **Location: W301**

No.1 **Celia Maria Mestre**
The Relation between the Evolution of Generalization and the Development of Relational Thinking and Functional Thinking: A Study with Grade 4 Students

No.2 **Lorena Trejo Guerrero**

Arithmetic Problems with Natural Numbers in a Multi–Grade Primary School

No.3 **Siyu Sun**
Investigating Early Algebraic Thinking in Primary School: An Empirical Study from China

No.4 **Gervasoni & Roche**
Multiplication and Division Problems as a Context For Developing Young Children's Algebraic Thinking

No.5 **Jodie Louise Miller**, Jodie Hunter
Young Students Noticing and Generalising Growing Pattern Tasks

No.6 **Lorraine Day**, Max Stephens, Marj Horne
Designing an Evidence–Based Learning Progression for Algebraic Reasoning

No.7 **Pearn**
Fraction Tasks Which Identify Algebraic Reasoning

TSG7: Teaching and Learning of Algebra at Secondary Level

Chair: Boon–Liang Chua (National Institute of Education, Singapore)
Team members: Levi Elipane (Philippine Normal University, Philippines), Yali Pang (Shanghai Normal University, China), Michael Steele (University of Wisconsin–Milwaukee, USA)
IPC Liaison Person: Daniel Chazan (USA)

Session I

July 13, 14:30–16:30 **Location: T120**

14:30–14:40 **Welcome and housekeeping matters by Chair of TSG7**
Session Chair then takes over. (Session Chair: Dr. Levi Elipane)

14:40–15:00 **Demonty Isabelle[1],** Vlassis Joëlle[2] (University of Liège/Department of psychology, Speech Therapy and Education Sciences/ Research Unit EQUALE (Evaluation and quality of teaching), Belgium[1]**;** University of Luxemburg/Faculty of Humanities, Education and Social Sciences/Department of Education and Social Work, Luxembourg[2]**)**
Knowledge for Teaching Algebra: Variation in the Use of Knowledge in the Light of Classroom Constraints

15:00–15:20 **Klila Copperman[1],** Anatoli Kouropatov[2] **(**Jerusalem College of Technology, Israel[1], Levinskey College of Education, Israel[2])
Constructing the Link between Graphical Visualization and Algebraic Computation by Means of Analogy: The Case of a System of Equations

15:20–15:30 **Jiqing Sun** (Deakin University, Australia)
Using an Online Card Game–Based Activity to Build Algebra Foundation

15:30–15:40 **Al Jupri** (Department of Mathematics Education, Universitas Pendidikan Indonesia, Indonesia)
Investigating Students' Algebraic Proficiency from a Symbol Sense Perspective

15:40–15:50 **Mukunda Prakash Kshetree** (Tribhuvan University, M. R. Campus (Dept of Maths Ed), Kathmandu, Nepal)
Diagnosis and Treatment of Students' Algebraic Misconceptions and Errors

15:50–16:00 **Aline Dorimana[1],** Alphonse Uworwabayeho[2] and Gabriel Nizeyimana[2] (University of Rwanda College of Education/ African Center of Excellence for Innovative Teaching and Learning Mathematics and Science (ACEITLMS), Rwanda[1]; University of Rwanda College of Education, Rwanda[2])
Examining the Quality of Classroom Interactions in the Teaching of Algebra for Upper Secondary Schools

16:00–16:20 **Q & A for Short Oral**

16:20–16:30 **Sum Up and Closure of Session 1**

Session II

July 14, 19:30–21:00 **Location: T120**

19:30–19:40 **Housekeeping Matters by Session Chair (Dr. Yali Pang)**

19:40–20:00 **Lori Burch**, Erik Tillema (Indiana University Bloomington, United States of America)
Generalization as a Marker for Robust Mathematical Meanings among In–Service Algebra Teachers

20:00–20:20 **Robert Powers**[1], Alees Lee[1], Melissa Troudt[2], & Jodie Novak[1] (University of Northern Colorado, United States of America; University of Wisconsin – Eau Claire, United States of America)
Student Knowledge of Exponential Functions

20:20–20:30 **Vlassis Joëlle**[1], Demonty Isabelle[2] (University of Luxemburg, Luxemburg, Faculty of Humanities, Education and Social Sciences, Department of Education and Social Work, Luxembourg; University of Liège, Department of psychology, Speech Therapy and Education Sciences, Research Unit EQUALE, Belgium)
The Importance of Teacher–Student Interactions in Mathematical Learning: The Example of Generalization

20:30–20:40 **Zwelithini Dhlamini** (Department of Mathematics Science and Technology Education, South Africa)
Learners' Number Patterns Generalizations in a South African Evaluative Assessment

20:40–20:50 **Q & A for Short Oral**

20:50–21:00 **Sum Up and Closure 0f Session 2**

Session III

July 17, 21:30–23:00 **Location: T120**

21:30–21:40 **Housekeeping matters by Session Chair, Dr. Michael Steele**
Introduction of Invited Speaker by Session Chair

21:40–22:10 **Noemí Ruiz–Munzón**[1]**,** Marianna Bosch[2], Josep Gascón[3] (Universitat Pompeu Fabra–Tecnocampus, Spain; Universitat Ramon Llull, Spain; Universitat Autònoma de Barcelona, Spain)
Thinking about Algebra from the Anthropological Theory of the Didactic: Reference Models for the Analysis and the Design

22:10–22:20 **Laurie Cavey**, Tatia Totorica, Patrick Lowenthal (Boise State University, United States of America)
Students' Unconventional Graphical Representations of Covariational Reasoning

22:20–22:30 **Zachary Stepp** (School of Teaching and Learning, College of Education, University of Florida, United States of America)
The Impact of an Online Learning Platform in Algebra

22:30–22:40 **Q & A for Short Oral**

22:40–23:00 **Sum up by Session Chair; Closure by TSG Chair**

TSG

TSG8: Teaching and Learning of Geometry at Primary Level

Chair: Nathalie Sinclair (Simon Fraser University, Canada)
Co–chair: Michael Battista (Ohio State University, USA)
Team members: Eszter Herendiné–Kónya (University of Debrecen, Hungary), Haiyue Jin (Nanjing Normal University, China)
IPC Liaison Person: Ewa Swoboda (Poland)

Session I

July 13, 19:30–21:00 **Location: T120**

19:30–19:40 **Introduction to the Group Michael Battista (Chair)**

19:40–20:05 **Tomoko Yanagimoto**, Akiyo Higasio, Madoka Koyama, Hisashi Kinoshita, Moe Miyazaki
Mathematical Knots as a Teaching Material to Improve Pupils Spatial Abilities in Elementary School

20:05–20:30 **Eszter Herendiné–Kónya**
The Transition from Informal to Formal Area Measurement

20:30–20:45 Paolo Bellingeri, **Emmanuelle Feaux De Lacroix**, Eric Reyssat, Andre Sesboue
Tilings and Symmetry Using the Labosaique

20:45–21:00 **Nazlı Akar**, Mine Işıksal Bostan
The Knowledge to Be Taught: A Novice Mathematics Teacher Plans to Teach Quadrilaterals in 5th Grade

Session II

July 16, 21:30–23:00 **Location: T120**

21:30–21:40 **Opening Remarks**
Nathalie Sinclair

21:40–22:05 **Catherine Diane Bruce**, Zachary Hawes, Tara C Flynn
Supporting the Development of Young Children's Spatial Reasoning: Insights from the Math for Young Children (M4yc) Project

22:05–22:30 **Guenter J. Maresch**
The Basic Routines of Spatial Thinking and Acting

22:30–22:45 Jean–Luc Dorier, **Sylvia Coutat**
Developing Spatial Abilities and Geometrical Knowledge with Use of a Virtual City

22:45–23:00 **Elisabeth Mantel**
Understanding Path Descriptions in a Manhattan–Like Map – A Comparison of German 2nd and 3rd Graders

Session III

July 17, 14:30–16:00 **Location: T120**

14:30–14:40 **Introduction to Session 3, Presentation of Posters**

14:40–15:05 **Ann Patricia Downton**
Impact of Teacher Professional Learning on Students Geometric Reasoning Relating to Prisms

15:05–15:30 **Shweta Sharma**
Unpacking Language in Geometry Lesson on Shapes in a New Zealand Multilingual Primary Class

15:30–15:55 **Taro Fujita**, Yutaka Kondo, Hiroyuki Kumakura, Susumu Kunimune, Keith Jones
Spatial Visualisation Reasoning about 2d Representations of 3d Geometrical Shapes: The Case of G4–6

15:55–16:10 **Yan–Hong Chen**
Exploring Second Graders Performances on Reading Comprehension of Mathematics Picture Book with Words and No–Word

16:10–16:25 **Jinyu Yu**
Implementing the Project–Based Approach in Teaching the Area of Circle: An Explorative Study

16:25–16:30 **Open Discussion**

TSG9: Teaching and Learning of Geometry at Secondary Level

Chair: Keith Jones (University of Southampton, UK)
Co–chair: Matthias Ludwig (Goethe University Frankfurt, Germany)
Team members: Liping Ding (Norges Teknisk–naturvitenskapelige Universitet, Norway), Joris Mithalal (University of Lyon, France), Yiling Yao (Hangzhou Normal University, China)
IPC Liaison Person: Maria Alessandra Mariotti (Italy)

Session I

July 13, 14:30–16:30 **Location: T523**

14:30–14:32 **Introduction**

14:32–14:44 **Marjorie Helen Horne**
Reasoning in Geometry in the Middle Years

14:44–14:49 **Elvira Garcia–Mora**
Didactic Suitability Characterization of Three Levels of Achievement on Geometric Drawing of Secondary School Students

14:49–14:54 **Judah Paul Makonye**
High School Learners' Preconceptions on the Classification of Quadrilaterals

14:54–15:00 **Discussion + Change**

15:00–15:12 **Alain Kuzniak**
Towards a Compliant and Correct Geometric Work in Context of Use of Classical and Digital Geometric Tools

15:12–15:17 **Feishi Gu**
Geometric Reasoning and Mechanics Experiment: A Case Study of Interdisciplinary Integration Teaching with Graphic Center of Gravity as an Example

15:17–15:21 **Discussion + Change**

15:21–15:26 **Zhikun Zhang**
A Study on the Performance of Seventh–grade Students in Mathematical Spatial Reasoning Tasks

15:26–15:31 **Yutaka Kondo**
Spatial Visualisation Reasoning about 2D Representations of 3D Geometrical Shapes: Case of G7–9

15:31–15:36 **Marion Zoeggeler**
Students Spatial Ability and Solving–strategies for Spatial Geometrical, Mathematical, and Physical Task

15:36–15:42 **Discussion + Change**

15:42–15:47 **Ken–ichi Iwase**
Let's Make a Circle by Three Persons

15:47–15:52 **Edwin Gerardo Acuna**
Workshop Geometry of the Space Illusions and Optical Analysis the Beauty and the Observation of the Geometry of the Space

15:52–15:57 **Melih Turgut**
Implicative Relationships among Spatial Perception, Mental Rotation and Spatial Visualisation: Implications for Teaching Geometry

15:57–16:00 **Discussion**

Session II

July 13, 19:30–21:00 **Location: T234**

19:30–19:31 **Introduction**

19:31–19:36 **Edward Southall**
Constructions: Alternative Approaches to Compass and Straight Edge Tasks

19:36–19:41 **Tsuyoshi Sonod**
Study of Angles and Trigonometric Ratio for 7th Grade

19:41–19:47 **Discussion + Change**

19:47–19:52 **Yuki Osawa**
Inquiry–based Learning Using the Centroids of the Circumscribed Equilateral Triangles

19:52–19:57 **Oi–Lam Ng**
Learning Circle Properties in Dynamic Geometry Environments: A Commognitive Perspective

19:57–20:04 **Discussion + Change**

20:04–20:09 **Ryoto Hakamata**
Possibility of the Pirates Treasure Problem for Teaching Elementary Geometry

20:09–20:14 **Eszter Varga**
Distance Under the Magnifying Glass: Developing Series of Problems around Fundamental Concepts in Geometry

20:14–20:19 **Matthias Ludwig**
Geometry Modelling Outdoors with MATHCITYMAP

20:19–20:30 **Discussion + Summary**

Session III

July 14, 19:30–21:00 **Location: T523**

19:30–19:33 **Introduction**

19:33–19:45 **Alik Palatnik**
Introduction of an Auxiliary Element as a Shift of Attention

19:45–19:50 **Benjamin James Waine**
An Unexpected Angle to Teaching Congruent Triangles

19:50–19:55 **Melissa Denisse Castillo Medrano**
Reconfiguration of Polygons to Determine the Measurement of Their Area

19:55–20:03 **Discussion + Change**

20:03–20:15 **Yael Luz**
Online Formative Assessment in Geometry Proving

20:15–20:20 **Ali Simsek**
A Teacher's Use of Dynamic Digital Technology to Address Students' Misconceptions Concerning the Use of Additive Strategies within Geometric Similarity

20:20–20:28 **Discussion + Change**

20:28–20:40 **Michelle Cirillo**
Decomposing Proof in Secondary Classrooms: A Promising Intervention for School Geometry

20:40–20:45 **Jeong–Won Noh**
Learning the Proof Structure through Semiotic Mediation Using Diagrams

20:45–20:50 **Joris Mithalal**

Construction Program as a Link between Drawing and Language to Prepare Proof Process

20:50–21:00 **Discussion + Summary**

Session IV

July 17, 21:30–23:00 **Location: T523**

21:30–21:32 **Introduction**

21:32–21:42 **Li Hai**
The Grasp of the Pythagorean Theorem and Its Proof by Chinese Pre–service Mathematics Teachers

21:42–21:47 **Rocio Gallardo**
Fostering Geometric Reasoning

21:47–21:52 **Murat Akarsu**
A Pre–service Teacher Mental Structure Development for Understanding the Geometric Reflection in Terms of Motion and Mapping View: Alexis Case

21:52–21:58 **Discussion + Change**

21:58–22:08 **Jogymol Alex**
Teacher Knowledge Related to Secondary School Level Geometry: Evidence from Teacher Development in SA

22:08–22:13 **Svein Arne Sikko**
Understanding Student Teachers' Mathematical Knowledge for Teaching Geometry in a History of Mathematics Course

22:13–22:18 **Liping Ding**
Distinguishing Content Knowledge and Pedagogical Content Knowledge for Geometry Teaching

22:18–22:25 **Discussion + Summary**

22:25–22:30 **TSG summary**

TSG10: Teaching and Learning of Measurement

Chair: Christine Chambris (Cergy University, France)
Co–chair: Florent Gbaguidi (Institut de Mathématiques et de Sciences Physiques, Benin)
Team members: Paula Baltar (Universidade Federal de Pernambuco, Brazil), Richard Lehrer (Vanderbilt University, USA), Yuqian Wang (University of Durham, UK)
IPC Liaison Person: Ewa Swoboda (Poland)

Session I

July 13, 19:30–21:00 **Location: W107**

19:30–19:40 **Introduction and Overview of Three Sessions**

19:40–20:10 Bonissoni, Marina Cazzola, Gianstefano Riva, **Ernesto Rottoli**, Sonia Sorgato (Gruppo di Ricerca sull'insegnamento della matematica per la scuola primaria – Università Milano Bicocca, Italy)
Rethinking Measure

20:10–20:40 Chambris Christine[1], **Coulange Lalina[2]**, Train Grégory[2] ([1]CY Cergy Paris Université, Université de Paris, Univ Paris Est Creteil, Univ. Lille, UNIROUEN, LDAR, F–95000 Cergy–Pontoise, France; [2]Lab–E3D – Université de Bordeaux, France)
Measurement Units and Numeration Units: What Reveals the Introduction of a "Mixed" Table in Decimals Teaching

TSG

20:40–21:00 **Chaereen Han**, Oh Nam Kwon (Graduate School of Seoul National University and Seoul National University, Korea)
Teaching with Clocks: Instrumental Dynamics' Effects on Time Learning

Session II

July 16, 21:30–23:00 **Location: W107**

21:30–22:00 **Ishan Santra**, Jeenath Rahman (Homi Bhabha Centre for Science Education, TIFR, Mumbai, India)
The Role of Error in Measurement

22:00–22:20 **Liveness Mwale** (University of Malawi, Malawi）
An Investigation of Teachers' Explanatory Talk When Introducing Standard Units of Measuring Length to Standard 4 Learners in Malawi

22:20–22:30 **Phei Ling TAN**[1], Liew Kee KOR[2] ([1]Methodist Girls' School, Penang, Malaysia; [2]Universiti Teknologi MARA (UiTM), Kedah, Malaysia)
Insight into Pupils' Errors in Solving Problems Involving Calendar Dates Through Analysis of Knowledge States

22:30–23:00 **Russell Tytler**, Peta White, Joseph Ferguson (Deakin University, Melbourne, Australia)
Measuring the Teacher's Arm Span: Interpreting a Data Modeling Sequence Through an Aesthetic Lens

Session III

July 17, 14:30–16:30 **Location: W107**

14:30–14:40 **Samet Okumus** (Recep Tayyip Erdoğan University, Turkey)
Conceiving Volume as a Multiplication of Three Quantities: The Cases of Stan and Sloane

14:40–14:50 **Charlotte de Varent** (LDAR, SPHERE, Université de Paris, France)
Articulations Between Mathematics and Physics Education: The Concept(s) of Unit of Measurement, From Geometry to Formulas

14:50–15:10 **Gbaguidi Ahonankpon Florent** (Institut de Mathématiques et de Sciences Physiques, Benin)
The Use of Geometric Construction Problems to Solve Measurement Problems at Middle School

15:10–15:40 **Peta White**[1], Russell Tytler[1], Joanne Mulligan[2], Melinda Kirk[1] ([1]Deakin University; [2]Macquarie University, Australia)
Young Students Learning the Mathematics of Measurement through an Interdisciplinary Approach

15:40–16:10 **Richard Lehrer** (Vanderbilt University, The USA)
Introduction to Final Discussion: Epistemological Junctures and Synergies in Co–Disciplinary Experiences of Measure

16:10–16:30 **Final Discussion**

TSG

TSG11: Teaching and Learning of Probability

Chair: Egan Chernoff (University of Sasaktchewan, Canada)
Co–chair: Ernesto Sánchez (CINVESTAV, Instituto Politécnico Nacional, Mexico)
Team members: Kan Guo (Beijing Normal University, China), Sibel Kazak (Pamukkale University, Turkey), Ali Rejali (Isfahan University of Technology, Iran)
IPC Liaison Person: Celi Espasandin Lopes (Brazil)

Session I

July 13, 14:30–16:30 **Location: W203**

14:30–14:33 **Welcome**
Egan Chernoff & **Ernesto Sánchez** (University of Saskatchewan, Canada, Canada;

Departamento de Matemática Educativa, Cinvestav–IPN, México)

14:33–14:53 **Amy Renelle,** Stephanie Budgett & Rhys Jones (The Department of Statistics at the University of Auckland, New Zealand)
A Consideration of Alternative Sample Spaces Used in Coin–Toss Problems

14:54–15:09 Sandra A. Martínez Pérez & **Ernesto Sánchez** (Departamento de Matemática Educativa, Cinvestav–IPN, México)
High–School Students' Probabilistic Reasoning When Working with Random Intervals

15:10–15:25 Zikun Gong & **Du Zhang** (Hangzhou Normal University, China; Xianlin Middle School, China)
Children's Spatial Cognitive Strategies and Their Development from the Perspective of Microgenesis

15:26–15:41 **Haneet Gandhi** (Department of Education, University of Delhi, INDIA)
Teachers' Epistemological Assumptions That Tend to Govern Their Pedagogy While Teaching Probability

15:42–15:57 **Sibel Kazak** & Aisling Leavy (Pamukkale University, Turkey; University of Limerick, Ireland)
The Emerging Interplay between Subjective and Objective Notions of Probability in Young Children

15:58–16:08 **Maria Ricart**, Pablo Beltrán–Pellicer & Assumpta Estrada (University of Lleida, Spain; University of Zaragoza, Spain)
Establishing Connections between Language and Probabilistic Notions through a WODB Task

16:09–16:19 **Oedoen Vancso** & Eszter Varga (Eötvös Loránd University, Budapest; Bornemissza Péter Highschool, Budapest)
Problem Sequences for Developing Two Basic Notions: Probability and Expected Value in Hungarian Secondary Schools

16:20–16:30 **Susanne Podworny** (Paderborn University, Germany)
Understanding Elements of a Randomization Test

Session II

July 14, 19:30–21:00 **Location: W203**

19:30–19:49 **Vincent Martin, Mathieu Thibault & Marianne Homier** (Université de Sherbrooke, Québec, CA, Université du Québec en Outaouais, Québec, CA)
Self–Reported Practices of Probability Teaching: The Use of the Frequentist Approach, Manipulatives and Technological Tools

19:50–20:05 **Egan Chernoff**, Nat Banting & Ryan Banow (University of Saskatchewan, Canada, CA)
Is It in the Cards?!? Revealing Consequential Probability

20:06–20:16 **Jannick Trunkenwald[1],** Fernand Malonga Moungabio[2] & Dominique Laval[1] ([1]LDAR Université Diderot Paris 7, France; [2]Université Marien Ngouabi, Congo)
The Frequentist Approach of Probability, From Random Experiment to Sampling Fluctuation

20:17–20:27 Claudia Vázquez, **Flavio Guiñez**, Camila Brito & Salomé Martínez (Universidad de Chile and Pontificia Universidad Católica, Chile)
Alice in Randomland: Differences in Attitudes of Future Primary School Teachers Towards Probability and Its Teaching

20:28–20:38 **Santiago Inzunza** (Universidad Autónoma de Sinaloa, Culiacán, MX)
Modeling Eliciting Activities for the Teaching of the Probability in a Computer Environment

20:39–20:49 **Bai Sheng–nan** & Han Ji–wei (Collaborative Innovation Center of Assessment toward Basic Education Quality, Beijing Normal University, Beijing, 100875; School of

TSG

Mathematics and Statistics, Northeast Normal University, Changchun, Jilin, 130024)
Developing a Learning Progression for Probability Based on the GDINA Model in China

20:50–21:00 **Lamanna Luca**, Magdalena Gea & Carmen Batanero (Free University of Bozen–Bolzano, Italy; University of Granada, Spain)
Secondary School Students' Strategies in Solving Permutation Problems

Session III

July 17, 21:30–23:00 **Location: W203**

21:30–21:50 **Gale Russell** (University of Regina)
From Towers of Linking Cubes to the Binomial Expansion Theorem: What Can Be Learned about Combinatorics?

21:51–22:06 **Caterina Primi,** Maria Anna Donati (NEUROFARBA – University of Florence, Italy)
How Can Probability Reasoning Protect Adolescents from Problem Gambling?

22:07–22:22 **Katherine Machuca Pérez** (Pontificia Universidad Católica de Valparaíso)
The Mathematical Work of Secondary Teachers in the Domain of Probability in Chili

22:23–22:33 **Jesús Salinas** & Julio César Valdez (Colegio de Ciencias y Humanidades, Plantel Vallejo, UNAM, México)
The Computer Simulation as a Resource to Teach Normal Distribution

22:34–22:44 **Beatriz A. Rodríguez González**[1], Gabriela Noemí Figueroa Ibarra[1], Omar Alejandro Guirette Barbosa[1], Héctor Antonio Durán Muñoz[1], Difariney González Gómez[2] ([1]Universidad Politécnica de Zacatecas, México; [2]Universidad Nacional de Colombia, Colombia)
Use of the Empirical Rule in the Course of Probability: An Application Proposed by Students

22:45–22:55 **Bustang Bustang** (Loughborough University and Universitas Negeri Makassar, England, UK)
Confidence and competence of Indonesian secondary school students in completing probability tasks.

22:56–23:00 **Closure**
Egan Chernoff & Ernesto Sánchez (University of Saskatchewan, Canada, CA; Departamento de Matemática Educativa, Cinvestav–IPN, México)

TSG12: Teaching and Learning of Statistics

Chair: Enriqueta Reston (University of San Carlos, Philippines)
Co–chair: Andreas Eichler (University of Kassel, Germany)
Team members: Gail Burrill (Michigan State University, USA), Qian Chen (Sichuan Normal University, China), Leandro de Oliveira Souza (Universidade Federal de Uberlândia, Brazil)
IPC Liaison Person: Celi Espasandin Lopes (Brazil)

TSG

Session I

July 13, 19:30–21:00 **Location: T423**

19:30–20:05 **Lonneke Boels**, (Utrecht University/ Christelijk Lyceum Delft, The Netherlands)
Designing Embodied Tasks in Statistics Education for Grade 10–12

20:05–20:20 **Hanan Innabi** (University of Gothenburg, Sweden)
Teaching Statistics and Sustainable Learning

20:20–20:35 **Daniel Frischemeier** (University of Paderborn, Germany)
Reading and Interpreting Distributions of Numerical Data in Primary School

20:35–20:50 Carlos Monteiro[1], **Karen François**[2] ([1]Universidade Federal de Pernambuco / The Federal

University of Pernambuco (UFPE), Brazil; [2]Vrije Universiteit Brussel / Free University Brussels (VUB), Belgium)
Statistical Literacy as Central Competence to Critically Understand Big Data

20:50–21:00 **General Discussion**

Session II

July 14, 19:30–21:00 **Location: T234**

19:30–20:05 **Danny Parsons**, David Stern, Balázs Szendrői, Elizabeth Dávid–Barrett (IDEMS International, University of Oxford, University of Sussex, United Kingdom)
Interdisciplinary Data Workshops

20:05–20:20 AnnaMarie Conner[1], Susan A. Peters[2] ([1]University of Georgia; [2]University of Louisville, U.S.A)
Distinctive Aspects of Reasoning in Statistics and Mathematics: Implications for Classroom Arguments

20:20–20:35 **Péter Fejes Tóth[1]**, Ödön Vancsó[2] ([1]Szent István University; [2]Eötvös Loránd University, Hungary)
A School Experiment for Introductory Inferential Statistics in Hungarian Secondary Schools

20:35–20:50 **Soledad Estrella**, Maritza Méndez–Reina, Tamara Rojas, Rodrigo Salinas (Pontificia Universidad Católica de Valparaíso, Chile)
An Informal Statistical Inferential Reasoning Experience with Seventh Graders: A Lesson Study

20:50–21:00 **General Discussion**

Session III

July 16, 21:30–23:00 **Location: T423**

21:30–22:05 **Gail Burrill** (Michigan State University, U.S.A.)
Margin of Error: Connecting Chance to Plausible

22:05–22:20 Cindy Alejandra Martínez–Castro[1], **Lucía Zapata–Cardona[1]**, Gloria Lynn Jones[2] ([1]University of Antioquia, Colombia; [2]University of Georgia, USA)
Critical Citizenship in Statistics Teacher Education

22:20–22:35 **Adam Molnar**, Shiteng Yang (Oklahoma State University, U.S.A.)
Mathematics Ability and Other Factors Associated with Success in Introductory Statistics

22:35–22:50 **Karoline Smucker**, Azita Manouchehri (The Ohio State University, U.S.A)
Elementary Students' Responses to Quantitative Data

22:50–23:00 **General Discussion**

Session IV

July 17, 14:30–16:30 **Location: T423**

14:30–14:45 **Saleha Naghmi Habibullah** (Kinnaird College for Women, Lahore, Pakistan)
Implementation of a Course on Tidyverse in Pakistan Under the Asa Educational Ambassador Program

14:45–15:00 **Michal Dvir,** Dani Ben–Zvi (University of Haifa, Israel)
Young Learners' Reasoning with Informal Statistical Models and Modeling

15:00–15:15 **Von Bing Yap** (National University of Singapore, Singapore)
The Binomial Model: Coin Tosses or Clay Pots?

15:15–15:30 **Orlando González** (Assumption University, Thailand)
Variability Modeling and Data–Driven Decision–Making Using Socially Open–Ended Problems: A Comparative Study of High School Students in Thailand, Brunei and Zambia

15:30–15:45 **Mara Magdalena Gea**, Jocelyn D. Pallauta, Pedro Arteaga, Carmen Batanero (University of Granada, Spain)
Algebraization Levels of Statistical Tables in Secondary Textbooks

15:45–16:00 **Stine Gerster Johansen** (Danish School of Education, Aarhus University & University College Copenhagen, Denmark)

TSG

Data Modelling with Young Learners as Experiences of *Allgemeingbildung*

16:00–16:15 **Jale Gunbak Hatil**, Gulseren Karagoz Akar (Bogazici University, Turkey)
Investigating Mathematics Teacher Educators' Conceptions for Informal Line of Best Fit

16:15–16:30 **General Discussion**

TSG13: Teaching and Learning of Calculus

Chair: David Bressoud (Macalester College, USA)
Co–chair: Kristina Juter (Kristianstad University, Sweden)
Team members: Xuefen Gao (Zhejiang Sci–Tech University, China), Elizabeth Montoya (Pontifical Catholic University of Valparaíso, Chile), Carlos Armando Cuevas Vallejo (CINVESTAV, Instituto Politécnico Nacional, Mexico)
IPC Liaison Person: Luc Trouche (France)

Session I

July 13, 14:30–16:30 **Location: W215**

14:30–14:45 **Jonaki B Ghosh** (Lady Shri Ram College for Women, University of Delhi, New Delhi, India)
Mathematical Knowledge for Teaching of Calculus: An Exploratory Study of Secondary School Teachers Mathematical Thinking Related to Concepts in Calculus

14:50–15:05 **Vladimir Nodelman** (Holon Institute of Technology, Holon, Israel)
Modeling Concepts of Derivative and Differential with Educational Software

15:10–15:25 **Regina Ovodenko**, Anatoli Kouropatov (Shenkar College of Engineering, Netanya, Israel)
Constructing Knowledge Using Digital Tools: The Case of the Inflection Point

15:30–15:45 **Inen Akrouti** (Virtual University of Tunis, Bizerta, Tunisia)
Students' Interpretations of the Definite Integral

15:50–15:55 **Yun Lu** (Education Department of East China Normal University, China)
Comparison of Mathematics Textbooks in IB School and Chinese Public High School: Take Core Concept—Calculus as an Example

15:58–16:03 **Gordana Stankov**[1], Djurdjica Takači[2] ([1]Subotica Tech College of Applied Sciences, Novi Knezevac, Serbia; [2]University of Novi Sad, Novi Sad, Serbia)
Research in Calculating Areas Between Curves

16:06–16:11 **Yingzhe Ban**[1], Qi Zhang[2] ([1]Peking University, Beijing, China; [2]Beijing Normal University, Beijing, China)
Cause Analysis and Solutions on the Problems in Teaching the Concept of Differential

16:14–16:19 **Matthaios Antonopoulos**, Eleonora Antonopoulou (University of Athens, Nea Pedeli, Greece)
The Concept of Continuity through Different Types of Representations of the Function

16:22–16:27 **Han Yue** (Jieyin Temple, CN)
How to Teach Calculus Correctly

Session II

July 14, 19:30–21:00 **Location: W215**

19:30–19:45 **Kristina Elisabeth Juter**, Örjan Hansson, Andreas Redfors (Faculty of Education, Kristianstad, Sweden)
Actions in the Learning Environment: Analyzing Physics and Mathematics Lessons in the

Case of ODE

19:50–20:05 **Arne Hole, Inger Christin Borge, Liv Sissel Grønmo** (University of Oslo, Oslo, Norway)
From Upper Secondary School to University Calculus: Language Difficulties versus Conceptual Difficulties

20:10–20:15 **Elizabeth Montoya Delgadillo** (Pontificia Universidad Catolica de Valparaiso, Chile)
The Discrete–Dense–Continuous Phenomenon and its Implication in Continuous

20:18–20:23 **Maria Astrid Cuida Gomez** (Universidad de Valladolid, Valladolid, Spain)
A Limit Free Calculus for Introducing the Concepts of Tangent and Asymptote. An Educational Proposal Inspired by the Past

20:26–20:31 **Jianhui Pan** (Chongqing University of Posts and Telecommunications, Chongqing, China)
An Approach to Reduce the Number of Failure Students in a Large Calculus Class

20:34–20:39 **Carlos Andres Ledezma Araya,** Elizabeth Montoya Delgadillo (University of Barcelona, Chile)
The Exponential Function from the Viewpoint of Mathematical Modelling: a Chilean Lesson Study

20:42–20:47 **Kenneth Horwitz** (New Jersey Institute of Technology, Cedar Grove, NJ, USA)
Using Open Educational Resources to Promote the Active Learning of Calculus in Urban Districts

20:50–20:55 **Harman Prasad Aryal**, Otto Joshua Shaw (Ohio University, Kapilvastu, Nepal)
Mathematics Anxiety Levels among Students in an Inquiry–Based Calculus I Class

Session III

July 17, 21:30–23:00 **Location: W215**

21:30–21:45 **David C. Webb** (University of Colorado Boulder, Boulder, CO, USA)
The Design and Use of Low Instructional Overhead Tasks in Undergraduate Calculus: Making Student Reasoning More Accessible to Calculus Instructors

21:50–22:05 **Su Liang** (University of Texas–San Antonio, San Antonio, TX, USA)
The Observed Impact Implementing Inquiry–Based Learning at a Calculus Classroom

22:10–22:15 **Mehmet Turegun** (Barry University, Miami, FL, USA)
Teaching Calculus Based on Complexity Theory of Teaching and Learning

22:18–22:23 **Antonio Bonilla**, Ricardo Cantoral, Ricardo Cantoral (Centro de investigacion y de estudios avanzados, Ciudad de Mexico, Mexico)
Notions of Continuity of Pre–Service Teachers; Reflections for a Problematization

22:26–22:31 **Jose Luis Morales Reyes**, Francisco Cordero Osorio (Cinvestav, Ciudad de Mexico, Mexico)
Resignification of the Derivative in a School Situation with a Perspective of an Exclusion – Inclusion Dialectic: From Emulation of the Concept to Autonomy of Uses

22:34–22:39 **Mihaly Andre Martinez Miraval**, Martha Leticia García Rodríguez (Universidad Peruana de Ciencias Aplicadas, Lima, Peru)
Covariational Reasoning: An Axis in the Construction Process of the Definite Integral Concept

22:42–22:47 **Nicolas Lopez**, Gloria Ines Neira Sanabria (Universidad Nacional de Colombia, Bogota, Colombia)
The “Overgeneralization of Linearity”: Difficulty, Conflict or Obstacle?

TSG

TSG14: Teaching and Learning of Programming and Algorithms

Chair: Chantal Buteau (Brock University, Canada)
Co–chair: Marina Rafalskaya (National Pedagogical Dragomanov University, Ukraine)
Team members: Xuemei Chen (Hebei Normal University, China), Bakhyt Matkarimov (Nazarbayev University, Kazakhstan)
IPC Liaison Person: Ivan Yashchenko (Russia)

Session I

July 13, 19:30–21:00 **Location: T124**

19:30–19:40 **Chantal Buteau[1], Maryna Rafalska[2]** ([1]Brock University, Canada; [2]Université Côte d'Azur, France)
Introducing TSG 14

19:40–20:05 **Max Stephens[1]**, Djordje M. Kadijevich[2] ([1]The University of Melbourne, Melbourne, Australia; [2]Institute for Educational Research, Belgrade, Serbia)
Algorithmic Thinking: Emerging Implications for School Mathematics Education

20:05–20:20 **Takuma Takayama** (Shimoda Junior High School, Japan)
Mathematics Education and Computational Thinking

20:20–20:35 **Camilla Finsterbach Kaup** (Aalborg University, Denmark)
Teachers Perceptions of Computational Thinking as Part of the Teaching of Mathematics: A Hermeneutic Literature Review

20:35–20:40 Allyson Hallman–Thrasher, **Susanne Strachota**, Danielle Dani (Ohio University, USA)
Engaging Prospective Teachers and Students in Programming Activities

20:40–21:00 **Chantal Buteau, Maryna Rafalska** (Brock University, Canada; Université Côte d'Azur, France)
Discussion

Session II

July 16, 21:30–23:00 **Location: T124**

21:30–21:35 **Chantal Buteau[1], Maryna Rafalska[2]** ([1]Brock University, Canada; [2]Université Côte d'Azur, France)
Introduction

21:35–22:00 **Djordje M Kadijevich[1]**, Max Stephens[2] ([1]Institute for Educational Research, Belgrade, Serbia; [2]The University of Melbourne, Melbourne, Australia)
Three Important Aspects of Research on Computational/Algorithmic Thinking

22:00–22:25 **Simon Modeste** (IMAG, University of Montpellier, CNRS, Montpellier, France)
On Enumeration in Mathematics and Computer Science: Some Didactical Issues

22:25–22:40 **Tran Kiem Minh**, Nguyen Thuy Viet Anh, Tran Trong Ha (College of Education, Hue University, Vietnam)
A Framework for Analyzing the Integration of Algorithms and Programming into Mathematics Textbooks

22:40–23:00 **Chantal Buteau[1], Maryna Rafalska[2]** ([1]Brock University, Canada; [2]Université Côte d'Azur, France)
Discussion

Session III

July 17, 14:30–16:30 **Location: T124**

14:30–14:35 **Chantal Buteau[1]**, **Maryna Rafalska[2]** ([1]Brock University, Canada; [2]Université Côte d'Azur, France)
Introduction

14:35–15:15 **Elena Prieto[1]**, Kathryn Holmes[2] ([1]The University of Newcastle, Australia; [2]Western Sydney University, Australia)
Working Mathematically and Thinking Computationally: Capitalising on Commonalities for Integrated Teaching

15:15–15:30 **Gregor Milicic & Matthias Ludwig** (Goethe University Frankfurt)
Modelling and 3D Printing A Circular Staircase for a Doll's House: Teaching Computational Thinking Using a Range of Different Tools

15:30–15:45 Chantal Buteau[1], Eric Muller[1], Ghislaine Gueudet[2], Joyce Mgombelo[1], Ana I. Sacristán[3] ([1]Brock University, Canada; [2]University of Brest, France; [3]Cinvestav, Mexico)
Researching the Teaching and Learning of Programming for University Mathematical Investigation Projects

15:45–16:00 David Doyen[1], **Antoine Meyer[2]** ([1]LAMA (UMR), UPEM, UPEC, CNRS, Université Paris–Est, France; [2]LIGM (UMR), UPEM, CNRS, ESIEE, ENPC, Université Paris–Est, France)
Math & CS Labs: A Bi–Disciplinary Course for Second–Year Undergraduates in Mathematics or Computer Science

16:00–16:30 **Chantal Buteau[1], Maryna Rafalska[2]** ([1]Brock University, Canada; [2]Université Côte d'Azur, France)
Discussion and Conclusion

TSG15: Teaching and Learning of Discrete Mathematics

Chair: Elise Lockwood (Oregon State University, USA)
Co–chair: Cecile Ouvrier–buffet (Université de Reims Champagne–Ardenne, France)
Team members: Mariana Durcheva (Technical University of Sofia, Bulgaria), Han Ren (East China Normal University, China), Ambat Vijayakumar (Cochin University of Science and Technology, India)
IPC Liaison Person: Catherine Vistro–Yu (Philippines)

Session I

July 13, 14:30–16:30 **Location: W107**

14:30–14:50 **Thomas Borys** (University of Education Karlsruhe, Institute of Mathematics, Germany)
Suggestion for an Integration of Cryptology into a Math Curriculum

14:50–15:10 **Cecile Ouvrier–Buffet** (Universite Paris–Est Creteil, France)
Enriching Pre–Service Teachers Conceptions about Proof with Discrete Mathematics

15:10–15:30 **Melissa Windler** (University of Bremen, Germany)
Graph Theory in Primary School Mathematical Education – A Quantitative Study on the Impact of Graph Theory Concepts on Psychological Characteristics of Fourth Grade Students

15:30–15:40 **Break**

15:40–16:00 **Jaime Carvalho e Silva** (Universidade de Coimbra, Portugal)
The Role of Discrete Mathematics in Secondary Mathematics for Non–Stem Paths

16:00–16:20 **Katalin Gosztonyi**, Csaba Csapodi (Eötvös Loránd University of Budapest, Mathematics Teaching and Education Centre, Hungary)
Discrete Mathematics in the Hungarian Mathematics Curriculum

16:20–16:30 **Discussion**

Session II

July 14, 19:30–21:00 **Location: W107**

19:30–20:00 **Erik S. Tillema**, Lori Burch (Indiana University, United States of America)
Leveraging Combinatorial and Quantitative Reasoning to Support the Generalization of Advanced Algebraic Identities

20:00–20:20 **Karina Höveler**, Janet Winzen (Westfälische Wilhelms–Universität Münster, Germany)
Combinatorial Counting Problems in Elementary School: A Comparative Analysis of

German Textbooks

20:20–20:40 **Joseph Antonides**, Michael T. Battista (Ohio State University, USA)
Preliminary Levels of Sophistication for Enumerating Permutations

20:40–21:00 **Belmira Mota**[1,2] and Rosa Antónia Tomás Ferreira[2,3] ([1]Colégio Efanor; [2]Faculdade de Ciências da Universidade do Porto; [3]CMUP CMUP, Portugal)
Guiding Students' Reinvention of Combinatorial Operations

Session III

July 17, 21:30–23:00 **Location: W107**

21:30–21:50 **Elise Lockwood**, Adaline De Chenne (Oregon State University, United States of America)
Preservice Teachers' Development of Mathematical Knowledge for Teaching via Combinatorial Tasks in a Computational Setting

21:50–22:10 **Janka Medová,** Soňa Čeretková (Department of Mathematics, Faculty on Natural Sciences, Constantine the Philosopher University in Nitra, Slovakia)
Relation between Algorithmic and Combinatorial Thinking of Undergraduate Students of Applied Informatics

22:10–22:30 **Mariana Durcheva** (Technical University of Sofia, Bulgaria)
Some Approaches for Incorporation of CAS in a Discrete Mathematics Course

22:30–22:50 **Eleonóra Stettner**, Szabina Tóth (Hungarian University of Agriculture and Life Sciences, Szabó Lőrinc Bilingual Primary and Secondary School, Hungary)
How Can Poly–Universe Sets Develop Creativity During the Solution of Combinatorial Exercises?

22:50–23:00 **Closure Wrap Up and Discussion**

TSG16: Reasoning, Argumentation and Proof in Mathematics Education

Chair: Viviane Durand–Guerrier (Montpellier University, France)
Co–chair: Samuele Antonini (University of Pavia, Italy)
Team members: Nadia Azrou (University Yahia Fares, Algeria), Kotaro Komatsu (Shinshu University, Japan), Chao Zhou (Soochow University, China)
IPC Liaison Person: Takeshi Miyakawa (Japan)

Session I

Moderator: Kotaro Komatsu (online)
July 13, 19:30–21:00 **Location: T223**

19:30–19:45 **Presentation of the four Sessions**

19:45–20:00 **Nadia Azrou** (University Yahia Fares, Algeria)
Writing a Proof Text at the University Level: The Role of Knowing What a Proof Is

20:00–20:15 **Faiza Chellougui** (Faculty of Sciences of Bizerte–Univ. of Carthage, Bizerte, Tunisia)
Formalisation of Proof. A Tool for Researcher

20:15–20:20 **Younggon Bae** (University of Texas Rio Grande Valley, Korea)
Student Interpretation of Diagram in Hyperbolic Geometry: Changes in the Ontology of Geometric Models

20:20–20:25 **GwiSoo NA**, Eric Knuth (Cheongju National University of Education, Cheongju–si, Chungcheongbuk–do, Korea; University of Texas at Austin, United States of America)
A Comparative Study of Example Use in the Proving–related Activities of Korean and American Students

20:25–20:30 **Michael Meyer**, Christoph Koerner, Julia Rey (University of Cologne, Cologne, Germany)
When is an Argument an Argument? Area–specific Aspects of Argument–reception

20:30–20:35 **Horacio Cristian Solar**[1], Manuel Goizueta[2], Maria Aravena–Diaz[3], Andres Ivan Ortiz Jimenez[4] ([1]Pontificia Universidad Catolica de Chile, [2]Pontificia Universidad Catolica de Valparaiso, Italy; [3]Catholic University of Maule, Chile; [4]Universidad Católica de la Santísima Concepción,Chile)
Articulation of Argumentation and Mathematical Modelling in the Math Classroom

20:35–20:40 **Hochieh Lin** (The Ohio State University–STEM Education, Columbus, United States of America)
Fostering Third Graders Fraction Conceptions through Argumentation and Technology

20:40–20:45 **Edgar Balaguera Ascencio** (Universidad Santo Tomas, Bogota, Colombia)
From Abductive Reasoning to the Proof

20:45–21:00 **Collective discussion on the six short oral presentations**

Session II

Moderator: Nadia Azrou (online)
July 14, 19:30–21:00 **Location: T219**

19:30–19:45 **Simone Jablonski**, Matthias Dieter Ludwig (Goethe University, Frankfurt, Germany)
Changes in the Argumentation Characteristics of Mathematically Gifted Students–A Longitudinal Study

19:45–20:00 **Carlotta Soldano** (University of Torino, Torino, Italy)
An Inquiring–Game for Discovering and Proving a Geometric Theorem

20:00–20:15 **Judith Njomgang Ngansop Sadja Kam** (University of Yaounde 1, Yaounde, Cameroon)
Why Do Teachers Write "$f(x) = a, \forall x \in \mathfrak{D}_f$"

20:15–20:20 **Markos Dallas** (University of Agder, Kristiansand, Norway)
Mathematics Classroom Argumentation: An Interactional Perspective

20:20–20:25 **Shogo Murata** (University of Tsukuba, Tsukuba, Japan)
The Function of Definition in Japanese Textbooks

20:25–20:30 **Milena Damrau** (Bielefeld University, Germany)
Understanding the Generality of Mathematical Statements and the Role Proofs Play

20:30–20:35 **Yoshiki Shibata, Tadashi Misono** (Shimane University, Japan)
Is There Any Difference in Students' Descriptions Due to Direction Differences in a Deductive Reasoning Task?

20:35–20:40 **Leander Kempen** (University of Paderborn, Paderborn, Germany)
Investigating the Difference between Generic Proofs and Purely Empirical Verifications

20:40–20:45 **Chun–Yeung Lee** (University of Oxford, United Kingdom)
Proof and Reasoning in High–stakes Testing Systems: The Senior Secondary Mathematics Curricula in Hong Kong and International Baccalaureate Diploma Programme

20:45–21:00 **Collective Discussion of the Six Short Oral Presentations**

Session III

Moderator: Samuele Antonini (online)
July 16, 21:30–23:00 **Location: T223**

21:30–21:45 **Xiaoheng (Kitty) Yan,** Gila Hanna (Simon Fraser University, Burnaby, Canada; OISE, University of Toronto, Canada)
Computer–assisted Proving in the Classroom

21:45–22:00 **Yuling Zhuang,** Anna Marie Conner (University of Georgia, Athens, United States of America)
An Application of Habermas' Theory of Validity Claims for Classroom–based Argumentation

22:00–22:15 **Orly Buchbinder**, Sharon Mc Crone (University of New Hampshire, Durham, United States of America)
Characterizing Mathematics Teachers' Proof–specific Knowledge, Dispositions and Classroom Practices

22:15–22:20 **Alejandro Walter De La Cruz Sanchez** (Universidad Peruana de Ciencias Aplicadas, Peru)
Development of Quantitative Reasoning through Neuro Learning in Students of Basic Mathematics

22:20–22:25 **Jeffrey Mark Rabin**, David Quarfoot (University of California San Diego, San Diego, United States of America)

TSG

Understanding Students' Difficulties in Producing Proofs by Contradiction

22:25–22:30 **Salvador Huitzilopochtli**, Daniel Lopez–Adame, Judit Moschkovich (University of California–Santa Cruz, Santa Cruz, United States of America)
Using Writing and Discussions to Support Mathematical Arguments in Early Algebra

22:30–22:35 **Kristen Marie Lew** (Texas State University, San Marcos, United States of America)
The Necessity of Context in Mathematical Proof Writing at the University Level

22:35–22:40 **Lucas Carato Mazzi** (Unesp, Rio Claro, Brazil)
Different Types of Reasoning in Geometry in Brazilian High School Mathematics Textbooks

22:40–22:45 **Marta T. Magiera** (Marquette University, Milwaukee, United States of America)
Prospective K–8 Teachers' Problem Posing and Their Views of Task That Promote Mathematical Argumentation

22:45–23:00 **Collective Discussion on the Six Short Papers**

Session IV

Moderator: Viviane Durand–Guerrier (online) & Zhou Chao (Shanghai)
July 17, 14:30–16:30 **Location: T223**

14:30–14:45 **Tomohiko Makino** (Utsunomiya University, Japan)
Cognitive Characteristics Generating Incomplete Proof: Analyzing the Solving Process of a Geometrical Problem by Japanese Ninth Graders

14:45–15:00 Sikunder Ali, **Trond Stoelen Gustavsen**, Sigurd Johannes Hals, Andrea Hofmann, Silje Trai (University of South–Eastern Norway, Drammen, Norway)
Caught In–Between Tensions in Teaching Proof and Proving

15:00–15:15 **Andreas Stylianides**, Gabriel Stylianides (University of Cambridge, Cambridge, Great Britain)
Posing New Researchable Questions as a Dynamic Process: The Case of Research on Students' Justification Schemes

15:15–15:20 **Kwong Cheong Wong** (The Hong Kong Polytechnic University, Honk Kong, SAR, China)
Justifications in Exposition in Algebra in School Mathematics Textbooks in Hong Kong

15:20–15:25 **Yaoyao Dong**, Jian Liu (Beijing Normal University, Beijing, China)
Analysis of Analogical Reasoning Exercises in Primary School Mathematics Textbooks: Taking Geometry Field as an Example

15:25–15:30 **Xin Zheng**, Jing Cheng (East China normal university, shanghai, China)
Regional and Gender Differences in Chinese 8th Grade Students' Mathematical Reasoning Competency

15:30–15:35 **Lei Hao**, P–Jen Lin (Mathematics and Science Education, NTHU, China)
A Comparative Study of Geometric Proof Opportunities in Taiwan and Mainland Middle School Textbooks

15:35–15:40 **Yi Zhang**, Xiaopeng Wu (East China Normal University, China)
A Study of the Teaching Process of Mathematical Concept Argumentation Based on Tap–taking Function Concept Teaching between Expert Teacher and Novice Teacher in China as a Case

15:40–15:55 **Collective Discussion on the Five Short Papers**

15:55–16:30 **Discussion on Future Research Agenda and Possible Collaborations**

TSG

TSG17: Problem Posing and Solving in Mathematics Education

Chair: Tin Lam Toh (Nanyang Technological University, Singapore)
Team members: Nicolina A. Malara (University of Modena and Reggio Emilia, Italy), Manuel Santos (CINVESTAV, Instituto Politécnico Nacional, Mexico), Dan Zhang (Beijing Academy of Educational Sciences, China)
IPC Liaison Person: Yufeng Guo (China)

Session I

July 13, 14:30–16:30 **Location: T225**

14:30–14:40 **Zheng PeiJun** (Qinghai Normal University, CN)
Analysis on Creating Problem Situation in Middle School Mathematic Teaching

14:40–14:55 Rong Wang, **Cuiqiao Wang** (Peoples Education Press, CN)
Historical Comparison and Analysis of Problems and Problem–posing in Middle School Mathematics Textbooks

14:55–15:05 **Ma Nympha Beltran–Joaquin** (University of the Philippines, Quezon City, PH)
Problem Posing among Pre–service and In–service Mathematics Teachers

15:05–15:15 **Puay Huat Chua** (Nanyang Technological University, NIE, Singapore, SG)
Regulation of Cognition during Problem Posing–A Case Study

15:15–15:25 **Stephane Favier** (Universite de Geneve, FR)
Characterizing the Problem–solving Processes Used by Pupils in Classroom: Proposition of a Descriptive Model

15:25–15:35 **Na Yan**, Lianchun Dong(Minzu University of China, Beijing, CN)
A Study on Primary School Students Mathematical Problem–posing Abilities in China

15:35–15:50 **Ling Zhang**, Jinfa Cai, Naiqing Song (Southwest University, CN)
A Framework for Examining Mathematical Communication in Problem Posing

15:50–16:05 **Yiling Yao**, Jinfa Cai (Hangzhou Normal University, Hangzhou, CN)
Using Problem Posing to Diagnose and Understand Preservice Teachers Conceptual Understanding

16:05–16:15 **Dan Zhang**, Yiling Yao, Jinfa Cai **(**Beijing Academy Of Education Sciences, China, CN)
Elementary Mathematics Teachers Learning to Teach Through Problem Posing: Initial Findings of a Longitudinal Study

16:15–16:30 **Benjamin Rott** (University of Cologne, Cologne, DE)
Primary School Teachers' Behaviors, Beliefs, and Their Interplay in Teaching for Problem Solving

Session II

July 14, 19:30–21:00 **Location: T225**

19:30–19:45 **Peter Juhasz,** Reka Szasz, Lajos Posa, Ryota Matsuura (Alfred Renyi Institute of Mathematics, Budapest, HU)
Teaching Students How to Pose Mathematical Questions

19:45–19:55 **Sintria Lautert**, Alina Galvao Spinillo, Rute Elizabete Borba, Juliana Silva, Ernani Martins dos Santos (Universidade Federal de Pernambuco – UFPE, Recife, BR)
How Elementary and Middle School Teachers Formulate Multiplication and Division Word Problems

19:55–20:05 **Yeliz Yazgan** (Bursa Uludag University, Bursa, TR)
Gifted Students Strategy Flexibility in Non–routine Problem Solving

20:05–20:15 **Maud Chanudet** (University of Geneva, FR)
Types of Reasoning Promoted in Mathematics Classes in the Context of Problem–solving Instruction in Geneva

20:15–20:25 **Min Wang,** Candace Ann Walkington (Southern Methodist University, Dallas, US)
Investigating Elementary School Students' Stem Problem Posing: The Walkstem After–School Club

20:25–20:35 **Jillian White**, Patrick Johnson, Merrilyn Enid Goos (University of Limerick, Limerick, IE)
Designing Professional Development Programs That Support Teachers' Incorporation of Problem Solving in Their Mathematics Instruction–The DCP Model

20:35–20:45 **Silvanio De Andrade** (UEPB, Campina Grande, BR)
Mathematics Problem Multicontextual Exploration, Solving and Posing in the Classroom and Teacher Education: A Perspective in Critical Education

TSG

20:45–20:55 **Tuba Aydogdu Iskenderoglu** (Trabzon University, Trabzon, TR)
The Problems Posed by Primary School Teachers, On Addition with Fractions

Session III

July 17, 14:30–16:30 **Location: T234**

14:30–14:40 **Jiajie Yan**, Yufeng Guo, Wenjia Zhou (Beijing Normal University, Beijing, CN)
How Do Chinese Textbooks Incorporate Mathematical Problem Posing in Different Stages?

14:40–14:50 **Hayato Hanazono** (Miyagi University of Education, JP)
Appreciation of the Aesthetic Qualities of Mathematical Objects: An Analysis of Students Problem Solving

14:50–15:00 **Jayasree Subramanian**, K. Subramaniam, R. Ramanujam (Homi Bhabha Centre for Science Education, Chennai, IN)
Towards LITE, a Local Instructional Theory for Mathematical Explorations

15:00–15:10 **Nor Azura Abdullah** (Universiti Brunei Darussalam, Brunei, BN)
Graphic Organizers for Problem–solving in Primary Mathematics: Teachers' Reflections

15:10–15:20 **Eda Vula** (University of Prishtina, Prishtina, AL)
The Effect of Problem–posing Strategies on Primary Pre–service Teachers Conceptual Knowledge of Fractions

15:20–15:30 **Brantina Chirinda**, Patrick Barmby (University of Johannesburg, Auckland Park, ZA)
Investigating Mathematics Teachers' Knowledge for Teaching Problem–solving

15:30–15:45 **Matias Camacho–Machin**, Alexánder Hernández, Josefa Perdomo–Díaz (Universidad de La Laguna, La Laguna, ES)
Elements of Mathematical Activity That Emerge When Future Teachers of Secondary School Mathematics Use Digital Technologies to Solve Problems

15:45–15:55 **Zoltan Kovacs** (Eszterhazy Karoly University, Eger, HU)
A Study on Evaluating Prospective Teachers' Problem Posing Activity

Session IV

July 17, 21:30–23:00 **Location: T225**

21:30–21:40 **Rogier Bos**, Rona Lemmink (Freudenthal Institute, Utrecht University, NL)
Supporting Students to Compress Mathematical Knowledge While Problem Solving

21:40–21:50 **Miguel Cruz Ramírez** (University of Holguín, Cuba)
A Strategy for Enhancing Mathematical Problem Posing

21:50–22:00 **Benjamin Dickman** (The Hewitt School, New York City, US)
Inverted Tasks and Bracketed Tasks in Mathematical Problem Posing

22:00–22:10 **Lukas Baumanns**, Benjamin Rott (University of Cologne, DE)
The Process of Posing Problems: Development of a Descriptive Process Model for Problem Posing

22:10–22:20 **Sergei Nickolaevitch Pozdniakov** (Saint Petersburg Electrotechnical University, St. Petersburg, RU)
Automation of Math Discovery Support: Reinforcement of Problems with Criteria for Evaluating Partial Solutions

22:20–22:30 **Fenqjen Luo**, Yali Yu, Monte Meyerink, Ciara Burgal (Montana State University, Bozeman, US)
Division Problem Posing of Fifth Graders: A Cross–national Study in China and the United States

22:30–22:40 **Nelia Amado**, Susana Carreira, Monica Alexandra Rebelo Valadao (UIDEF, IE–UL, FARO, PT)
Students Engagement in Problem Posing While Solving A Fermi Problem

22:40–22:50 **Luisa–Marie Hartmann**, Stanislaw Schukajlow, Janina Krawitz (Muenster University, Muenster, DE)
Develop Your Own Problem! – Problem Posing in Given Real–world Situations

TSG

TSG18: Students' Identity, Motivation and Attitudes towards Mathematics and Its Study

Chair: Maike Vollstedt (University of Bremen, Germany)
Co–chair: Masitah Shahrill (Universiti Brunei Darussalam, Brunei)
Team members: Karin Brodie (University of the Witwatersrand, South Africa), Donglin Chen (The University of Hong Kong, Hong Kong SAR, China), Bozena Maj–Tatsis (University of Rzeszow, Poland)
IPC Liaison Person: Ewa Swobodal (Poland)

Session I

July 17, 14:30–16:30 **Location: T230**

14:30–14:35 **Opening Session**
Maike Vollstedt[1], Masitah Shahrill[2], Bozena Maj–Tatsis[3], Karin Brodie[4], Donglin Chen[5] ([1]University of Bremen, Germany; [2]University of Brunei Darussalam, Brunei Darussalam; [3]University of Rzeszow, Poland; [4]University of Witwatersrand, South Africa; [5]The University of Hong Kong, Hong Kong SAR, China)

14:35–15:00 **Katrina Grace Q. Sumagit**, Nympha B. Joaquin (Ateneo de Manila University; University of the Philippines Diliman)
Mathematical Problem–solving Beliefs of Filipino Seventh Graders

Masitah Shahrill, Ai Len Gan (Sultan Hassanal Bolkiah Institute of Education, Universiti Brunei Darussalam; Sekolah Menengah Sayyidina Hasan, Ministry of Education, Brunei Darussalam)
Understanding the Intentions of Shadow Education in Brunei Darussalam

Changgen Pei, **Jiancheng Fan** (Southwest China University; Teaching Research and Teacher Training Center for Primary and Middle Schools, Xindu District, Chengdu, China)
Developing and Validating a Scale for Measuring Students' Critical Thinking Disposition in Mathematics Education

Beijia Tan, Jenee Love, Leigh M. Harrell–Williams, Christian E. Mueller (University of Memphis)
Exploration of Math Mindset Changes over Time in an Urban Sample of Elementary and Secondary School Students in the United States

15:00–15:25 **Yang Rui**, Wang Guangming, Li Shuang (Tianjin Normal University, China; Tianjin Economic–Technological Development Area International School, China)
The Non–intellectual Level of Efficient Mathematics Learning of Junior High School Students and Their Influence Pathways on Mathematics Learning Performance

Cao Chengcheng (The University of Hong Kong, Hong Kong SAR, China)
Integrating Physical Activity into Mathematics Lessons

Sheng Zhang, Guanming Wang (Tianjin Normal University, China)
Different Contributions of Parental Expectations and Teacher's Behaviors to Students' Mathematics–related Beliefs

Mingxuan Pang, Xiaorui Huang (Institute of Curriculum and Instruction, East China Normal University, China)
Does Parents' Attitude towards Math Matter to Young Adolescents' Math Achievement in China? Meditating Effects of Math Anxiety

15:25–15:40 **Zhi–Cheng Chen**, **Juei Hsin Wang** (Taichung University of Education, Department of Math Education, Taiwan, China; Chiayi University, Taiwan, China)
The Action Research of 'Math Table Game' in Teaching and Learning

Meng Guo, Xiang Hu (Faculty of Education, The University of Hong Kong, Hong Kong SAR, China; School of Education, Renmin University of China, China)
Classroom Goal Structures, Chinese Students' Goal Orientations and Mathematics Achievement

Zifu Shi, Yuntian Xie, **Jingjing Liang** (Department of Psychology, Hunan Normal University, China)
Effect of Mathematics Anxiety on Probabilistic Reasoning among Junior Middle School

TSG

Students: A Moderated Mediation Model

15:40–16:05 **Xiaorui Huang**, Bo Dong (Institute of Curriculum and Instruction, East China Normal University, China)
Stereotype on Female's Success Boosts Female's Math Learning

Yelena Portnov Neeman, Miriam Amit (Department of Science and Technology Education, Ben–Gurion University of the Negev, Beer–Sheva, Israel)
Students Attitudes towards Metacognitive Skills for Strategic Math Problems

16:05–16:30 **Zahra Rahimi**, Mohammad Bahrami (Department of Education, Allameh Tabataba'i University, Tehran, Iran; Department of Computer Science, University of Texas, Texas, United States)
Investigating the Effects of Multiple Solutions on Students' Attitudes Towards Mathematics

Wellington Munetsi Hokonya, Pamela Vale Mellony Graven (Rhodes University, grahamstown, ZA)
Mathematical Identities of a High School Mathematics Learner in Landscapes of Mathematical Practice

Lovejoy Comfort Gweshe, **Karin Brodie** (University of the Witwatersrand, Johannesburg–Braamfontein, ZW)
A Conceptual Framework Relating Mathematics Clubs and Mathematical Identities

Maike Vollstedt (University of Bremen, Bremen, Germany)
Meaningful Reasons for Learning Mathematics

Session II

July 13, 19:30–21:00 **Location: T225**

19:30–19:55 **Daniel Barton** (Bielefeld University, Bielefeld, DE)
Make a Tutorial! The Impact of a Classroom Video Project on Emotions, Motivation and Achievement

Aarifah Gardee, **Karin Brodie** (University of the Witwatersrand, South Africa)
A Framework for Learners' Mathematical Identities

19:55–20:10 **Mun Yee Lai**, **Pauline Wong Wing Man Kohlhoff** (University of Technology Sydney, AU)
Applying the Theory of Planned Behaviour to 2012 Australian PISA Data
Ana Isabel Silvestre, Célia Mestre, Cristina Martins, Elvira Santos, Hélia Jacinto, Hélia Pinto, Joana Pacheco de Castro, Manuel Vara Pires, Nelia Amado, Rosa Antonia Tomas Ferreira (Research Group of the Portuguese Association of Mathematics Teachers)
What Is Valued in Learning and Teaching Mathematics? An Overview of the WIFItoo Study in Portugal

Rileigh Luczak (Michigan State University, USA)
Math Circles and Secondary School–aged Children's Mathematical Identities

20:10–20:35 **Farzaneh Saadati** (Center for Advanced Research in Education, Institute of Education (IE), Universidad de Chile)
Influence of Collaborative Learning on Student Attitudes toward Mathematical Problem Solving

Ciara Lane, Megan Heffernan, Kerrie–Anne Kelly (University of Limerick, Ireland)
A Comparison of Student Interest in Mathematics under Two Curricula: Has Anything Changed?

20:35–21:00 **Marta Saccoletto**, **Camilla Spagnolo** (University of Torino, Free University of Bolzano/Bozen)
Perceived Difficulty in Answering Mathematical Task: Reflections on Metacognitive Factors

García–Cerdá, **C.** & **Ferrando, I** (Departamento de Didáctica de la Matemática, Universitat de València, Spain)
Does Type of Problem Influence on Interest? A Replication of a German Study in the Spanish Context

Marios Ioannou (Alexander College, Canada)
Affective Issues in the Learning of Abstract Algebra

Bozena Maj–Tatsis; **Konstantinos Tatsis**; Andreas Moutsios–Rentzos (University of Rzeszow, Poland; University of Ioannina, Greece; University of the Aegean, Greece)
Peer Pressure Effect on Student Teachers' Affective Relationship with Problem Posing

Session III

July 16, 21:30–23:00 **Location: T225**

21:30–21:55 **Yuliya Melnikova**, Kristen Lawson, **Yongtao Cao** (Indiana University of Pennsylvania, USA)
Effects of a Summer Bridge Program: Changes in Math Self–efficacy over the Course of a Semester

Elizabeth Ottie Ayisi, Mathew Felton–Koestler (Ohio University, USA)
College Student Perceptions of the Transition from High School to College Mathematics

Claudia Vargas–Díaz, Victoria Núñez–Henríquez (Universidad de Santiago de Chile, Liceo Bicentenario Italia)
Attitudes, Beliefs and Emotions Towards Graph Theory

Hongwei Yang, Giang–Nguyen Nguyen, Shanshan Hu, Mark Malisa, Clement Yeboah, Thelma Quardey Missedja (University of West Florida, University of West Florida; Virginia Premier, University of West Florida; University of Southern Mississippi; University of West Florida)
Assessing Measurement Invariance of Mathematics Self–efficacy between Chinese (Shanghai) and American Students

21:55–22:10 **Jihyun Hwang**, Kyong Mi Choi (University of Iowa; University of Virginia)
Predicting College Major Choice in STEM with Students Data at Grades 9 and 11

Carlos R. Paez Paez, **Mayra L. Ortiz Galarza**, **Maria Cruz** & **Rocio Gallardo** (Navajo Technical University, New Mexico, USA; UT Rio Grande Valley, USA; UACJ, Mexico UT at El Paso, USA)
Views from a Community College on the U.S.–Mexico Border: Mexican/Mexican–American Postsecondary Students´ Perceptions of K–16 Mathematics

22:10–22:35 **Paul Regier**, Miloš Savić, **Houssein El Turkey** (University of Oklahoma, USA; University of New Haven, USA)
A Quantitative Analysis of Six Aspects of Student Identity and Creativity–fostering Instruction

Gustavo Martínez–Sierra, Yuridia Arellano–García, Antonia Hernández–Moreno (Research Centre of Mathematics Education, Faculty of Mathematics, Autonomous University of Guerrero, México)
Changes in Attitudes towards Mathematics of High–school Students in a Problem–posing Workshop

22:35–23:00 **Amanda Meiners**, Kyong Mi Choi, Dae Hong (University of Iowa, USA; University of Virginia, USA)
Exploring Pre–service Teachers Persistence through Multiple Strategies Tasks

Yewon Sung, Ana Stephens, Ranza Veltri Torres, Susanne Strachota, Karisma Morton, Maria Blanton, Angela Murphy Gardiner, Eric Knuth, Rena Stroud (University of Wisconsin–Madison; TERC, University of Texas–Austin; Merrimack College)
Positive Emotions in Early Algebra Learning

Shande King[1], **Lynn Hodge**[2], **Qintong Hu**[3] ([1]The University of Tennessee, [2]The University of Tennessee, [3]Shandong University of Science and Technology)
The Role of Interpersonal Discourse in Small–group Collaboration in Developing Mathematical Arguments and Student Identity

Katherine N. Vela & Robert M. Capraro (Texas A&M University, Bryan, US)
Attitudes, Affect, and Beliefs: What Is the Difference?

Session IV

July 17, 14:30–16:30 **Location: T225**

14:30–14:55 **Isao Shimada** (Nippon Sport Science University, Tokyo, JP)
Aspects of Critical Thinking Abilities That Primary School Students Express When Solving a

TSG

Socially Open–ended Problem: Focus on Values and Mathematical Models in Classroom

Yoshinori Fujii, **Koji Watanabe** (University of Miyazaki; Miyazaki International College)
Questionnaire of Attitudes toward Statistics for Junior High School Students in Japan

Natanael Karjanto (Sungkyunkwan University, Suwon, KR)
"Dear 'Kingos', It's All Right to Be Noisy!" Why Is It So Hard to Get Them Talking?

Miho Yamazaki, Wee Tiong Seah (U Teikyo University, JP)
The Character of Students Mathematical Values in Learning Mathematics

14:55–15:20 **Tomoaki Shinobu** (Sakata First Junior High School, Sakata, JP)
A Case Study of Mathematical Research Presentation in a Public Junior High School; Focus on the Relationship of Assumption of Others and the Quality of Learning

Wee Tiong Seah, Na Wang (Melbourne Graduate School of Education; The University of Melbourne, Australia)
Mathematics Education in the Fourth Industrial Revolution: The Jedi Approach to Developing Soft Skills

Gregory Hine (The University of Notre Dame Australia)
Declining Mathematics Enrolments at Secondary Level: An Australian Perspective

Penelope Kalogeropoulos (Monash University, AU)
Student Valuing of Mathematics Learning through the Getting Ready in Numeracy (G.R.I.N.) Intervention Program

15:20–15:35 **Vanda Santos**, Anabela Pereira, Teresa Neto, Margarida M. Pinheiro (CIDTFF–Research Centre on Didactics and Technology in the Education of Trainers, University of Aveiro, Portugal; Department of Education and Psychology, Portugal; Higher Institute of Accounting and Administration–University of Aveiro, Portugal)
Mathematics Anxiety: A Portuguese Study in Higher Education

Sebastian Geisler (Ruhr–Universitaet Bochum, DE)
The Transition from School to University Mathematics: Which Role Do Students Interest and Beliefs Play?

15:35–16:00 **Jake Stephen Little** (The University of Sydney, Sydney, AU)
Contextualising Mathematics Teaching through Science Connections and Gendered Mathematics Motivations

Kai Kow Joseph YEO (National Institute of Education, Nanyang Technological University)
Mathematics–anxiety Students Reasons and Feelings When Choosing to Solve Particular Problems

16:00–16:25 **Hongyu Xiang** (Tianli Primary School, Chengdu, Chengdu, China)
Put Title Here, Which Can Be Multiple Lines, But No Return Key Allowed within the Title

Jiraporn Wongkanya, **Narumon Changsri**, Kiat Sangaroon, **Maitree Inprasitha** (Master Program in Science and Technology Education, Faculty of Education, KKU, Thailand; Mathematics Education Program, Faculty of Education, KKU, Thailand; Center for Research in Mathematics Education, KKU, Thailand)
Exploring 11th Grade Students' Attitude towards Mathematics

Ruiyan Gao, **Simiao Liu** (The University of Hong Kong, Hong Kong SAR China)
From Escs to Math Achievement: The Mediating Role of Math Self–efficacy, Math Anxiety and Math Self–concept

Shashidhar Belbase (United Arab Emirates University, Al Ain, AE)
High School Students Images, Anxieties and Attitudes toward Mathematics

16:25–16:30 **Maike Vollstedt, Masitah Shahrill, Bozena Maj–Tatsis, Karin Brodie, Donglin Chen** (University of Bremen, Germany; University of Brunei Darussalam, Brunei Darussalam; University of Rzeszow, Poland; University of Witwatersrand, South Africa; The University of Hong Kong, Hong Kong SAR, China,)
Closing Session

TSG19: Mathematical Literacy, Numeracy and Competency in Mathematics Education

Chair: Sarah Bansilal (University of KwaZulu–Natal, South Africa)
Co–Chair: Ratu Ilma Indira Putri (Universitas Sriwijaya, Indonesia)
Team members: Kathy O'Sullivan (National University of Ireland, Galway (NUIG), Ireland), Vince Geiger (Australian Catholic University, Australia), Bo Zhang (Yangzhou University, China)
IPC Liaison Person: Gabriele Kaiser (Germany)

Session I

July 13, 14:30–16:30 **Location: W303**

14:40–15:10 **Ross Turner** (Australian Council for Educational Research, Australia)
Mathematical Literacy: What, Why and How

15:10–15:20 **He Xuan**[1], Ma Yunpeng[2] ([1]BUU, China; [2]Northeast Normal University, China)
Elements and Definitions of the Core Literacy of Mathematics in Primary School from an International Perspective: Based on NVivo 12.0 Coding Analysis

15:20–15:30 **Feng Ma** (Shanghai High School, Shanghai China)
Top–level Design and Systematic Thinking for the Cultivation of Math Competencies–Case Study and Inspirations

15:30–15:40 **Questions**

15:40–15:50 **Kathy O'Sullivan** (EPI·STEM, School of Education, University of Limerick, Ireland)
It Is Time Pre–service Teachers Develop Their Numerate Abilities to Support Their Students' Numeracy Learning

15:50–16:00 **Yuichiro Hattori,** Hiroto Fukuda (Kochi University, Okayama University of Science)
Aspects of Fair–minded Critical Thinking in Mathematics Education: Based on the Perspective of Critical Mathematics Education

16:00–16:10 **Questions**

16:10–16:30 **Vince Geiger** (Institute for Learning Sciences and Teacher Education, Australia)
How Teachers Generate Ideas for Classroom Numeracy Tasks

Session II

July 14, 19:30–21:00 **Location: W303**

19:30–20:00 **Kees Hoogland**, Javier Díez–Palomar, Niamh O'Meara (HU University of Applied Sciences Utrecht, University of Barcelona, University of Limerick)
Common European Numeracy Framework–A Multifaceted Perspective on Numeracy

20:00–20:10 **Jennifer Hall**, Anna Podorova (Monash University)
Pre–service Teachers' Experiences with the Australian National Numeracy Test

20:10–20:20 **Zetra Hainul Putra**, Gustimal Witri, Syahrilfuddin (Department of Elementary Teacher Education, Faculty of Education and Teacher Training, University of Riau, Indonesia)
Mathematical Literacy in Pre–service Teacher–designed Mathematics Picture Books

20:20–20:30 Maryam Mohsenpour, Mahbobeh Rohanifar and Zahra Gooya (Alzahra University, Alzahra University and Shahid Beheshti University)
Identifying 9th Grade Students' Errors in Solving A Mathematical Literacy Problem

20:30–20:40 **Cigdem Arslan**, Murat Altun, Tugce Kozaklı–Ulger, Isıl Bozkurt, Recai Akkaya, Furkan Demir, Zeynep Ozaydin, Burcu Karaduman (Bursa Uludag University, Harran University , Bolu Abant Baysal University, Dumlupınar University, Turkey)
A New Model Design to Improve Mathematical Literacy: A Dual Focus Teaching Model

20:40–20:50 **Sarah Bansilal** (University of KwaZulu–Natal, South Africa)
Unpacking Some Challenges of Learning Mathematical Literacy in South Africa

20:50–21:00 **Questions**

TSG

Session III

July 17, 21:30–23:00

Location: W303

21:30–21:45 **Ratu Ilma Indra Putri**, Zulkardi Zulkardi(Universitas Sriwijaya, Palembang, Indonesia)
Designing Pisa–Like Mathematics Task Using Asian Games Context

21:45–22:00 **Ahmad Wachidul Kohar**, Tatag Yuli Eko Siswono, Dayat Hidayat (Universitas Negeri Surabaya; Universitas Negeri Surabaya; Universitas Negeri Surabaya, Indonesia)
Assessing Pisa–Like Tasks Considering Levels of Context Use for Mathematical Problem

22:00–22:10 **Questions**

22:10–22:20 **AS Cavalcante**, A Savard (Mcgill University)
Financial Numeracy Practices in Secondary School: A Study with Mathematics Teachers from Quebec, Canada

22:20–22:30 **Eun Hyun Kim**, Rae Young Kim (The Graduate School of EWHA Womans University, EWHA Womans University)
A Semantic Network Analysis of Information Literacy in School Mathematics in Korea

22:30–22:40 **Oda Heidi Bolstad** (Volda University College, Norway)
Mathematical Literacy in Norway

22:40–22:50 **Luckson Muganyizi Kaino** (Josiah Kibira University College, Tumaini University, Tanzania)
Merging the Classroom to Practice: Enhancing Mathematical Literacy through the Artifacts

22:50–23:00 **Questions**

TSG20: Learning and Cognition in Mathematics (Including the Learning Sciences)

Chair: Gaye Williams (University of Melbourne, Australia)
Co–chair: Pablo Dartnell (University of Chile, Chile)
Team members: Wenjuan Li (New York University, USA), Chunli Zhang (Beijing Normal University, China)
IPC Liaison Person: Maria Alessandra Mariotti (Italy)

Session I

July 13, 19:30–21:00 **Location: W315**

19:30–20:00 **Alison Superfine Castro** (University of Illinois at Chicago)
Exploring New Models for Teacher Professional Learning: Working with Teachers Rather than on

20:00–20:15 **Fatlume Berisha**, Eda Vula (Faculty of Education, University of Prishtina, Kosovo)
Introduction of STEM Education through Collaborative Action Research Practices

20:15–20:30 **Biyao Liang**, Kevin C. Moore (University of Georgia, USA)
Theorizing Teachers' Learning of Students' Mathematical Thinking in the Context of Student–teacher Interaction

20:30–20:40 **Joyce Mgombelo**[1], Wendy Ann Forbes[1], Chantal Buteau[1], Eric Muller[1], Ana I. Sacristán[2] ([1]Brock University, Canada; [2]Cinvestav, Mexico)
Students' Ways of Thinking in a Computer–based Mathematics Investigation Projects

20:40–20:50 **Gaye Williams** (the University of Melbourne, Australia)
Reciprocity between Teachers' and Students' Problem–solving Actions Enables Teacher Change

20:50–21:00 **Discussion**

Session II

July 16, 21:30–23:00 **Location: W315**

21:30–22:00 **Keiko Hino**[1], Yuka Funahashi[2] ([1]Utsunomiya University, Japan; [2]Nara University of Education, Japan)
Interactive Patterns that Lead to Children's Discursive Changes in Lessons Comparing Fractions

22:00–22:15 **Eivind Kaspersen**, Trygve Solstad (Norwegian University of Science and Technology, Norway)
Assessing Mental Abstraction Activities Using Eye–tracking Techniques

22:15–22:30 **Michael Neubrand** (Carl von Ossietzky University Oldenburg, Germany)
Mathematics Itself: Reflections about an Often Neglected, but Pivotal Dimension

22:30–22:40 **Marcia M. F. Pinto**[1], Thorsten Scheiner[2] ([1]Federal University of Rio de Janeiro, Brazil; [2]Institute for Learning Sciences & Teacher Education, Australia)
On the Epistemological Significance of Contextualizing in Mathematical Cognition

22:40–22:50 **Bishnu Khanal** (Tribhuvan University, Kathmandu, Nepal)
Learning Strategies Used by High Achieving and Low Achieving Students in Mathematics

22:50–23:00 **Discussion**

Session III

July 17, 14:30–16:30 **Location: W315**

14:30–15:00 **Lieven Verschaffel**, Joke Torbeyns, Gwen Verguts, Bert De Smedt (KU Leuven, Belgium)
The Amazingly Frequent, Efficient, and Flexible Use of the Subtraction–by–addition Strategy in Elementary School Children's Mental Multi–digit Arithmetic: A Challenge for Cognitive Psychology and Mathematics Education

15:00–15:15 **Nancy EstÉvez**[1], Danilka Castro[2], Eduardo Martínez[3], Vivian Reigosa[4] ([1]Neurodevelopmental Laboratory, Cuban Centre for Neurosciences, Cuba; [2]Centre for Advanced Research in Education, Universidad de Chile, Chile, School of Psychology. Universidad Mayor, Chile; [3]Neuroinformatics Department. Cuban Centre for Neurosciences, Cuba; [4]National Institute for Educational Assessment, Uruguay)
Numerical Processing Profiles in Children with Varying Degrees of Arithmetical Achievement

15:15–15:25 Estivaliz Aragon, Gamal Cerda, Manuel Aguilar, Carlos Mera, **Jose I. Navarro**[1] ([1]University of Cadiz, Spain)
General and Specific Cognitive Precursors on the Early Mathematical Performance

15:25–15:35 **Jairo Alfredo Navarrete** (Universidad de O'Higgins, Chile)
A Cognitive Model of Learning Applied to Data Analysis of Mathematics Learning

15:35–15:45 Danilka Castro Cañizares[1], **Pablo Dartnell**[2], Nancy Estévez Pérez[3] ([1]Center for Advanced Research in Education. Universidad de Chile, Chile. School of Psychology. Universidad Mayor, Chile; [2]Center for Advanced Research in Education and Center for Mathematical Modeling. Universidad de Chile, Chile; [3]Educational Neurosciences Department. Cuban Centre for Neurosciences, Cuba)
Exploring Basic Numerical Capacities in Children with Varying Degrees of Arithmetical Achievement

15:45–15:55 **Discussion for Session 3**

15:55–16:30 **Overview Discussion**

TSG

TSG21: Neuroscience and Mathematics Education / Cognitive Science

Chair: Inge Schwank (University of Cologne, Germany)

Co–chair: Mary–line Gardes (Lyon University, France)

Team members: Yijie He (East China Normal University, China), Yasufumi Kuroda (Kyoto University

of Education, Japan), Trygve Solstad (Norwegian University of Science and Technology, Norway)
IPC Liaison Person: Jiansheng Bao (China)

Session I

July 14, 19:30–21:00 **Location: T206**

19:30–19:45 **Inge Schwank**[1], Marie–Line Gardes[2] ([1]University of Cologne, Germany; [2]Lyon Neuroscience Research Center (CRNL), University of Lyon 1, France)
Introduction & General Discussion

19:45–20:00 Zhou Xinlin, Qi Chunxia, Wang Li, **Cao Chen** (Beijing Normal University, China)
General Spatial Ability Other than Special Mathematical Ability Correlates with Ill–Structured Problems in Junior Students

20:00–20:15 Parnika Bhatia, Jessica Leone, Jerome Prado, **Marie–Line Gardes** (Lyon Neuroscience Research Center (CRNL), University of Lyon 1, France)
Behavioral Processing of Fractions in Adults with and without Mathematics Learning Difficulties

20:15–20:30 **Tatsuki Kondo**[1], Naoko Okomato[2], Yasufumi Kuroda[3] ([1]Graduate school of Education, Kyoto University of Education, Japan; [2]Department of Social Sciences, College of Social Sciences, Ritsumeikan University, Japan; [3]Department of Mathematics, Faculty of Education, Kyoto University of Education, Japan)
Consideration of Characteristics of Eye Movement and Brain Activity during Mental Rotation Tasks

20:30–20:45 **Trygve Solstad**, Silvester Sabathiel, Celestino Creatore(Norwegian University of Science and Technology, Norway)
Learning Representations of Mathematical Objects in Computational Models of Mathematical Cognition

20:45–21:00 **Yuqing Zhao**[1], Feidan Yu[2], Zikun Gong[1] ([1]Hangzhou Normal University, China; [2]Yuhang Chongxian First Primary School, China)
Electrophysiological Characteristics of First–grade Children at Different Levels of Number Sense

Session II

July 17, 21:30–23:00 **Location: T206**

21:30–21:55 Roland Grabner[1], Stefan Halverscheid[2], Jochen A. Mosbacher[1], **Kolja Pustelnik**[2] ([1]Institute of Psychology, University of Graz, Austria; [2]Mathematics Institute, University of Göttingen, Germany)
Declarative Knowledge and Procedural Knowledge: Learning Processes in the Case of Pound Arithmetic

21:55–22:20 **Inge Schwank**[1] & Elisabeth Schwank[2] ([1]University of Cologne, Germany; [2]University of Münster, Germany)
Even Young Children Are Able to Grasp and Apply Logical Rules in Mathematically Structured Environments. The Puzzle of Cognition

22:20–22:45 **Jo Van Hoof**[1], Eva Ceulemans[2], and Wim Van Dooren[1] ([1]Centre for Instructional Psychology and Technology, University of Leuven, Belgium; [2]Centre for Quantitative Psychology and

Individual Differences, University of Leuven, Belgium)
The Role of the Natural Number Bias and Strategy Switch Cost in a Fraction Comparison Task: A Reaction Time Study with Seventh Graders

22:45–23:00 **Inge Schwank**[1], Marie–Line Gardes[2] ([1]University of Cologne, Germany; [2]Lyon Neuroscience Research Center (CRNL), University of Lyon 1, France)
General Discussion & Closing

TSG22: Mathematical Applications and Modelling in Mathematics Education

Chair: Gilbert Greefrath (University of Münster, Germany)
Co–chair: Susana Carreira (Universidade do Algarve, Portugal)
Team members: George Ekol (University of Witwatersrand, South Africa), Xiaoli Lu (East China Normal University, China)
IPC Liaison Person: Gabriele Kaiser (Germany)

Session I

July 13, 14:30–16:30 **Location: T219**

14:30–14:45 **Introduction**

14:45–15:05 **Gabriele Kaiser** (University of Hamburg, Germany)
The Teaching and Learning of Mathematical Modelling a Description of the Current State–of–the–Art

15:05–15:10 **Discussion**

15:10–15:20 **Milton Rosa**, Daniel Clark Orey (Universidade Federal de Ouro Preto, Brazil)
Sociocultural Influences on Mathematical Modelling: An Ethnomathematical Perspective

15:20–15:30 **Stanislaw Schukajlow, Werner Blum** (University of Muenster, University of Kassel, Germany)
Teaching Methods for Modelling Problems

15:30–15:35 **Discussion**

15:35–15:40 **Masahiro Takizawa** (Otawara Senior High School, Otawara City, Japan)
Examining the Geographical Features of the Nasu Area Analyzing the Origin of the Nasu Area Using Mathematics

15:40–15:45 **Eloisa Benitez–Mariño** (Universidad Veracruzana, Xalapa, Mexico)
A Mathematical Modelling Technique as Tool for Teaching Mathematics

15:45–15:50 **Wenmin Zhao**, Samuel Otten (Guangdong University of Education, Guangzhou, China)
Theorizing Tensions between Mathematical Modeling Processes and Conventional Mathematics Instruction

15:50–15:55 **Discussion**

15:55–16:00 **Takashi Kawakami**, Jonas Bergman Arleback (Utsunomiya University, Japan)
The Rationales of Statistical Modelling in Education Research from a Mathematical Modelling Perspective

16:00–16:05 **Dragana Martinovic** (University of Windsor, Canada)
Modelling in a Teacher Education Programme

16:05–16:15 **Discussion**

16:15–16:30 **Poster Presentation**

TSG

Session II

July 13, 19:30–21:00 **Location: T219**

19:30–19:40 **María Aravena Diaz**, Marcelo Alejandro Rodriguez, Susan Valeria Sanhueza Henriquez, Maria Jose Seckel, Angelica Urrutia Seplveda (Catholic University of Maule, Talca, Chile)
Mathematical Modeling in STEM Contexts. Characterization of STEM Skills and Gender Gaps in Initial Formation of Mathematics Teachers

19:40–19:50 **Dario Andres Gonzalez** (Universidad de Chile, Santiago, Chile)
Correspondence versus Covariation Perspectives While Modeling Global Warming

19:50–19:55 **Discussion**

19:55–20:00 **George Ekol** (University of Witwatersrand, Johannesburg, South Africa)
Using Assessment for Learning to Support Students Modelling Activities

20:00–20:05 **George Gotoh**, Mitsuru Kawazoe, Hirofumi Ochiai (Niigata University, Japan)
Epistemic States of University Mathematics Teachers in Mathematical Modelling Education

20:05–20:10 **Alina Alwast**, Katrin Vorhölter (University of Hamburg, Germany)
Using Staged Videos to Foster Pre–service Teachers Noticing Skills

20:10–20:20 **Hans–Stefan Siller, Gilbert Greefrath**, Raphael Wess, Heiner Klock (University of Wuerzburg, University of Muenster, Germany)
Prospective Teachers Self–efficacy for Teaching Mathematical Modelling

20:20–20:30 **Discussion**

20:30–20:35 **Rejoice Akapame**, Robin Angotti (University of Washington Bothell, United States of America)
Pedagogy That Supports Mathematical Modeling One Elementary School Teachers Story

20:35–20:40 **JooYoung Park** (Florida institute of technology, Melbourne, United States of America)
Pre–service Mathematics Teachers Project–based Mathematical Modeling Instruction: Conception, Task Design, And Enactment

20:40–20:45 **Akihiko Saeki**, Masafumi Kaneko, Takashi Kawakami, Toshikazu Ikeda (Naruto University of Education, Yokohama National University, Japan)
The Development of a Modelling Teacher Education Program Starting from the Transformation of a Mathematised Task into Modelling Tasks

20:45–20:50 **Abolfazl Rafiepour**, Zohreh Khazaei (Shahid Bahonar University of Kerman, Iran)
Prospective Teachers of Mathematics Suspend Common Sense in Solving Word Problem

20:50–21:00 **Discussion**

Session III

July 16, 21:30–23:00 **Location: T219**

21:30–21:35 **Armando Paulino Preciado Babb**, Fredy Peña Acuña, Andrea Ortiz Rocha, Armando Solares Rojas (University of Calgary, Canada)
The Mathematical Modelling Landscape: A Literature Review on Perspectives, Methodology, Content, Unit of Analysis, And Geography

21:35–21:45 **Paola Andrea Ramirez Gonzalez** (Universidad de Talca, Chile)
Distinguishing the Distinctions: Observing the Solving of a Mathematical Modelling Task

21:45–21:50 **Discussion**

21:50–21:55 **Kwan Eu Leong** (University of Malaya, Kuala Lumpur, Malaysia)
Mathematical Modelling Skills of Secondary Students

21:55–22:05 **Jian Huang**, Binyan Xu (East China Normal University, Shanghai, China)
Mathematical Modeling in the New Curriculum: Are Chinese Students Ready?

22:05–22:15 **Hyunyi Jung**[1], Corey Edison Brady[2], Jeffrey Allen McLean[3], Angeles Dominguez[4], Aran Glancy[5] ([1]University of Florida, US; [2]Vanderbilt University, US; [3]University of North Carolina at Chapel Hill, US; [4]Tecnologico de Monterrey, Mexico; [5]University of St. Thomas, USA)
Student Presentations of Mathematical Modelling as a Site for Fostering Reflective Discourse

22:15–22:20 **Discussion**

22:20–22:25 **Kazuhiko Imai** (Graduate school of education, Saitama University, Kawagoeshi, Japan)
How Do Undergraduate Students Hold the Individual Assumptions in Collaborative Modelling?

22:25–22:30 **Jeffrey Allen McLean**[1], Corey Edison Brady[2], Hyunyi Jung[3], Angeles Dominguez[4], Aran Glancy ([1]University of North Carolina at Chapel Hill, US; [2]Vanderbilt University, US; [3]University of Florida, US; [4]Tecnologico de Monterrey, Mexico)
Investigating Students Data Moves in a Citizen Science Based Data–Rich Model–Eliciting Activity

22:30–22:35 **Flavio Guiñez** (Universidad de Chile, Santiago, Chile)
Differences in Students Conceptions about Mathematics When Participating in a Mathematical Modeling Contest

22:35–22:40 **Discussion**

22:40–22:45 **Xie Zhiyong**, Li Yaling, Wang Tian, Liu Jian (Beijing Normal University, Beijing, China)
Measurement Mathematical Modeling Competency and Its Relationship to Mathematical Interests of Seventh Grade

22:45–22:50 **Tian Wang**, Xie Zhiyong, Jian Liu (Beijing Normal University, Beijing, China)
Assessment of Four–grade Students Mathematical Modelling Competency: Take One City of China as an Example

22:50–23:00 **Discussion**

Session IV

July 17, 14:30–16:30 **Location: T219**

14:30–14:35 **Laurent Moutet** (Paris Diderot University, Paris, France)
Study of a Problem Solving Using the Extended Mathematical Working Space Framework (Extended MWS)

14:35–14:40 **Bambang Riyanto** (Sriwijaya University, Ogan Komering Ilir, Indonesia)
Mathematical Modelling Learning in Indonesian Senior High School

14:40–14:45 **Kazem Abdollahpour Chenary, Abolfazl Rafiepour** (Shahid Bahonar University of Kerman, Iran)
Introducing a Composite Model for Investigation in Real World Problem

14:45–14:55 **Discussion**

14:55–15:00 **Lena Frenken** (University of Muenster, Germany)
A Computer–based Learning Environment on Mathematical Modelling: Research Design and Pilot Studies

15:00–15:05 **Susana Carreira**, Guillermo Enrique Ramirez Montes, Ana Claudia Henriques (Universidade do Algarve & UIDEF – IE, UL, Faro, Portugal)
Undergraduate Students' Modelling Routes Mediated by Technology in the Learning of Linear Transformations

15:05–15:10 **Discussion**

15:10–15:20 **Rina Durandt**, Werner Blum, Alfred Lindl (University of Johannesburg, South Africa)
Is Quality Teaching Favourable for the Development of Modelling Competency? An Empirical Study with Engineering Students over Two Years

15:20–15:30 **Jennifer A. Czocher**, Sindura Kandasamy, Elizabeth Roan (Texas State University, United States of America)
Validating a Modelling Competencies Assessment

15:30–15:35 **Saul Ernesto Cosmes Aragon**, Elizabeth Montoya Delgadillo (Pontificia Universidad Catolica de Valparaiso, Chile)
Mathematical Modelling in The Training of Engineers in the Civil Structures Context

15:35–15:40 **Discussion**

15:40–15:45 **Yuriy Rogovchenko** (University of Agder, Krisitansand, Norway)

Mathematical Modelling with Biology Undergraduates: Using Activity Theory to Understand Tensions

15:45–15:50 **Lorenza Illanes, Roberto Retes** (Tecnológico de Monterrey, México; Universidad Peruana de Ciencias Aplicadas (UPC), Santiago, Chile)
Calculus Learning Competency through Mathematical Modelling

15:50–15:55 **John Anthony Gordon** (City University of New York, United States of America)
Applicability and Transferability–Important Pedagogical Objectives Crucial in the Compartmental Analysis Module of an Introductory Course in Ordinary Differential Equations

15:55–16:00 **Yixin Dong**, Huanhuan Zhang, Meng Ci, Ziyi Wang (Huaibei Normal University, China)
Research on Evaluation of College Students' Mathematical Modeling Ability Based on AHP and BP Neural Network

16:00–16:10 **Discussion**

16:10–16:30 **Final Report and Discussion**

TSG23: Visualization in the Teaching and Learning of Mathematics

Chair: Cristina Sabena (University of Torino, Italy)
Co–chair: Marc Schäfer (Rhodes University, South Africa)
Team members: Marei Fetzer (Goethe–University Frankfurt, Germany), Hui–Yu Hsu (Taiwan Tsing Hua University, Taiwan, China), Zhiqiang Yuan (Hunan Normal University, China)
IPC Liaison Person: Alicia Dickenstein (Argentina)

Session I

July 13, 14:30–16:30 **Location: T418**

14:30–14:50 **Welcome and Introduction – Setting the Scene: Visualization and Problem–solving**

14:50–15:06 **Ferdinando Arzarello**, Cristina Sabena, Carlotta Soldano (University of Turin, Torino, Italy)
Imaging and Visualizing in Geometry: Explorations by Mathematics University Students

15:06–15:22 **Beata Dongwi**, Marc Schäfer (Rhodes University, Windhoek, South Africa)
Visualization as an Embodied Problem–solving Process

15:22–15:38 **Leah Michelle Frazee**, Michael Battista (Central Connecticut State University, US)
Characterizing Visualization and Spatial Analytic Reasoning for Solving Isometry Problems

15:38–15:54 **Dennis Lee Jarvis Baring Ybanez**, Catherine Vistro Yu (Ateneo de Manila University, Quezon City, Philippines)
The Role of Visualization towards Student's Mathematical Abstraction and Representation in Solving Probabilities

15:54–15:58 **Introduction to the Theme: Classroom Interaction**

15:58–16:14 **Clemence Chikiwa**, Marc Schäfer (Rhodes University, Grahamstown, South Africa)
The Use of Gestures and Language as Co–existing Visualization Teaching Tools in Multilingual Classes

16:14–16:30 **Marei Fetzer** (Goethe–University, Frankfurt, Germany)
On Objects and Visualizations–An Interactionistic Perspective

Session II

July 13, 19:30–21:00 **Location: T226**

19:30–19:33 **Link with Previous Session and Introducing the New Session: Visualization and Teaching**

19:33–19:49 **Hui–yu Hsu** (Taiwan Tsing Hua University, Taiwan, China)
How Teachers Scaffold Students in Visualizing Diagram for Understanding Geometric Problem

Solving

19:49–20:05 **Vimolan Mudaly** (University of KwaZulu–Natal, Durban, ZA, South Africa)
Preservice and Inservice Teachers' Mathematics Visualization Skills

20:05–20:16 **Hirotshi Furutsu**, Yukiko Ishii, Hisashi Kato, Yusuke Washio, Noriko Hirata–Kohno (Nihon University, Japan)
Dynamic Visual Instructions by Geogebra for Introducing Takada's Theorem on Pentagons

20:16–20:27 **Wei Wang**, Xue Huang (Northeast Yucai School, Shenyang, China)
High School Mathematics Inquiry Teaching Based on Geogebra Visualization Environment

20:27–20:28 **Introduction to the Theme: Different Kinds of Representations, Different Technologies**

20:28–20:44 **Jill A. Cochran** (Berry College, Rome, US)
The Development of 3D Representations Using Physical Manipulatives, Technology–aided Design and 2D Drawings

20:44–21:00 **Elena Naftaliev** (Achva Academic College, Israel)
The Social Construction of Knowledge in a New Pedagogical Setting: The Same Activity Presented as Three Different Interactive Diagrams

Session III

July 14, 19:30–21:00 **Location: T418**

19:30–19:35 **Emerging Themes from Previous Session and Prompt for Discussion**

19:35–19:58 **Discussion**

19:58–19:59 **Introduction to the Theme: Diagrams and Mathematics Visualization**

19:59–20:15 **Francesco Beccuti** (University of Turin, Italy)
Visualization as Vision, Imagination and Intuition: Reflections on Graduate Students Struggling with a Visual Conjecturing Problem

20:15–20:26 **Martin Flashman** (Humboldt State University, US)
Mapping Diagrams: Function Visualization of Real and Complex Analysis and Matrix Algebra

20:26–20:37 **Antti Rasila** (Guangdong Technion Israel Institute of Technology, Shantou, China)
Interactive Visualizations of Topics in Engineering Mathematics

20:37–20:38 **Introduction to the Theme: Math, Visualization and Other Disciplines**

20:38–20:49 **Liora Nutov** (Gordon Academic College of Education, Haifa, Israel)
Concept Images of Infinity in Pre–service Teachers Artworks

20:49–21:00 **Yan Li**, Pan Liu, Xinyu Liu (East China Normal University, Shanghai, China)
Research on Visualization in Mathematics Learning Based on Mathematical Drama Performance or by Video

Session IV

July 17, 21:30–23:00 **Location: T418**

21:30–21:33 **Link with Previous Session and Introduction to the Theme: Visualization and (Latest) Technologies**

21:33–21:49 **Giulia Bini**, Ornella Robutti (University of Turin, Italy)
Some Like It Social: Looking into the Interplay Between Math and Internet Memes

21:49–22:05 **Daniela Goetze** (University of Siegen, Germany)
Children's Ambiguous Interpretation of Visualizations – Eye Tracking as a Diagnostic Tool for Division Concepts

22:05–22:16 **Luona Wang** (East China Normal University, China)
A Review of the Application Cases of Augmented Reality (AR) in Mathematics Education

22:16–22:17 **Introduction to the Theme: Educational Materials**

22:17–22:28 **Jiling Gu**, Fei Zhang (Nanjing normal university, Nanjing, China)

TSG

The Textbook Design of Geometrical Visualization in "Number and Algebra" Field

22:28–22:39 **Janos Szasz Saxon**, Zsuzsa Dardai (Poly–Universe Ltd, Budapest, Hungary)
PUSE (Poly–universe in School Education) Methodology Visual Experience Based Mathematics Education 2019

22:39–22:50 Santanu Dutta, Charudatta Sharad Navare, HARITA RAVAL (Homi Bhabha Centre for Science Education, Mumbai, IN)
Drawing (on) Diagrams: Typicality of Geometric Shapes in Concept Image Elicitation for Secondary Students

22:50–23:00 **Discussion and Conclusion**

TSG24: The Role and the Use of Technology in the Teaching and Learning of Mathematics at Primary Level

Chair: George Gadanidis (Western University, Canada)
Co–chair: Sitti Patahuddin (University of Canberra, Australia)
Team members: Jiaxia Liu (Beijing Institute of Education, China)
IPC Liaison Person: Luc Trouche (France)

Session I

July 13, 19:30–21:00 **Location: W111**

19:30–19:40 **Introductions, TG Organization**

19:40–20:05 **Kevin Larkin**[1], **Christina Marie Watts Lommmatsch**[2], Thomas Lowrie[3] ([1]Griffith University, Australia; [2]University of Canberra, USA; [3]University of Canberra, USA)
Developing Young Children's Early Logical Reasoning: A Novel Approach to the Use of User Generated Content

20:05–20:15 **Discussion**

20:15–20:30 **Jia Yi Boo**, Kwan Eu Leong (University Malaya, Malaysia)
Effectiveness of Digital Game–based Learning (DGBL) in Enhancing Fraction Skills among Primary Four Pupils

20:30–20:40 **Ernest Qinghua Lin** (Pei Hwa Presbyterian Primary School, Singapore)
How Will the Use of Technology Enhance the Conceptual Understanding of Comparing Fractions at Lower Primary?

20:40–20:50 **Sitti Patahuddin**, Jonathan Adam (University of Canberra, Australia)
ELPSA Framework Uses in Designing Lessons with Web–based Resources: A Case of Equivalent Fractions

20:50–21:00 **Discussion**

TSG

Session II

July 16, 21:30–23:00 **Location: W111**

21:30–21:35 **Introduction**

21:35–21:50 **Mollie Helen Appelgate**, Christa DeAnn Jackson, Kari Nicole Jurgenson (Iowa State University, USA)
Using Mathematically–focused Text Messages to Connect Families with Their Childs Learning

21:50–22:05 **Rafikh Rashid Shaikh**, **Harita Raval**, **Harshit Agrawal**, **Nagarjuna Gadiraju** (HBCSE, Tata Institute of fundamental Reasearch, India)
Impact of Computer–mediated Sharing on Classroom Activities

22:05–22:15 **Discussion**

22:15–22:30 **Nigel Stuart Calder** (University of Waikato, New Zealand)

Interacting with Scratchmaths to Facilitate Collaborative Problem Solving

22:30–22:45 **George Gadanidis**, Janette Hughes, Immaculate Namukasa, Ricardo Scucuglia (Western University, Canada)
Computational Modelling in Grades 1–3 Mathematics

22:45–23:00 **Discussion**

Session III

July 17, 14:30–16:30 **Location: W111**

14:30–14:35 **Introduction**

14:35–14:45 **Discussion**

14:45–15:00 **Catherine Attard**, Kathryn Holmes (Western Sydney University, Australia)
An Exploration of the Effective Use of Technology in Four Primary Mathematics Classrooms

15:00–15:15 **K M Leung**, P Y Tang (Curriculum Institution, Hong Kong SAR, China)
Coding in Elementary Mathematics Lessons

15:15–15:25 **Discussion**

15:25–15:35 **Rune Herheim**, Elena Severina (Western Norway University of Applied Sciences, Norway)
Scratch Programming and Students Explanations

15:35–15:45 **Manabu Goto** (Sagami Womens University, Japan)
Proposal on How to Use Digital Textbooks at Primary Level and Research Directions

15:45–15:55 **Megan Lea Clune** (The University of Auckland, New Zealand)
Understanding Students Use of Mathematical Processes during a Digital Escape Experience

15:55–16:10 **Discussion**

16:10–16:30 **Global Discussion and Remarks**

TSG25: The Role and the Use of Technology in the Teaching and Learning of Mathematics at Lower Secondary Level

Chair: Morten Misfeldt (University of Copenhagen, Denmark)
Co–chair: Hans–Stefan Siller (University of Wuerzburg, Germany)
Team members: Mariam Haspekian (Université Paris Descartes, France), Arthur Lee (The University of Hong Kong, Hong Kong SAR, China), Mailizar Mailizar (Syiah Kuala University, Indonesia)
IPC Liaison Person: Alicia Dickenstein (Argentina)

Session I

July 13, 14:30–16:30 **Location: T223**

14:30–14:40 **Welcome and Housekeeping**

14:40–14:50 **Morten Elkjaer**, Lui Albaek Thomsen (AU / EduLab, Denmark; Aalborg University, Denmark)
An Immersive Learning Experience for Teaching Equations Equation Lab

14:50–15:00 **Ghislaine Gueudet**, Sophie Joffredo–Le Brun (University of Brest, France; Catholic University of the West, France)
Student's Autonomy and Digital Technologies: Collective Documentation Work in Preservice Teacher Education

15:00–15:10 **Discussion of the two long papers**

15:10–15:20 **Break**

15:20–15:28 **Shiwei Tan** (Guangxi Normal University, China)
Using Augmented Reality Technology for Instructional Media in Mathematics Education

15:28–15:36 **Marianne Thomsen**[1], Uffe Thomas Jankvist[2] ([1]Aarhus University, DPU, Denmark; [2]Aarhus University, Afghanistan)
Mediations and Rules when Working with the Interplay between Original Sources and Geogebra

15:36–15:44 **Sylvia Van Borkulo**, Paul Drijvers (Utrecht University, Netherlands)
Developing Spatial Skills in a Virtual Reality Environment for Carpentry Apprentices

15:44–15:54 **Discussion of the Three Short Papers**

15:54–16:04 **Break**

16:04–16:07 **Wesley Matheus Moura Balbino**, Medeiros de Oliveira, Francismar Holanda (Instituto Federal Do Piaui, Brazil)
Application of GeoGebra in the Function Study: The Use of ICT in Teaching Mathematics

16:07–16:10 **André Greubel**, Hans–Stefan Siller (Faculty of Mathematics and Computer Science, Germany)
EVA: An Educational Tool to Simulate Evacuations of Buildings

16:10–16:13 **Erin Herz**, **George Ekol** (University of Witwatersrand, South Africa)
Perspectives on the Use of ICT in the High School Mathematics Classrooms

16:13–16:16 **Santosh Paudel**[1], **Binaya Bhandari**[2] ([1]Adarsha Secondary School, Layaku Thimi Bhaktapur, Nepal; 2Sainik Awasiya Mahavidyalaya, Nepal)
Role of ICT to Enhance Mathematics Teaching

16:16–16:19 **Carlos Eduardo Leon**[1], **Jefer Camilo Sachica–Castillo**[2] ([1]La Gran Colombia University, Colombia; [2]Universidad Nacional De Colombia, Colombia)
The Mathema Kids Research Seed: A Geogebra Youth Club that Tells Stories

16:19–16:29 **Discussion of the 5 posters**

Session II

July 14, 19:30–21:00 **Location: T223**

19:30–19:40 **Zhu Fangchun** (East China Normal University, China)
Instrumental Orchestration with Dynamic Geometry: A Chinese Case Study

19:40–19:50 **Cecilie Carlsen Bach** (Aarhus University, Denmark)
Gray–boxing as a Means for Mathematical Communication

19:50–20:00 **Discussion of long papers**

20:00–20:10 **Break**

20:10–20:18 **Jair Dias de Abreu**[1], Silviano de Andrade[2] ([1]Universidade Estadual Da Paraiba, Brazil; [2]UEPB, Brazil)
Desmos App in the Mathematics Classroom: Limitations and Potentialities

20:18–20:26 **Adi Nur Cahyono**, Yulius Leonardus Sukestiyarno, Mohammad Asikin and Matthias Dieter Ludwig (Universitas Negeri Semarang, Indonesia)
Augmented Reality for Outdoor Modeling Tasks: Bridging Real Problems with Mathematical Concepts

20:26–20:34 Daniel Thurm, **Baerbel Maria Barzel** (University Duisburg–Essen, Germany)
Micro–teaching of Landmark Jobs Fostering Self–efficacy for Teaching Mathematics with Technology

20:34–20:42 **Joaquin Gimmenez**, Silvia Carvajal, Vicenç Font (Barcelona University, Spain)
Digital Competency Found by Prospective Secondary Teachers According Ontosemiotic Approach

20:42–20:52 **Discussion of the four short papers and the poster**

Session III

July 16, 21:30–23:00 **Location: T226**

21:30–21:40 **Ahlam Anabousy**, Michal Tabach (Tel–aviv university, Seminar Hakibutzim College, Israel)
The Development of Technological Craft Knowledge within a Community of Inquiry

21:40–21:50 **Ana Donevska–Todorova** (Goethe University Frankfurt am Main, Germany)
Mobile Learning of Mathematics with Apps for Math Trails

21:50–22:00 **Discussion of long papers**

22:00–22:10 **Break**

22:10–22:18 **Prateek Shah**[1], Harshit Agrawal[2], Sanjay Chandrasekharan ([1]Indian Institute of Management Ahmedabad, India; [2]Homi Bhabha Centre for Science Education, India)
Media, Cognition and Assemblage Perspectives on ICT in Education: A Three–part Study in an Indian School

22:18–22:26 **Mariam Haspekian** (University of Paris, France)
Evolution of Teaching Practices with ICT: A Case Study with Scratch in the French New Mathematics Curricula

22:26–22:34 **Ingi Heinesen Hojsted** (Aarhus University, Denmark)
Connecting Conjectures and Proof Using Dynamic Geometry Environments and a Toolbox Puzzle Approach

22:34–22:37 **Alejandro Miguel Rosas Mendoza** (Instituto Politecnico Nacional, Mexico)
Technology in Classroom: A Report of 3 Researches

22:37–22:47 **Discussion of the Three Short Papers and the Poster**

Session IV

July 17, 21:30–23:00 **Location: T223**

21:30–21:38 **Brigitte Grugeon–Allys**, Elann Lesnes–Cuisiniez, Fabrice Vandebrouck (University Paris Est Creteil, France)
Impact of Online Automated Learning Path on Student Learning: The Mindmath Project in Elementary Algebra

21:38–21:46 **Joseph Simon Madrinan**, Catherine Vistro Yu (Ateneo de Manila University, The Philippines)
Engagement and Moderation of Mathematical Modelling Tasks in Virtual Environments

21:46–21:54 **Rabindra Kumar Bhattacharyya** (Retired. Calcutta University, Dept App Math, India)
Computer–dependent Mathematics Teaching in Schools

21:54–22:02 **Liping Yao** (South Dongchang Middle School Attached to ECNU, China)
Type of Mathematics Tasks with Dynamic Geometry Software

22:02–22:12 **Discussion of the Four Short Papers**

22:12–22:17 **Break**

22:17–22:25 **Thomas K.F. Chiu** (The Chinese University of Hong Kong, Hong Kong SAR, China)
Strategic Use of Content–specific and Content–neutral Technologies to Cater Learning Diversity in Mathematics

22:25–22:33 **Rikke Maagaard Gregersen** (Aarhus University, Denmark)
Digital Tools and Mediation in Informal Justification

22:33–22:41 **Mathilde Kjaer Pedersen**[1], Uffe Thomas Jankvist[2], Morten Misfeldt[3] ([1]Danish School of Education, Aarhus University, Denmark; [2]Aarhus University, Afghanistan; [3]University of Copenhagen, Denmark)
Digital Technology in Relation to the Mathematical Thinking Competency

22:41–22:44 **Hoi Kei Melody Wong**[1], I.A.C.Mok[2] ([1]Good Hope School, Hong Kong SAR, China; [2]The University of Hong Kong, Hong Kong SAR, China)
Students Mathematics Experience of the Technology Self–directed Learning (TSDL) Pedagogy

22:44–22:54 **Discussion of the Three Short Papers and the Poster**

22:54–22:55 **Closing**

TSG

TSG26: The Role and the Use of Technology in the Teaching and Learning of Mathematics at Upper Secondary Level

Chair: Ornella Robutti (Universita degli Studi di Torino, Italy)
Co–chair: Gilles Aldon (École Normale Supérieure de Lyon, France)
Team members: Rongrong Cao (Qingdao University, China), Victor Giraldo (Universidade Federal do Rio de Janeiro, Brazil), Azimeh Khakbaz (Bu–Ali Sina University, Iran)
IPC Liaison Person: Alicia Dickenstein (Argentina)

Session I

July 13, 19:30–21:00 **Location: T316**

19:30–19:45 **Introduction**

19:45–20:00 **Gilles Aldon**[1], Monica Panero[2] （[1]IFÉ–ENS de Lyon, France; [2]SUPSI, Locarno, Confédération Helvétique）
Formative Assessment and Technology: An Attempt of Framework

20:00–20:15 **Annalisa Cusi**[1], Agnese Ilaria Telloni[2] ([1]Sapienza University of Rome, [2]University of Ancona)
Students as Designers of Digital Curriculum Resources

20:15–20:30 **Rosa Annalucia Alberto**, Anna Shvarts, Arthur Bakker, Paul Drijvers (Freudenthal Institute, Faculty of Science, Utrecht University, the Netherlands)
Straightening the Bend: Sequencing Embodied Experiences with High and Low–tech Designs for the Notion of Radian

20:30–21:00 **Discussion**

Session II

July 16, 21:30–23:00 **Location: T316**

21:30–21:40 **Introduction**

21:40–21:45 **Marie Joubert**, Geoff Wake, Marc North (University of Nottingham, Great Britain)
Questions of Design Research: A Technology Mathematics Lesson Framed by the Didactical Triangle

21:45–21:50 Ornella Robutti[1], **Theodosia Prodromou**[2], Gilles Aldon[3] ([1]University of Torino, Italy; [2]University of New England, Australia, [3]IFÉ–ENS de Lyon, France)
Merlo Item as Boundary Object in Teachers Professional Development

21:50–21:55 **Maxima Joyosa Acelajado**[1], Arlene B. Miyas[2] ([1]De La Salle University–Manila, [2]Muntinlupa National High School, Main)
Acceptability of the Proposed Multimedia Instructional Module in Selected Pre–calculus Topics among STEM Students of Muntinlupa National High School

21:55–22:00 **Mario Sanchez Aguilar** (Instituto Politecnico Nacional, CICATA Legaria, Mexico City, MX**)**
Twitter, Emotion and Mathematics

22:00–22:25 **Discussion**

22:25–22:30 **Mingyu Shao** (East China Normal University, China/ENS de Lyon, France)
Integrating Geogebra in Classroom Teaching of 3d Geometry: Contrasting a French and a Chinese Cases

22:30–22:35 **Kim Agatha Ramatlapana** (Botswana Open University, Gaborone, BW)
Mathematics Prospective Teacher Display of Technological Content Knowledge in a Geogebra–based Environment

22:35–22:40 **Carolina Guerrero Ortiz** (Pontificia Universidad Catolica de Valparaiso, Valparaiso, CL)
An Implementation of Technological Pedagogical Content Knowledge Framework for Analising the Design of Tasks in an Digital Environment

22:40–23:00 **Discussion**

TSG

Session III

July 17, 14:30–16:30 **Location: T316**

14:30–14:40 **Introduction**

14:40–14:45 **Jijian Lu**, Xiaoyuan Shen, Yi Lv (Hangzhou Normal University, Hangzhou, CN)
Mathematics VR Teaching Design Mode and Its Practice at Upper Secondary Level: Based on VR All–in–one Computer

14:45–14:50 **Stefan Rothschuh** (University of Calgary, Calgary, CA)
Mobilizing Mathematics: How Technology Enhances Embodied Learning

14:50–14:55 Roberto Capone, Federica Ferretti, Alessandro Gambini, **Camilla Spagnolo** (Free University of Bolzano/Bozen, Forli, IT)
The Reading and the Comprehension of Mathematics Text: An Eye–tracking Study with Primary Pre–service Teachers

14:55–15:00 **Yahya Tabesh** (Polyup Research, US)
Computational Thinking for Mathematical Learning

15:00–15:25 **Discussion**

15:25–15:30 **Jose Orozco–Santiago**, Carlos Armando Cuevas Vallejo, Luc Trouche (CINVESTAV, Mexico City, MX)
Students' Understanding of the Notion of Collinear Vectors in Dynamic Geometry Environment

15:30–15:35 **Chak Him Fung**, Poon Kin–Keung, Michael Besser (Education University of Hong Kong, Hong Kong SAR, China)
Enhancing Metacognition by Using Flipping Classroom with Geogebra

15:35–15:40 **Sofya Lyakhova**, Marie Joubert, Dominic Richard Oakes (Swansea University, Swansea, GB)
Students Coping with a Post–16 Mathematics Course: Flipped Learning, Self–regulation and Technology

15:40–16:00 **Discussion**

16:00–16:30 **Synthesis and Conclusion**

TSG27: The Role of the History of Mathematics in Mathematics Education

Chair: Ysette Weiss (Johannes Gutenberg–University Mainz, Germany)
Co–chair: Desiree van den Bogaart (Amsterdam University of Applied Sciences, the Netherlands)
Team members: Silvia Schoeneburg–Lehnert (University of Leipzig, Germany), Jiachen Zou (East China Normal University, China)
IPC Liaison Person: Maria Alessandra Mariotti (Italy)

TSG

Session I

July 13, 14:30–16:30 **Location: T423**

No.1 **Erika Zubillaga Guerrero**
Methodological Proposal for the Analysis of Historical Sources of Mathematics

No.2 **David Guillemette**
Towards Qualitative and Participative Research on History of Mathematics in Mathematics Education: Some Arguments and Possible Paths

No.3 **Jiaye Han**
The Application of HPM Micro–video in the Teaching of Binomial Theorem

No.4 **Zhuochen Li**
The Design and Cases of Primary School HPM Micro–video

Session II

July 14, 19:30–21:00 **Location: T423**

No.1 **Desiree van den Bogaart–Agterberg**
Combining Cognitive Demand with History of Mathematics in Mathematics (Teacher) Education

No.2 **Ysette Weiss**
The Gradual Linearization of German Geometry Teaching

No.3 **Silu Liu**
An Empirical Study on the Impact of Students' Cognition through the Concept of Function Teaching from the Perspective of HPM in Senior High School

Session III

July 16, 21:30–23:00 **Location: T230**

No.1 **Zhongyu Shen**
The Development of Teachers' MKT: A Case Study of HPM Learning Community

No.2 **Haozhe Jiang**
Enhancing Mathematics Teaching Self–efficacy in Pre–service Teachers: Effects of an HPM Learning Community in Shanghai

No.3 **Yanjun Hong**
A Study on History of Mathematics & Professional Development for Middle School Mathematics Teachers from the Perspective of MKT

Session IV

July 17, 21:30–23:00 **Location: T423**

No.1 **Silvia Schoeneburg–Lehnert Organum**
Organum Mathematicum – a Mathematical Shrine as Source for Modern Math Education

No.2 **Jorge Soto–Andrade**
The Binary Tree and Its Avatars: From Xiantian to the Eternal Symmetree

No.3 **Qingchun Yu**
An Empirical Research on the Intension of Mathematical Culture Based on the History of Mathematics

TSG28: Preservice Mathematical Teacher Education at Primary Level

Chair: Salvador Llinares (Universidad de Alicante, Spain)
Team members: Hui Jiang (Shanghai Normal University, China), Rukiye Didem Taylan (MEF University, Turkey), Craig Willey (Indiana University, USA)
IPC Liaison Person: Caroline Lajoie (Canada)

TSG

Session I

July 13, 14:30–16:30 **Location: T226**

14:35–14:50 **Christin Laschke,** Bettina Rösken–Winter, Sven Schüler (Humboldt–Universität zu Berlin, Germany)
How Pre–service Teachers Judge an Unexpected Student Solution – Explicit and Implicit Criteria

14:50–15:05 **Ji–Eun Lee[1],** Mi Yeon Lee[2] ([1]Oakland University, USA; [2]Arizona State, USA)
An Analysis of Preservice Teachers' Noticing of Student Pattern Generalization Strategies

15:05–15:10 **Bernabeu, M.**, Moreno, M., Llinares, S. (University of Alicante, Spain)
Designing Tasks for Support Preservice Primary Teachers' Noticing of Geometrical Thinking

15:15–15:25 **Jia He[1]**, Bo Zhang[2] ([1]Augusta University, USA; [2]Yang Zhou University, China)
Preservice Chinese Teachers' Responses of a Student Invented Decimal Division Algorithm

15:25–15:35 **Guðbjörg Pálsdóttir** (University of Iceland, Iceland)
Student Teachers´ Noticing of Children's Beliefs and Understanding in Mathematics

15:35–15:45 **Qintong Hu**[1], Lynn Hodge[2], Shande King[2] ([1]Shandong University of Science and Technology, China; [2]The University of Tennessee, Knoxville)
Relationship between Preservice Teachers' Knowledge and Their Responses to Students' Errors: Making Word Problems for the Concept of Division

15:45–15:55 **Müjgan Baki**, Zeynep Medine Özmen (Trabzon University, Trabzon, Turkey)
A Study on Written Feedback on Preservice Teachers' Teaching Practices and Its Impact on Noticing

15:55–16:05 **Zeynep ÖZEL**[1], Mine IŞIKSAL–BOSTAN[2], Reyhan TEKİN–SİTRAVA[3] ([1]Kırıkkale University; [2]Middle East Technical University; [3]Kırıkkale University, Turkey)
Prospective Teachers' Noticing of Student's Algebraic Thinking: Pattern Generalization

16:05–16:15 Hiroko Warshauer[1], **Christina Starkey**[2], Christine Herrera[3], Shawnda Smith[4] ([1]Texas State University; [2]Southern New Hampshire University; [3]California State University; [4]Chico Texas Woman's University, USA)
Developing Preservice Teachers' Noticing and Notions of Productive Struggle with Video Analysis

Session II

July 13, 19:30–21:00 **Location: T319**

19:30–19:45 **Gwen Ineson**[1]**, Julie Alderton**[2], Chronoula Voutsina[3], Kirsty Wilson[4], Gina Donaldson[5], Tim Rowland[6] ([1]Brunel University London; [2]University of Cambridge; [3]University of Southampton; [4]University of Birmingham; [5]Canterbury Christ Church University; [6]University of Cambridge, UK)
Tracing Threads of Awareness in Initial Teacher Education: Peer–collaboration

19:45–19:55 **Kinful Lartebea Aryee,** Immaculate Kizito Namukasa, Marja Bertrand (Western University, USA)
Preservice Mathematics Teacher Education for the Montessori Teachers

19:55–20:05 **Sangyeon Park** (University of Florida, USA)
Exploring Pre–service Teachers' Mathematics Learning Experiences and Self–efficacy in Teaching Primary Level Mathematics

20:05–20:15 **Xue Han** (National Louis University, USA)
Developing Prospective Teachers' Mental Models of Expertise in Teaching Elementary Mathematics

20:15–20:25 **Chikiwa Samukeliso**, Graven Mellony (Rhodes University, South Africa)
Where the Journey to Reflective Practice Begins: A Case of Pre–service Teachers

20:25–20:35 **Anjali Khirwadkar**, Candace Figg (Brock University, Canada)
Preservice Teachers Designing Meaningful Digital Learning Environments Using Makerspaces for Math

20:35–20:45 **Jean Claude Dushimimana**, Alphonse Uworwabayeho (University of Rwanda, Rwanda)
Situation Analysis on the Teaching and Learning of Statistics and Probability in Teacher Training Colleges

Session III

July 16, 21:30–23:00 **Location: T319**

21:30–21:45 Valentina Celi[1], José Ignacio Cogolludo[2], Raquel García Catalán[3], Elena Gil Clemente[4], **Inmaculada Lizasoain**[5], Ana María Millán Gasca[6], Luigi Regoliosi[7] ([1]Université Bordeaux; [2]Universidad de Zaragoza; [3]Universidad Pública de Navarra; [4]Universidad de Zaragoza; [5]Universidad Pública de Navarra; [6]Università Roma Tre; [7]Associazione Tokalon)
Mathematics Workshops: Changing the Perceptions of Both In–service and Prospective Teachers with Regard to Mathematics

21:45–22:00 **Rukiye Didem Taylan**, Zelha Tunç–Pekkan, Mustafa Özcan (MEF University, Turkey)
School University Partnership in Mathematics Teacher Education: How Prospective Mathematics Teachers View Their Experiences

TSG

22:00–22:10 **Ryan G. Zonnefeld,** Valorie L. Zonnefeld (Dordt University, USA)
Building a University–school Partnership: From Early Missteps to Emerging Success

22:10–22:20 **Bridgette A. Fincher**[1], Derrel V. Fincher[2] ([1]Pittsburg State University; [2]Oklahoma House of Representatives, USA)
Pre–service Elementary Teachers Do STEM Night: Inquiry Learning and Aha! Moments

22:20–22:30 **Dongchen Zhao**[1], Yunpeng Ma[2] ([1]Harbin Normal University, China; [2]Northeast Normal University, China)
Features of Exemplary Lessons over Different Decades: A Comparative Analysis of Eleven Elementary Mathematics Lessons in China

22:30–22:40 **Mark Arvidson** (Azusa Pacific University, USA)
In What Ways Does a Mathematics Curriculum Based on the Theory of Multiple Intelligences Affect the Attitudes and Beliefs of Pre–service Elementary School Teachers toward Mathematics?

22:40–22:50 **Suzanne R. Harper, Dana C.Cox**, Jane M. Keiser (Miami University, USA)
The Impact of Defining Activity on the Beliefs of Prospective Elementary Teachers

Session IV

July 17, 14:30–16:30 **Location: T319**

14:30–14:45 **Montes, M.**, Martín, J., Pascual, M.I., Climent, N., Carrillo, J. (University of Huelva, Spain)
Exploring How Prospective Teachers Pose Problems: The Case of 8×(–2)

14:45–15:00 **Marjolein Kool**[1], Ronald Keijzer[2] ([1]Hogeschool Utrecht, the Netherlands; [2]Hogeschool iPabo, the Netherlands)
Torpedo, a Digital Learning Environment for Developing Mathematical Problem–solving Ability in Primary Teacher Education

15:00–15:15 **Melva R. Grant**[1], Signe Kastburg[2] ([1]Old Dominion University, USA; [2]Purdue University, USA)
Using Technology for Virtual Representation of Teaching for Developing Math Talk during Problem Solving

15:15–15:25 **Suhaidah Tahir**, Masami Isoda, Munirah Ghazali, Dominador Dizon Mangao (Teacher Training Institute, Malasya)
Pre–service Teachers' Conceptual Understanding of Fractions: Implications for Improving Curriculum Standards and Classroom Practices

15:25–15:35 **Norma J. Boakes** (Stockton University, USA)
Integrating EDTPA Preparation in a Methods of Teaching Elementary Mathematics Course

15:35–15:45 **Hyun Jung Kang**[1], Paula Guerra Lombardi[2] ([1]University of Northern Colorado, USA; [2]Kennesaw State University, USA)
Elementary Preservice Teacher's Understanding of Fraction – In the Context of Fraction Division

15:45–15:55 **Alejandro López**[1], Salomé Martínez[2], Aldo Ramírez[2], Ricardo Salinas[2] ([1]Universidad Andres Bello, Chile; [2]Universidad de Chile, Chile)
Design of a Learning Unit for Pre–service Elementary School Teachers: Definition of the Boundary of a 2D Shape

15:55–16:05 **Israel García–Alonso**, Josefa Perdomo–Díaz, **Diana de las Nieves Sosa–Martín** (Universidad de La Laguna, Spain)
Contribution of a Didactic Course on the Development of Primary Pre–service Teachers' Knowledge of Measurement and Geometry

16:05–16:15 **Justina Longwe–Mandala** (University of Malawi, Malawi)
Explanatory Talk in the Teaching of Number Concepts and Operations to Pre–service Teachers: A Case of One Mathematics Teacher Educator

TSG29: Preservice Mathematical Teacher Education at Secondary Level

Chair: Olive Chapman (University of Calgary, Canada)
Co–chair: Benita Nel (The University of Cape Town, South Africa)
Team members: Jing Cheng (East China Normal University, China), Tracy Helliwell (University of Bristol, UK), Immaculate Kizito Namukasa (Western University, Uganda)
IPC Liaison Person: Jiansheng Bao (China)

Session I

July 13, 14:30–16:30 **Location: W301**

14:30–14:45 **Kim Beswick** (University of New South Wales, Australia)
Measuring Prospective Secondary Mathematics Teachers' Knowledge

14:45–14:57 **Jacqueline Coomes** (Eastern Washington University, USA)
Developing Preservice Teachers' Ability to Enact Formative Assessment for Mathematical Practices

14:57–15:05 **Ana Henriques,** Hélia Oliveira, Leonor Santos, and Henrique Guimarães (Universidade de Lisboa, Portugal)
Developing Prospective Teachers' Knowledge to Promote Students' Mathematical Reasoning: Design of a Teacher Education Experiment

15:05–15:13 **Na Young Kwon** (Inha University, South Korea)
A Case Study on Applied Lesson Study for Korean Secondary Pre-service Teachers

15:30–15:40 **Judy Anderson**, Debbie Tully (The University of Sydney, Australia)
Developing an Identity as a Mathematics Teacher: Connecting with the Community of Teacher Graduates

15:40–15:48 **Réka Szász** (Budapest Semesters in Mathematics Education, Hungary)
Emotional Awareness and Support for Preservice Teachers during Micro–teaching

15:48–15:56 **Viren Ramdhany** (University of Johannesburg, South Africa)
Should School and University Mentors Agree in Their Feedback to Pre-service Mathematics Teachers?

15:56–16:04 Ruthmae Sears[1], **Cynthia Castro–Minnehan**[1], Laurie Riggs[2], Pier Junor Clarke[3], Jamalee Stone[4], Charity Cayton[5], Maureen Grady[5], Jennifer Oloff–Lewis[6], Patricia Brosnan[7], Marilyn Strutchens[8] ([1]University of South Florida, USA; [2]Cal Poly Pomona, USA; [3]Georgia State University, USA; [4]Black Hills State University, USA; [5]East Carolina University, USA; [6]Chico State University, USA; [7]Ohio State University, USA; [8]Auburn University, USA)
Teacher Candidates' and Mentor Teachers' Perspectives of Using Co-planning and Co-teaching During Clinical Experiences in Secondary Mathematics

16:04–16:12 **Kakoma Luneta** (University of Johannesburg, South Africa)
Mentor Teachers as Inductors of Preservice Mathematics Teachers at Secondary Schools– A Southern African Perspective

Session II

July 14, 19:30–21:00 **Location: W301**

19:30–19:45 **W. Gary Martin,** Marilyn E. Strutchens (Auburn University, USA)
Transforming Secondary Mathematics Teacher Preparation: A Multi–dimensional Problem

19:45–19:57 **Daniel Chazan,** Patricio Herbst (University of Maryland and University of Michigan, USA)
Teacher Educators' Use of Technology to Represent Instruction

19:57–20:05 **Immaculate Namukasa**, George Gadanidis, Derek Tangredi (Western University, Canada)
Integrating Computational Making Tools in Mathematics Thinking Activities

20:05–20:17 **Xiangquan Yao** (Pennsylvania State University, USA)
Instrumental Genesis and the Growth of Preservice Secondary Mathematics Teachers' Technological Content Knowledge

20:17–20:27 **Le Thi Bach Lien**, Tran Kiem Minh (Quang Binh University, Hue University, Vietnam)
A Situated Approach to Assess Prospective Mathematics Teachers' Professional Competencies

TSG

20:27–20:35 **Jeremy Zelkowski**, Tye Campbell (The University of Alabama, USA)
Direct & Indirect Effect Sizes on Secondary Mathematics Teacher Candidates' Content Knowledge & Pedagogical Content Knowledge as Measured by National Examinations: A Structural Equation Modeling Multi–Cohort Longitudinal Study

Session III

July 17, 21:30–23:00 **Location: W301**

21:30–21:42 **Meiyue Jin** (Liaoning Normal University, China)
A case study on the development of pedagogical design capacity of mathematics prospective

21:42–21:57 **James A. Mendoza Álvarez**, Theresa Jorgensen, Janessa Beach (The University of Texas at Arlington, USA)
Using Multiple Scripting Tasks to Probe Preservice Secondary Mathematics Teachers' Understanding of Visual Representations of Function Transformations

21:57–22:09 **Xiaoying Chen**, Bomi Shin (Chonnam National University, South Korea)
Tertiary and Secondary Mathematical Knowledge for Prospective Teachers: A Comparison on Teacher Employment Tests for Secondary Mathematics in Korea and China

22:09–22:17 **Benita Portia Nel** (University of the Western Cape, South Africa)
Investigating the Professional Learning of Pre–service Mathematics Education Students Using Reflection and Collective Feedback to Enhance Teaching

22:17–22:25 Cristina Ochoviet (Consejo de Formación en Educación, Uruguay)
Concept Cartoon Design in Preservice Teacher Training: An Opportunity to Learn from the Practice

22:25–22:35 **M. Kathleen Heid**, Matthew Black (Pennsylvania State University, USA)
Physical Representations and Understanding of Multivariate Functions

TSG30: In–service Mathematical Teacher Education and Mathematical Teacher Professional Development at Primary Level

Chair: Yeping Li (Texas A&M University, USA)
Co–chair: Leonor Santos (Universidade de Lisboa, Portugal)
Team members: Munira Amirali (Aga Khan University Pakistan, Pakistan), Xingfeng Huang (Shanghai Normal University, China), Masakazu Okazaki (Okayama University, Japan)
IPC Liaison Person: Anjum Halai (Pakistan/Tanzania)

Session I

Moderator: Leonor Santos
July 13, 19:30–21:00 **Location: T418**

19:32–19:54 **Xingfeng Huang**, Yunji Zhang (Shanghai Normal University, China)
Chinese Teachers' Learning as Transformation of Didactic Praxeologies in a Cross–cultural Teacher Exchange Programme

19:54–20:16 **Sharyn Livy**[1], Janette Bobis[2], Ann Downton[1], Sally Hughes[1], Maggie Feng[2], Melody McCormick[1], James Russo[1], Peter Sullivan[1] ([1]Monash University, Australia; [2]University of Sydney, Australia)
Developing Teachers' Classroom Actions and Pedagogical Knowledge through the Facilitation of Teaching a Challenging Task

20:16–20:38 **Kyong Mi Choi**[1], Jihyun Hwang[2], Jessica Jensen[3], Dae Hong[2], Wesley Cox[1] ([1]University of Virginia, USA; [2]University of Iowa, USA; [3]California Polytechnic University, USA)
Changes in Mathematical Knowledge for Teaching and Belief on Practices through Professional Development Based on Reasoning–modeling Approach

20:38–21:00 **Yeping Li**[1], Huirong Zhang[2], Naiqing Song[2] ([1]Texas A&M University, USA; [2]Southwest University, China)
Are Elementary In–service Teachers Confident and Well Prepared in Mathematics They Teach? – The Case of Fraction Division

Session II

Moderator: Munira Amirali

July 16, 21:30–23:00 **Location: T418**

21:30–21:41 **Leonor Santos**[1], Ana Henriques[2], Joana Mata–Pereira[3], Lurdes Serrazina[4] ([1]Instituto de Educação; [2]Universidade de Lisboa; [3]Escola Superior de Educação; [4]Instituto Politécnico de Lisboa, Portugal)
Mathematical Reasoning and Teacher Education

21:41–21:52 **Lurdes Serrazina**[1], Joana Brocardo[2] ([1]Escola Superior de Educação, Instituto Politécnico de Lisboa; [2]Escola Superior de Educação, Instituto Politécnico de Setúbal; [1, 2]UIDEF; [1, 2]Instituto de Educação, Universidade de Lisboa, Portugal)
In–service Teacher Education for Promoting Mathematics Reasoning in Primary School

21:52–22:03 **Derek J. Sturgill** (University of Wisconsin–Stout, U.S.A.)
Growing through Inquiry: A Story of Three Primary Teachers Investigating Their Practice

22:03–22:14 **Ana Paula Canavarro** (Universidade de Évora, Portugal)
Analyzing Students' Mathematical Productions: A Successful Strategy for the Development of Mathematical Demanding Practices?

22:14–22:25 **Ilze France**, Dace Namsone, Liga Cakane, Ilze Saleniece (University of Latvia, Letonia)
Math Teachers Competence Assessment to Develop Personalized Professional Learning

22:25–22:36 **Babette Moeller**[1], Matt McLeod[1], Teresa Duncan[2], Jason Schoeneberger[3], John Hitchcock[4], Marvin Cohen[5] ([1]Education Development Center; [2]Deacon Hill Research Associates; [3]ICF; [4]Abt Associates; [5]Bank Street College of Education, USA)
Assessing the Efficacy of the Math for All Professional Development Program for Primary Teachers and Their Students

22:36–22:47 **Viviane Hummes**[1], Adriana Breda[1], Elvira García–Mora[1], Vicenç Font[1], Javier Díez–Palomar[1], Maria José Seckel[2] ([1]University of Barcelona, Spain; [2]Universidad Católica del Maule, Chile)
Drawing on the Didactical Suitability Criteria to Analyse a Lesson Study Enhancing Teachers Competence of Didactical Reflection

22:47–22:58 **Hong Yuan** (The City University of New York, USA)
Insights on Shanghai In–service Primary Mathematics Teachers' Acquisition of Pedagogical Content Knowledge through Teaching Research Group Activities: A Case Study

Session III

Moderators: Xingfeng Huang, Masakazu Okazaki

July 17, 14:30–16:30 **Location: T418**

14:30–14:44 **Masakazu Okazaki**[1], Keiko Kimura[2], Keiko Watanabe[3] ([1]Okayama University, Japan; [2]Hiroshima–Shudo University, Japan; [3]Shiga University, Japan)
Kyozaikenkyu as Well–formed Story Making for Developing Quality Mathematics Lessons

14:45–14:59 **Ban Heng Choy**[1], Jaguthsing Dindyal[2] ([1]National Institute of Education; [2]Nanyang Technological University, Singapore)
Teaching as Professional Learning: Small Steps towards Sustainable Mathematics Teacher Professional Development

15:00–15:14 **Nagisa Nakawa**[1], Nanae Matsuo[2] ([1]Kanto Gakuin University; [2]Chiba University, Japan)
Improvement of a Preschool Teacher's Reflection on Pedagogical Content Knowledge during a Professional Development Programme in Japan

15:15–15:29 **Jill Cheeseman** (Monash University, Australia)
Teachers Views of the Effects of the Fostering Inquiry in Mathematics Project

15:30–15:44 **Munira Amirali** (Aga Khan University Institute for Educational Development, Karachi, Pakistan)
Developing Teachers' Knowledge of Fractions: A Case from Karachi, Pakistan

15:45–15:59 **Shikha Takker**, K. Subramaniam (Homi Bhabha Centre for Science Education, TIFR, Mumbai, India)
Contingencies as Moments of Collaboration: A Report on Investigating and Supporting Mathematics Teachers' Knowledge

16:00–16:14 **Lawan Abdulhamid**[1], Balarabe Yushau[2] ([1]University of the Witwatersrand, Johannesburg, South Africa; [2]Abubakar Tafawa Balewa University, Bauchi, Nigeria)
Re–conceptualizing Primary Mathematics In–service Teacher Professional Development in

TSG

Nigerian Context

16:15–16:29 **Tan Saw Fen** (Wawasan Open University, Bayan Lepas, Malaysia)
Development of Critical Lenses among Teachers in Lesson Study

16:29–16:30 **Wrap–up** (Xingfeng Huang, Masakazu Okazaki, Munira Amirali)

TSG31: In–service Mathematical Teacher Education and Mathematical Teacher Professional Development at Secondary Level (Focus on Scaling Up)

Chair: Konrad Krainer (Alpen–Adria–Universität Klagenfurt, Austria)
Co–chair: Betina Duarte (Universidad Pedagógica Nacional, Argentina)
Team members: Youchu Huang (Shanghai Normal University, China), Talli Nachlieli (Levinsky College, Israel), Craig Pournara (University of the Witwatersrand, South Africa)
IPC Liaison Person: Jill Adler (South Africa)

Session I

July 13, 14:30–16:30 **Location: T116**

14:30–14:50 **Konrad Krainer, Betina Duarte, Youchu Huang, Craig Pournana, Talli Nachlieli**
Introduction

14:50–15:30 **Paul Cobb** (Vanderbilt University, USA)
Invited speaker (40 minutes: 30 minutes input, 10 minutes discussion)
Investigating What It Takes to Improve the Quality of Mathematics Teaching and Learning on a Large Scale

15:30–15:45 **Talli Nachlieli**[1], Einat Heyd–Metzuyanim[2] ([1]Levinsky College of Education, Technion, Israel; [2]Israel Institute of Technology, Israel)
Shifting Cultural Contexts: A Professional Development Program towards Cognitively Demanding Instruction

15:45–16:00 **Chenfei Zhu**[1], Hongbing Wang[2] ([1]East China Normal University, China; [2]Teaching and Researching Department of Nanjing, China)
How Chinese Mathematics Teachers Prepare for Teaching Competition in Community?

16:00–16:15 **Wenjun Zhao**[1], Rui Ning[1], Xiaoxia Zhang[2], Chuan Zeng[3], Xianjia He[3], Jun Wen[3] ([1]Sichuan Normal University, China; [2]Teacher (cadre) Development Center, China; [3]Chengdu Experimental Foreign Language School West Campus, China)
Linking Theories and Practices: Understanding Teachers' Learning in Chinese Lesson Study through Activity Theory Perspective

16:15–16:30 **Discussion**

TSG

Session II

July 14, 19:30–21:00 **Location: T116**

19:30–19:40 **Craig Pournara** (University of the Witwatersrand, South Africa)
Scaling Up a Mathematics Professional Development Course in South Africa and Its Impact on Students

19:40–19:50 **Tamsyn Margaret Terry** (University of Canberra, Australia)
Action Learning: A Tool to Help Teachers Promote Self–regulation (SR) in Students

19:50–20:00 **Discussion**

20:00–20:07 Pilar Peña[1], **Horacio Solar**[1], Constanza San Martín[2], Florencia Gómez[1] ([1]Pontificia Universidad Católica de Chile, Chile; [2]Universidad Diego Portales, Chile)
Collaboration between Mathematics and Special Education Teachers to Promote

Argumentation as an Inclusive Practice

20:07–20:14 Lillie R. Albert, Chi–Keung Cheung, **Solomon Friedberg** (Boston College, USA)
Developing and Supporting Exemplary Mathematics Educators in High Need Schools

20:14–20:21 **Ralf Nieszporek**, Birgit Griese, Rolf Biehler (Paderborn University, Germany)
Professional Development Facilitators and Their Learning Goals towards a PD Course on Teaching Probability and Inferential Statistics

20:21–20:28 **Adnan Baki**, Bülent Gúven, Aslıhan Batur (Trabzon Üniversitesi, Artvin Çoruh Üniversitesi, Turkey)
Investigation of Secondary Mathematics Teachers' Noticing of Students' Mathematical Thinking in Numbers, Algebra, Geometry, Statistics and Probability

20:28–20:35 **Limin Chen**[1], Caroline Williams–Pierce[2], Min Jing, Lieven Verschaffel[3] ([1]Shenyang Normal University, Shenyang, China; [2]University of Maryland, College Park, Maryland, America; [3]Center for Instructional Psychology and Technology, KU Leuven, Belgium)
An Investigation on Mathematics Teachers' Professional Development in Rural China

20:35–20:42 **Nouzha El Yacoubi** (Mohammed V University, Rabat, Morocco)
In–service Mathematical Teacher Education in Morocco: Impediments and Challenges

20:42–21:00 **Discussion**

Session III

July 16, 21:30–23:00 **Location: T132**

21:30–21:40 **Zhen Feng Eric Koh**, Leng Low, Ngan Hoe Lee (Yusof Ishak Secondary School, Academy of Singapore Teachers, National Institute of Education, Singapore)
Sustainability and Scaling Up of School–based Teacher Professional Development Programme

21:40–21:50 **Karen Hollebrands**, Hollylynne S. Lee (North Carolina State University, USA)
Effective Design of Massive Open Online Courses to Support Mathematics Teachers' Professional Learning

21:50–22:00 **Discussion**

22:00–22:07 **Derya ÇELİK**[1], Mustafa GÜLER[1], Rukiye Didem TAYLAN[2], Müjgan BAKİ[1], Esra Bukova GÜZEL[3], Fatma Aslan TUTAK[4], Damla KUTLU[1], Aytuğ Özaltun ÇELİK[5] ([1]Trabzon University, Fatih Faculty of Education, Department of Mathematics Education, Turkey; [2]MEF University, Faculty of Education, Department of Mathematics Education, Turkey; [3]Dokuz Eylul University, Buca Faculty of Education, Department of Mathematics Education, Turkey; [4]Boğaziçi University, Faculty of Education, Department of Mathematics Education, Turkey; [5]Pamukkale University, Faculty of Education, Department of Mathematics Education, Turkey)
Developing an E–mentoring Professional Development Program in Supporting Pedagogical Content Knowledge of Novice Mathematics Teachers: A Design–based Study

22:07–22:14 **Christoph Look**, Christin Laschke, Bettina Roesken–Winter, Rebekka Stahnke (Humboldt–Universität zu Berlin, Germany)
Using Videos to Foster Facilitators' Noticing in the Field of Language–responsive Mathematics Teaching

22:14–22:21 **Luyishou Ma** (Shanghai Normal University, China)
Investigation on the Identification and Group Differences of Professional Development Approaches of Mathematics Teachers

22:21–22:28 **Yan Deming**, Wang Hongwei (School of Mathematics and Statistics, Henan Finance University, Henan Zhengzhou 450046, China)
Survey and Analysis of Confusion of the Implementation of the New Curriculum for High School Mathematics Teachers in Henan Province

22:28–22:35 **Ming–Yan Tsui**, Ida A. C. Mok (The University of Hong Kong, Hong Kong SAR, China)
Changes in Mathematics Teachers' Technology Acceptance after the Implementation of

TSG

BYOD Scheme

22:35–22:42 **Soo Kyung Jeon**, Cheong– Soo Cho (Sangwon High School, YeungNam University, South Korea)
Difficulties of Using Technology in Mathematics Classes: A Study of Secondary Mathematics Teachers in Korea

22:42–23:00 **Discussion**

Session IV

July 17, 21:30–23:00 **Location: T116**

21:30–21:40 Joana Mata–Pereira, **João Pedro da Ponte** (Instituto de Educação, Universidade de Lisboa, Portugal)
Enhancing Students' Mathematical Reasoning through a Professional Development Experiment

21:40–21:50 Robert Weinhandl, **Stefanie Schallert** (Johannes Kepler University, Linz, Austria)
Exploring Online Learning Environments in Professional Development for Scaling–up Educational Innovations

21:50–22:00 **Discussion**

22:00–22:07 **Freyja Hreinsdóttir** (School of Education, University of Iceland, Iceland)
On the Efficiency of a Professional Development Program for Mathematics Teachers in Upper–secondary Schools in Iceland

22:07–22:14 **Steffen Lünne**, Rolf Biehler (Paderborn University, Germany)
Out–of–field Teachers' Acquisition of School–related Content Knowledge during a Professional Development Course

22:14–22:21 **Ilana Horn** (Vanderbilt University, Nashville, US)
Windows on the Backstage of the Classroom: Using Video to Support Mathematics Teachers Conceptual Change about Instruction

22:21–22:28 **Victoria Mamani Choque** (Universidad Pedagógica, Bolivia)
Postgradual Training of Masters and Masters of Mathematics in Bolivia

22:28–22:40 **Discussion**

22:40–23:00 **Summary and Closing**

TSG32: Knowledge in/for Teaching Mathematics at Primary Level

Chair: Stephane Clivaz (Haute École Pédagogique de Vaud, Switzerland)
Co–chair: Polly Lao (The Open University of Hong Kong, Hong Kong SAR China)
Team members: Janne Fauskanger (University of Stavanger, Norway), Verónica Martín Molina (University of Sevilla, Spain)
IPC Liaison Person: Catherine Vistro–Yu (Philippines)

TSG

Session I

July 13, 19:30–21:00 **Location: W303**

19:30–19:40 **Introduction**

19:40–19:55 **Lilian Cristina de Souza Barboza**, Etienne Lautenschlager (Federal University of ABC (UFABC); Federal University of Rio Grande do Norte (UFRN), Brazil)
Teachers' Knowledge of the Early Years and the Sign of Equality: An Investigation with Professional Learning Task

19:55–20:05 **Yolanda Chávez Ruiz**, Lorena Trejo Guerrero (Escuela Normal de Rincón de Romos, Universidad Nacional Autónoma de México, Mexico)

Addition and Multiplication Teaching in the Multi–grade Primary School

20:05–20:15 **Discussion**

20:15–20:30 **Carolyn A. Maher**, James A. Maher, Louise Cherry Wilkinson (Rutgers University, Syracuse University, USA)
Primary Teachers' Recognition of Students' Mathematical Reasoning and Beliefs about Teaching and Learning

20:30–20:45 **Christine Alyssa Herrera**, Shawnda Rae Smith, Christina Starkey, Hiroko Kawaguchi Warshauer (California State University, Chico, Texas Women's University, Southern New Hampshire University, Texas State University, USA)
Exploring Preservice Teachers' Noticing of Resources That Support Productive Struggle and Promote Equity

20:45–20:55 **Barbara Beata Pieronkiewicz** (Institute of Mathematics, Pedagogical University of Cracow, Poland)
Why Does 1/4:1/5 Equal 5/4? A Case of a Post–graduate Student's Understanding of Common Fractions Division

20:55–21:00 **Discussion**

Session II

July 16, 21:30–23:00 **Location: W303**

21:30–21:35 **Introduction**

21:35–21:45 **Mi Yeon Lee**, Ji–Eun Lee (Arizona State University, Tempe, USA)
Elementary Preservice Teachers' Expected Challenges in Teaching Pattern Generalization

21:45–21:55 **Muteb M. Alqahtani**, Arthur Belford Powell (State University of New York at Cortland, Rutgers University–Newark, USA)
Affordances of Measurement Approach: Pre–service Teachers' Knowledge of Fraction Magnitude

21:55–22:10 **Verónica Martin–Molina** (Universidad de Sevilla, Spain)
Pre–service Primary Teachers' Knowledge and the Mathematical Practice of Defining

22:10–22:25 **Discussion**

22:25–22:55 **Randolph Philipp**, John (Zig) Siegfried, Eva Thanheiser (San Diego State University, San Diego, USA)
Seeing Mathematics through the Lens of Children's Mathematical Thinking: A Perspective on the Enhancement of Mathematical Knowledge for Teaching

22:55–23:00 **Discussion**

Session III

July 17, 14:30–16:30 **Location: W303**

14:30–15:00 **Elisabeth Rathgeb–Schnierer** (University of Kassel, Germany)
Flexibility in Mental Calculation

15:05–15:15 **Thevarasa Mukunthan** (The Open University of Sri Lanka, Colombo, LK)
Achievement Levels in Mathematics of the Primary School Grade 4 Children in Sri Lanka

15:15–15:25 **Gönül Günes**, Furkan Keleş (Trabzon University, Fatih Education Faculty, Department of Basic Education, Turkish Ministry of Education, Turkey)
An Analysis of Novice Primary School Teachers' Knowledge of Mathematics Curriculum

15:25–15:40 **Stéphane Clivaz, Valérie Batteau**, Audrey Daina, Luc–Olivier Bunzli, Sara Presutti (Lausanne University of Teacher Education, Switzerland)
Towards a Dialogic Analysis of Mathematical Problem–solving Knowledge for Teaching in a Lesson Study Group

15:40–15:50 **Discussion**

15:50–16:05 **Reidar Mosvold, Janne Fauskanger**, Kjersti Wæge, Raymond Bjuland (Norwegian University of Science and Technology, University of Stavanger, Norway)

TSG

Teacher Time Out as Site for Studying Mathematical Knowledge for Teaching

16:05–16:20 **Kam Ling Lao** (The Open University of Hong Kong, Hong Kong SAR, China)
A Comparative Study on the Professional Knowledge of Elementary Mathematics Teachers in Shanghai and Hong Kong – From Two Scenarios in Data Handling and Geometry

TSG33: Knowledge in/for Teaching Mathematics at Secondary Level

Chair: Nils Buchholtz (University of Oslo, Norway)
Co–chair: Miguel Ribeiro (University of Campinas, Brazil)
Team members: Miroslawa Sajka (Pedagogical University of Cracow, Poland), Thorsten Scheiner (Australian Catholic University, Australia), Qiaoping Zhang (The Education University of Hong Kong, Hong Kong SAR, China)
IPC Liaison Person: Catherine Vistro–Yu (Philippines)

Session I

July 13, 14:30–16:30 **Location: T323**

14:30–14:50 **TSG organizing team**
The team will introduce to the main topics of the TSG 33

14:50–15:10 **Thorsten Scheiner** (Institute for Learning Sciences & Teacher Education, Australian Catholic University, Australia)
Critical Remarks on The Notion of Unpacking Mathematics in Discourses of Teacher Knowledge

15:10–15:30 **Dandan Sun** (School of Mathematical Sciences, East China Normal University, China)
What Subject Matter Knowledge Do Chinese In–service Junior Middle School Teachers Lack?

15:30–15:40 **Mailizar Mailizar** (Universitas Syiah Kuala, Banda Aceh, Indonesia)
Assessing the Relationship between Teachers' Knowledge and Classroom Practices in the Use of ICT in the Secondary Mathematics Classroom

15:40–15:50 **Rahmah Johar**, Munirah Ghazali, Mailizar, Suci Maulina (Universitas Syiah Kuala & Universiti Sains, Malaysia)
Number Sense of Teachers in Different School Levels

15:50–16:00 **Binod Prasad Pant**, Bal Chandra Luitel, Indra Mani Shrestha (Kathmandu University, Nepal)
Arts Integrated Pedagogy for Meaningful Mathematics Teaching and Learning

16:00–16:10 **Achmad Nizar**, Merrilyn Goos, Niamh O'Meara, Ciara Lane (University of Limerick, Ireland)
Uncovering Mathematics Teaching Knowledge of Out–of–field Mathematics Teachers

16:10–16:20 **G.M. Wadanambi**[1], Frederick K.S. Leung[2] ([1]Nilwala National College of Education, Sri Lanka; [2]The University of Hong Kong, Hong Kong SAR, China)
A Study of Sri Lanka's Pre–service Mathematics Teachers' Pedagogical Content Knowledge

16:20–16:30 **Discussion**

Session II

July 14, 19:30–21:00 **Location: T323**

19:30–19:40 **TSG organizing team**
Introduction to session 2 TSG 33

19:40–20:00 **Ruti Segal,** Atara Shriki, Boaz Silverman, Nitsa Movshovitz–Hadar Oranim (Academic College of Education, Kibbutzim College of Education, Technion –I.I.T, Israel)

Interweaving Mathematics–news–snapshots in Class: Implications for Teachers' Horizon Content Knowledge

20:00–20:20 **Veronika Hubeňáková,** Ute Sproesser, Ingrid Semanišinová (Pavol Jozef Safarik University in Košice, Ludwigsburg University of Education)
Comparing German and Slovak Teachers' Knowledge of Content and Students Related to Functions

20:20–20:30 **Miguel Ribeiro**, Marlova Caldatto, Milena Policastro (State University of Campinas – UNICAMP, Brazil; Federal Technological University of Paraná – UTFPR, Brazil)
A Focus on the Specificities of Teachers' Knowledge for Improving Teacher Education: The Case of the MTSK Conceptualization

20:30–20:40 **Maria D. Cruz Quiñones[1],** Mourat Tchoshanov[2], Héctor Jesús Portillo Lara[1], Carlos Paez[3], Rocio Gallardo[2] ([1]Universidad Autónoma de Cd. Juárez, [2]University of Texas at El Paso, [3]Navajo Technical University)
The Influence of Teaching Experience on Mathematical Teacher Content Knowledge at Middle School Level

20:40–20:50 **Sarah Sparks,** Alees Lee, Katie Morrison, Gulden Karakok (University of Northern Colorado)
Implementation of Eight Teaching Practices for Teaching Problem Solving

20:50–21:00 **David Alfonso Páez[1]**, Cesar Martínez Hernández[2,] Daniel Eudave Muñoz[1], Teresa de J. Cañedo Ortiz[1] (CONACyT, [2]Universidad de Colima, & [1]Universidad Autónoma de Aguascalientes)
Teacher's Mathematical Knowledge in Solving a System of Linear Equations. A Case Study

Session III

July 17, 14:30–16:30 **Location: T226**

14:30–14:40 **TSG organizing team**
Introduction to session 3 TSG 33

14:40–15:00 **Rüya Savuran,** Mine Işıksal–Bostan (Middle East Technical University, Turkey)
A Preservice Secondary Mathematics Teacher's Specialized Knowledge: The Case of Limit

15:00–15:20 **Anna Hoffmann,** Ruhama Even (Weizmann Institute of Science, Israel)
What Do Teachers Learn about What Mathematics Is in Academic Mathematics Courses?

15:20–15:40 **Yi–An Cho** (Hsin Chu Senior Industrial Vocational School, Taiwan, China)
High–school Mathematics Teacher's Horizon Content Knowledge: A Case Study

15:40–15:50 **Fatma Aslan–tutak,** Buket Semercioglu Kapcak (Bogazici University, Turkey)
Mathematical Quality of Geometry Instruction of a Novice High School Teacher in Terms of Richness of Mathematics

15:50–16:00 **Zeynep Pehlivan**, Fatma Aslan–Tutak Achmad (Bogazici University & Bogazici University, Turkey)
Investigation of Preservice Mathematics Teachers' Translations among Multiple Representations

16:00–16:10 **Florence Thomo Mamba** (Mathematics and Statistics Department, University of Malawi–Polytechnic, The Republic of Malawi)
Preservice Secondary School Teacher's Errors When Translating between Representations

16:10–16:20 **Miroslawa Sajka** (Institute of Mathematics, Pedagogical University of Cracow, Poland)
Influence of Everyday Experience on Pre–service Teachers Subject Matter Knowledge of Functions

16:20–16:30 **Discussion**

TSG

Session IV

July 17, 21:30–23:00 **Location: T323**

21:30–21:50 **Agida G. Manizade**, Dragana Martinovic (Radford University, USA; University of Windsor, Canada)
Connecting Knowledge for Teaching Geometry at the Secondary Level with Instructional Quality in Mathematics Teaching

21:50–22:10 **Nicholas H. Wasserman,** Keith Weber, Juan Pablo, Mejia–Ramos, Timothy Fukawa–Connelly (Columbia University & Rutgers University, USA)
Upgrading Learning for Teachers in Real Analysis (ultra): An Instructional Model for Secondary Teacher Education

22:10–22:30 **Elizabeth G. Arnold,** Elizabeth A. Burroughs, Elizabeth W. Fulton, James A. Mendoza Álvarez (James Madison University, Montana State University & University of Texas at Arlington, USA)
Applications of Teaching Secondary Mathematics in Undergraduate Mathematics Courses

22:30–22:40 **Heather Bleecker**, Polly Dupuis (Salish Kootenai College)
Mathematics Teachers' Perceptions of Teaching Competencies: A Study of Grades 5 through 8

22:40–22:50 Jodie D. Novak, Robert A. Powers, Alees T. Lee, **Michelle (Morgan) King**, Adam Ruff, Shweta Naik (University of Northern Colorado & Western Colorado University, USA)
Identifying Mathematical Learning Opportunities in a Task as a Missing, Essential Skill of Teaching

22:50–23:00 **Discussion**

TSG34: Affect, Beliefs, and Identity of Mathematics Teachers

Chair: Francesca Morselli (University of Goenoa, Italy)
Co–chair: Einat Heyd–Metzuyanim (Technion – Israel Institute of Technology, Israel)
Team members: Narumon Changsri (Khon Kaen University, Thailand), Forster Ntow (University of Cape Coast, Ghana), Shengying Xie (Hunan Normal University, China)
IPC Liaison Person: Jiansheng Bao (China)

Session I

July 13, 19:30–21:00 **Location: T519**

19:30–19:35 **Introduction to the TSG34**

19:35–19:50 **Dionne Cross Francis**[1], Ji Hong, Jinqing Liu[1], Ayfer Eker[2], Pavneet Kaur Bharaj, MiHyun Jeon[1] ([1]Indiana University, US, [2]Giresun University, University of Oklahoma, US, Turkey)
Examining Teachers' Emotional Experiences through the Process of Mathematics Instructional Change

19:50–20:05 **Wilfred W.F. Lau** (The Chinese University of Hong Kong, Hong Kong SAR, China)
Investigating Changes in Attitudes toward Calculus of Pre–service Mathematics Teachers Enrolled in a Pedagogy Course

20:05–20:10 **Hui Min Chia**, Xuanzhu, Jin, Qiaoping Zhang (The Education University of Hong Kong, Hong Kong SAR, China)
Comparing Espoused Values in Mathematics Teaching between Novice and Experience Primary Teachers: A Case Study in Mainland China

20:10–20:15 **Kanita Pamuta**[1], Narumon Changsri[1,2], Maitree Inprasitha[1] ([1]Mathematics Education Program, Faculty of Education, KKU, [2]Center for Research in Mathematics Education, KKU)
Mathematics Student Teachers' Self–efficacy Beliefs on Teaching

20:15–20:20 **Elizar Elizar**, Cut Khairunnisak (Universitas Syiah Kuala, ID)
Teacher's and Students' Beliefs Concerning Higher Order Thinking in Mathematics: Are They

on the Same Page?

20:20–20:30 **Discussion on the Short Papers 4, 5, 6**

20:30–20:35 **Gabriella Pocalana** (Università degli Studi di Torino, Italy)
What Kind of Students Should Deserve Challenging, Laboratory and Inquiry–based Mathematical Activities?

20:35–20:40 **Harita Raval**, Aaloka Kanhere (Homi Bhabha Centre for Science Education, TIFR)
Understanding Open Exploration in a Classroom

20:40–20:45 **Candy Clara Ordoñez Montañez**[1], Gina Patricia Paz Huamán[2] ([1]Peruvian Research Association in Mathematical Education, [2]Ministry of Education)
A Study on Conceptions of Trainers of Mathematics Teachers in Pedagogical Superior Educational Institutes of Peru in Relation to Mathematics and Their Teaching

20:45–21:00 **Discussion on the Papers 8, 9, 10**

Session II

July 16, 21:30–23:00 **Location: T519**

21:30–21:35 **Introduction**

21:35–21:50 **Sonja Lutovac**, Raimo Kaasila (Faculty of Education, University of Oulu)
'There Are So Many Ways to Fail': Pre–service Elementary School Teachers Define Failure in Mathematics

21:50–22:05 **Einat Heyd–Metzuyanim**, Talli Nachlieli (Technion – Israel Institute of Technology)
Teacher's Identity Negotiation while Presenting Themselves on Video in a Professional Development Setting

22:05–22:20 **Diane Dalby**, Andrew Noyes (University of Nottingham, UK)
The Changing Professional Identities of Mathematics Teachers within Further Education in England

22:20–22:25 **Tara Paudel** (Department of Mathematics Education, Tribhuvan University, Mahendraratna Campus, Tahachal, Nepal)
Identity Construction of Female Mathematics Teachers in Professional Life: A Narrative Inquiry

22:25–22:30 **Forster D. Ntow**[1], Jill Adler[2] ([1]University of Cape Coast, Ghana; [2]University of the Witwatersrand, South Africa)
Learning and Developing as a Mathematics Teacher Educator

22:30–22:35 **Jukyung Park**[1], Youngyoul Oh[2] ([1]Graduate School of Education, Seoul National University of Education, Korea; [2]Seoul National University of Education, Korea)
Understanding South Korean Elementary Mathematics Teachers' Identities in Relation to Their Professional Development

22:35–22:50 **Discussion on the Papers 16, 17, 18**

22:50–23:00 **Discussion**

Session III

July 17, 14:30–16:30 **Location: T519**

14:30–14:35 **Introduction**

14:35–14:50 **Lars Jenßen**, Regina Möller, Bettina Roesken–Winter (Humboldt–Universität zu Berlin, Germany)
Shame: A Significant Emotion Influencing Pre–service Primary School Teachers' Mathematics Education

14:50–15:05 Annalisa Cusi[1], **Francesca Morselli**[2] ([1]University of Rome "La Sapienza", [2]University of Genoa, Italy)
Prospective Teachers' Attitude towards Mathematics and Its Teaching: Stories of Development

15:05–15:20 Qiaoping Zhang, **Xuanzhu Jin**, Hui Min Chia (Department of Mathematics and Information Techonology, The Education University of Hong Kong, Hong Kong SAR, China)
Affect in Mathematics Curriculum in Mainland China: A Review of Seventy Years in

TSG

Compulsory Education

15:20–15:35 **Wanda Masondo** (University of the Witwatersrand, Johannesburg, South Africa)
Using a Quantitative Approach to Explore Teachers' Identity in Mathematics

15:35–15:40 **Zheng Jiang**[1], Ida Ah Chee Mok[1], Jinbo Tang[2] ([1]The University of Hong Kong, Hong Kong SAR, China [2]Shenzhen High School of Science, China)
Mathematics Teacher Emotions during Classroom Practice: A Case Study in Mainland China

15:40–15:45 **Indra Mani Shrestha**, Bal Chandra Luitel, Binod Prasad Pant (School of Education, Kathmandu University, Nepal)
Touching the Untouchables: Promoting Non/Linear Mathematics Pedagogy

15:45–15:55 **Discussion on the Papers 26,27**

15:55–16:00 **Hanna Viitala** (University of Helsinki, Finland, Luleå University of Technology, Sweden)
Excited but Sceptical: Examining Teachers' Motivational Aspects for a Professional Development Project

16:00–16:05 **David Tannor** (Kellogg Community College, US)
Two–year College: Teacher Self–efficacy and Knowledge Levels for Effective Mathematics Instruction

16:05–16:15 **Discussion on the Papers 29,30**

16:15–16:30 **Final Discussion**

TSG35: Knowledge and Practice of Mathematics Teacher Educator

Chair: Maria Giuseppina Bartrtolini Bussi (Università di Modena e Reggio Emilia, Italy)
Co–chair: Paola Sztajn (North Carolina State University, USA)
Team members: Chi–Tai Chu (Taiwan Normal University, Taiwan, China), Ruchi Kumar (Tata Institute for Fundamental Research, India), Nada Vondrova (Charles Univesity, Czech)
IPC Liaison Person: Binyan Xu (China)

Session I

July 13, 14:30–16:30 **Location: T316**

14:30–15:00 Mariolina, **Bartolini Bussi** (Department of Education and Humanities, Italy)
Introduction

15:00–15:30 **Merrilyn Goos**[1], Margaret Marshman[2] ([1]University of Limerick, Ireland; [2]University of the Sunshine Coast, Australia)
Boundary Crossing and Mathematics Teacher Educators' Hybrid Identities

15:30–15:50 **Discussion**

15:50–16:00 **Short Break**

16:00–16:10 **Ruchi S. Kumar** (Tata Institute of Social Sciences, India)
Analyzing Challenges in the Practice of a Math Teacher Educator for Developing Community of Math Educators

16:10–16:15 **Discussion**

16:15–16:25 **Nada Vondrova** (Charles University, CZ)
Mathematics and Science Teacher Educators Learning Induced by Common Research on Professional Vision

16:25–16:30 **Discussion**

Session II

July 14, 19:30–21:00 **Location: T316**

19:30–19:40 **Melissa Soto**[1], Lara Dick[2], Mollie Appelgate[3], Dittika Gupta[4] ([1]San Diego State University, US; [2]Bucknell University, US; [3]Iowa State University, US; [4]Midwestern State University, US)
Using a Community of Practice Perspective to Analyze Mathematics Teacher Educator Learning during Lesson Study

19:40–19:45 **Discussion**

19:45–19:55 **Zhenzhen He,** feishi Gu, lingyuan Gu (Shanghai Normal University, CN)
Characterizing Mathematics Teaching Research Specialists' Mentoring in the Context of Chinese Lesson Study

19:55–20:00 **Discussion**

20:00–20:05 **Carola Manolino**[1], Viviane Hummes[2], Adriana Breda[2], Alicia Sánchez[2], Vicenç Font[2] ([1]University of Torino, Italy; [2]University of Barcelona, Spain)
Didactical Suitability Criteria Used by Italian Teachers in Lesson Studies

20:05–20:10 **Alessandro Ramploud**[1], Maria Mellone[2], Silvia Funghi[3], Simone Esposito[2] ([1]University of Pisa, Italy; [2]University of Naples, Italy; [3]University of Modena and Reggio Emilia, Italy)
The Lesson Studys Cultural Transposition: From Chinese Lesson Study to Italian Lesson Study

20:10–20:15 **Yingkang Wu** (East China Normal University, CN)
Using a Nested Structure of Lesson Study Approach: A Self–study as a Mathematics Teacher Educator

20:15–20:20 **Daniela Pages** (Consejo de Formacion en Educacion, UY)
A Collaborative Work of Four Mathematics Teacher Educators. A Study in Uruguay

20:20–21:00 **General Discussion: Lesson Study**

Session III

July 16, 21:30–23:00 **Location: T234**

21:30–21:35 **Introduction**

21:35–21:45 **Paola Sztajn**[1], Kristen Malzahn[2], Reema Alnizami[3] ([1]North Carolina State University, USA; [2]Horizon Research Inc., USA; [3]North Carolina State University, USA)
Teacher Educators' Preparation Model: Example from a Successful Professional Development

21:45–21:50 **Discussion**

21:50–21:55 **Lindsay Keazer**[1], Kathleen Nolan[2] ([1]Sacred Heart University, USA; [2]University of Regina, Canada)
A Collaborative Self Study of Two Mathematics Teacher Educators Learning and Growing as Culturally Responsive Pedagogues

21:55–22:00 **Craig Joseph Willey**[1], Michael Richard Lolkus[2], Jill Newton[3], Troy Bell[4] ([1]Indiana University–Indianapolis, US; [2]Purdue University, US; [3]Purdue University, US; [4]Purdue University, US)
Exploring Power and Oppression: A Study of Mathematics Teacher Educators' Professional Growth

22:00–22:05 **Hwa Young Lee,** Emily Miller, Travis Weiland, Tuyin An, Daniel Clark (Texas State University, KR)
Differing Contexts and Tensions Mathematics Teacher Educators Experience in Content Courses for Elementary Preservice Teachers

22:05–22:15 **Discussion of the first short oral of the day**

TSG

22:15–22:20 **Chadd McGlone** (Teachers2Teachers Global, US)
Developing Mathematics Education Leaders in Schools in Guatemala and Implications for Work in Other Countries

22:20–22:25 **Natalia Ruiz**, Nicole Fuenzalida & Luz Valoyes–Chávez (University of Chilec, Chile)
Transitioning between Different Identities: How the Different Positions Assumed by the Mathematics Teacher Educator Impact Their Practice

22:25–22:30 **Helena Montenegro**[1], Salomé Martínez[2], Francisco Rojas[1] ([1]Pontificia Universidad Católica de Chile, Chile; [2]Center for Mathematical Modeling, Chile)
Mathematics Teacher Educators as Role Model: Intentions and Strategies

22:30–22:35 **Francisco Rojas**[1], Helena Montenegro[1], Flavio Guiñez[2], Marco Catalán[1], Valentina Giaconi[3] ([1]Pontificia Universidad Católica de Chile, Chile; [2]Universidad de Chile, Chile; [3]Universidad de O´Higgins, Chile)
Experience of Learning to Teach Mathematics: What Do Prospective Teachers Learn from Their Mathematics Teacher Educators**?**

22:35–22:40 **Sagar Dahal** (Kathmandu University School of Education, Nepal)
Narratives of Maths Teachers: Students & Teacher Ratio in Mathematics Classes in Private Schools

22:40–23:00 **General Discussion of the short orals**

Session IV

July 17, 21:30–23:00 **Location: T316**

21:30–21:35 **Introduction**

21:35–21:40 **Haw–Yaw Shy**[1], Ting–Ying Wang[2], Yen–Ting Chen[3], Chi–Tai Chu[2], Chen–Ju Pai[1], Mei–Hsien Chen[4] ([1]Changhua Normal University, Taiwan, China; [2]Taiwan Normal University, Taiwan, China; [3]Taichung University of Education, Taiwan, China; [4]Liuqiu Junior High School, Taiwan, China)
Integrated Mathematics Teacher Educators' Professional Development Program

21:40–21:45 **Cengiz Alacaci**[1], Bulent Cetinkaya[2], Ayhan Kursat Erbas[3] ([1]University of Agder, Narway; [2]Middle East Technical University, Turkey; [2]Middle East Technical University, Turkey)
Talking across Professional Communities: Teacher Educator Competencies in Mathematics and in Technology

21:45–21:50 **Dinglei Huang** (Independent Researcher)
Mathematics Teacher Educators' Knowledge for Designing Online Professional Development

21:50–21:55 **Annie Mamoretsi Kgosi** (University of the Witwatersrand, South Africa)
Mathematics Teachers' Professional Noticing in Teaching of Inverse Functions and Graphs in Grade 12

21:55–22:25 **Discussion of the first papers**

22:25–22:30 **Marta Kobiele** (McGill University)
Examining Teacher Educator Noticing during Rehearsals of Teaching: A Focus on Attending

22:30–22:35 Signe Kastberg, Lizhen Chen, **Sue Ellen Richardson**, Mahtob Aqazade (Purdue University, USA)
Mathematics Teacher Educator Care and Questioning in Mathematics Methods Early Field Debriefing Discussions

22:35–22:40 **Amrit Bahadur Thapa** (Ohio University, USA)
Un/Intelligent Way to Professional Development of Mathematics Teachers: A Case from Nepal

22:40–23:00 **General discussion – Conclusions**

TSG36: Research on Classroom Practice at Primary Level

Chair: Shuhua An (California State University, Long Beach, USA)
Co–chair: Birgit Brandt (Technical University of Chemnitz, Germany)
Team members: Benedetto Di Paola (University of Palermo, Italy), Wanzala Batalingaya Richard (Busuubizi Primary teachers' college, Uganda), Jiushi Zhou (Tianjin Normal University, China)
IPC Liaison Person: Anjum Halai (Pakistan/Tanzania)

Session I

July 13, 19:30–21:00 **Location: W201**

19:30–20:00 **Carolyn A. Maher** (Rutgers University, US)
The Benefits of Using Videos from Research Studies for Teacher Education: Attending to Students' Reasoning and Argumentation

20:00–20:15 **Jinqing Liu**[1], Dionne Cross Francis[2], Ayfer Eker[3] ([1]Indiana University; [2]University of North Carolina; [3]Giresun University)
Examining U.S. Elementary Teachers' Perceptions of and Comfort with Students' Mathematical Mistakes

20:15–20:30 **Benedetto Di Paola** (Università degli Studi di Palermo, Italy)
Problems With Variation: An Educational Experience of Cultural Transposition with Prospective Primary Teachers

20:30–20:40 **Min Zhang** (Teaching Research Section of Shanghai Municipal Education Commission)
Shanghai Practice of Primary Mathematics Classroom Activities

20:40–21:00 **Open Discussion**

Session II

July 16, 21:30–22:00 **Location: W201**

21:30–22:00 **Pi–Jen Lin** (Taiwan Tsing–Hua University, Taiwan, China)
Conjecturing Teaching as Competency–based Instruction

22:00–22:15 **Valérie Batteau** (HEP Lausanne, Switzerland)
How Does a Japanese Primary School Teacher Manage the Whole–class Discussion Named Neriage?

22:15–22:25 **Edith Arévalo Vázquez**, Hilda Alicia Guzmán Elizondo, Elvira Alicia Sánchez Díaz (Escuela Normal Miguel F. Martínez, Mexiko)
Teaching Mathematics at Mexican Elementary Schools

22:25–22:35 **Antoine Fenech**[1], Richard Cabassut[2] ([1]IREM de Strasbourg; [2]Strasbourg University, France)
Action–research Group on Go Game as Classroom Practice to Learn Mathematics at Primary Level

22:35–22:45 **Fraser Gobede** (University of Malawi)
A Grade 2 Teacher's Shift in the Use of Mediational Means within and across Two Addition Lessons

20:45–21:00 **Open Discussion**

Session III

July 17, 14:30–16:30 **Location: W201**

14:30–14:45 **Shuhua An** (California State University, Long Beach)
Using Math Clinic to Support Classroom Teaching Practice and Sharpen Teachers' Pedagogical Content Knowledge

14:45–15:00 **Kirsty Jane Watson** (University of Northampton)
How Might Reasoning Question and Answer Prompts Impact Learners Mathematical Thinking?

15:00–15:10 **Jong Cherng Meei** (Institute of Teacher Education Penang Campus, Malaysia)
Data Use to Inform Mathematics Instruction: An Exploratory Study

15:10–15:20 **Takeshi Miyakawa**[1], Valérie Batteau[2], Minbom Ryu[3] ([1]Waseda University, Japan; [2] HEP Lausanne, Switzerland; [3]Joetsu Univ. of Education, Japan)
Concept of Collective Milieu to Understand the Japanese Mathematics Lesson

15:20–15:30 **Yiru Pei**[1], Min Chen[2], Qiaoping Zhang[3] ([1]The Education University of Hong Kong, Hong Kong SAR, China; [2]College of Teacher Education, East China Normal University, Shanghai, China; [3]The Education University of Hong Kong, Hong Kong SAR, China)
Exploring the Differences between Expert and Pre–service Teachers Noticing

15:30–15:40 **Allan Tarp** (MATHeCADEMY.net, Denmark)
From Loser to User, from Special to General Education, Learning inside Mathematics through outside Actions

15:40–16:00 **Open Discussion**

16:00–16:30 **Closing Discussion**

TSG37: Research on Classroom Practice at Secondary Level

Chair: Yoshinori Shimizu (University of Tsukuba, Japan)
Team members: Carmel Mesiti (University of Melbourne, Australia), Jarmila Robova (Charles University in Prague, Czech), Li Tong (Chongqing Normal University, China)
IPC Liaison Person: Daniel Chazan (USA)

Session I

July 13, 14:30–16:30 **Location: T419**

14:30–14:40 **An Overview and Introduction to the TSG 37**

14:30–14:50 **Julie Horoks**[1], Julia Pilet[1], Brigitte Grugeon–Allys[1], Sylvie Coppé[2], Marina De Simone[2] ([1]LDAR: UPEC; [2]FAPSE: UNIGE, France)
A Large–scale Study of Teachers' Practices in Algebra

14:50–15:00 Ayse Kaya, **Fatma Aslan–Tutak** (Bogazici University, Turkey)
Teaching Functions Using RME Approach to Improve Students' Perceptions of Mathematics Learning and Learning Functions

15:00–15:10 **Marie Aasa Viktoria Sjöblom**[1], Paola Valero[2], Clas Olander[1] ([1]Malmö University, Sweden; [2]Stockholm University, Sweden)
Teachers Promoting Student Interaction: What Happens When Teachers Enter a Mathematical Discussion?

15:10–15:20 **Discussion**

15:20–15:30 **Carmel Mesiti**, David Clarke, Jan van Driel (University of Melbourne, Australia)
The LEXICON Project: Seeking a Structure for the Australian Mathematics Teachers' Professional Lexicon

15:30–15:40 **Jarmila Novotná**[1], Alena Hošpesová[2], Hana Moraová[1], Iva Žlábková[2] ([1]Charles University, Czech Republic; [2]University of South Bohemia, Czech Republic)
The Lexicon Project: Understanding the Universality and Applicability of the Czech Teachers Professional Lexicon

15:40–15:50 **Yoshinori Shimizu**[1], Yuka Funahashi[2], Hayato Hanazono[1] ([1]University of Tsukuba, Japan; [2]Nara University of Education, Japan)
Technical Vocabulary of Japanese Mathematics Teachers: The Japanese Lexicon in the Tradition of Lesson Study

15:50–16:00 **Discussion**

16:00–16:25 Cheng Lu Pien[1], **Cynthia Seto[2],** Lee Ngan Hoe[1], Wong Zi Yang[1], June Lee[1] ([1]National Institute of Education, Singapore; [2]Academy of Singapore Teachers, Somgapore)
Inquiry–based Learning in the Mathematics Classroom: Insights from a Case of Two Lessons

Dan Shen (Ningbo No.7 Middle School, China)
The Practice of Project–based Mathematics Extended Curriculum at Secondary Level

Abdul Halim Abdullah[1], Bomi Shin[2] ([1]Universiti Teknologi Malaysia, Malaysia; [2]Chonnam National University, South Korea)
The Implementation of Project–based Learning (PBL) in Middle School Mathematics Classroom in Malaysia and South Korea

16:25–16:30 **Discussion**

Session II

July 14, 19:30–21:00 **Location: T419**

19:30–20:15 **Charalambos Y. Charalambous** (University of Cyprus, Cyprus)
Studying Instructional Quality in Mathematics: The Need for Content–specificity and Other Open Challenges

20:15–21:00 **Aurelie Chesnais** (Université de Montpellier et Université Paul Valéry de Montpellier, France)
An Approach of Mathematics Teaching and Learning Based on Activity Theory: Principles and Examples of Results

Session III

July 17, 14:30–16:30 **Location: T230**

14:30–14:40 **Nitsa Movshovitz–Hadar**, Ruti Segal, Karni Shir, Atara Shriki, Boaz Silverman, Varda Zigerson (Technion – Israel Institute of Technology, Israel)
A Multi–stage Attempt at Narrowing the Gap between Contemporary Mathematics and High School Mathematics

14:40–14:50 **Luca Agostino[1]**, Bruno Durand, Laetitia Sonia–Doucet, Dimitri Zvonkine Varda Zigerson ([1]Laboratoire de mathématiques de Trappes Espe d'Evry, UEVE; Laboratoire de mathématiques de Versailles, UVSQ, CNRS, France)
Puzzle–based Class Format to Foster Students' Mathematical Oral Production and Exchange

14:50–15:00 Low Leng[1], **Ang Yue Hua[2]**, Lee Ngan Hoe[3] ([1]Academy of Singapore Teachers, Singapore; [2]Yusof Ishak Secondary School, Singapore; [3]National Institute of Education, Singapore)
Developing Students' Metacognitive Practice: A Systematic Approach

15:00–15:10 **Discussion**

15:10–15:20 **Iben Maj Christiansen**, Johan Lagneborg (Stockholm University, Sweden)
Applying the MDI Framework to Swedish Classrooms

15:20–15:30 **Hyun–Young Kang[1]**, Byungjoo Tak[2], Daewon Park[3], Chung Rok Lee[4], Namhyeong Kim[5], Hee Dong Han[6] ([1]Mokwon University, South Korea; [2]Jeonju National University of Education, South Korea; [3]Sejong Seongnam High School, South Korea; [4]Daejeon Daeshin High School, South Korea; [5]Daejeon Science High School for the Gifted, South Korea; [6]Daejeon Dongsan Middle School, South Korea)
The Role of Curricular Noticing as Mediating between the Written Curriculum and Enacted Curriculum

15:30–15:40 **Discussion**

15:40–16:20 **Yu Hongyu** (Nanjing University of Information Science & Technology, China)
Learning Situation Analysis: Problem, Focus and Method

Mayumi Kawamura, Kazuya Kageyama, Masataka Koyama (Hiroshima University,

TSG

Japan)
A Lesson Design Model to Enhance Students' Activities with Examples

Vasantha Moodley (University of the Witwatersrand, South Africa)
Re–visiting Instructional Explanations: How Might the Organisation of a Lesson Contribute to an Explanation

Yukiko Asami–Johansson (University of Gävle, Sweden)
Anthropological Perspective on Japanese Mathematics Teachers' Professional Knowledge of Board Writing

Jarmila Robová, Vlasta Moravcová (Charles University, Czech Republic)
The Implementation of a Set of Tasks for the Development of Spatial Ability in Secondary Schools

16:20–16:30 **Discussion**

Session IV

July 17, 21:30–23:00 **Location: T419**

21:30–21:40 **Azita Manouchehri**, Reyhan Safak (The Ohio State University, USA)
Productive Struggle: A Focus on Sense Making and Connecting

21:40–21:50 **Melissa Kemmerle** (University of Michigan, USA)
Promoting Student Questions in Mathematics Classrooms

21:50–22:40 **Sashi Sharma** (University of Waikato, New Zealand)
English Language Learners Learning Statistics in Multilingual Classrooms

Tomohiko Shima[1], Minoru Ito[2] ([1]Kanagawa Gakuen Girls' Junior and Senior High School, Japan; [2] Tokyo University of Science, Japan)
A Class for Conceptualizing Lagrange's Four–square Theorem

Li Changjie, Lu Yun (Faculty of Education, East China Normal University, China)
Different Learning Opportunities for Students Provided by Teachers in High School Mathematics Classrooms: A Classroom Video Analysis

Xu Wang (Anhui Vocational and Technical College, China)
A Study on Unit Instructional Design Based on UBD – Taking "Logarithm" Unit as an Example

22:40–23:00 **Reflections for the Next Steps**

TSG38: Task Design and Analysis

TSG

Chair: Minoru Ohtani (Kanazawa University, Japan)
Co–chair: Michiel Doorman (Utrecht University, Netherlands)
Team members: Berta Barquero (University of Barcelona, Spain); Heather Johnson (University of Colorado Denver, USA); Xuhua Sun (University of Macau, Macao SAR, China)
IPC Liaison Person: Binyan Xu (China)

Session I

July 13, 19:30–21:00 **Location: T419**

19:30–19:40 **Introduction to TSG38**

19:40–20:00 **Maria Trigueros**[1], Asuman Oktaç[2], Rita Xochitl Vázquez Padilla[3], Avenilde Romo Vázquez[4] ([1]ITAM, Instituto Tecnológico Autónomo de México; CINVESTAV, [2]Centro de

Investigación y de Estudios Avanzados del IPN; [3]UACM, Universidad Autónoma de la Ciudad de México; [4]CICATA, Instituto Politécnico Nacional)
Action, Process or Object? Can They All Be Perceived in a Single Task?

20:00–20:10 **Willy Viviani,** Kayla White (University of Maryland, College Park, USA)
The Design of Tasks for Automatic Formative Assessment: Supporting Teachers and Students

20:10–20:20 **Heather Lynn Johnson[1]**, Anna Shvarts[2], Amy Smith[1] ([1]University of Colorado Denver, USA; [2]Utrecht University, The Netherlands)
A Joint Embodied and Simulation Design for Graphing: Coordinating Distances That Change Together

20:20–20:30 **Natalie Ross[1]**, Ann–Kristin Adleff[1], Gabriele Kaiser[1], Johannes König[2], Sigrid Blömeke[3] ([1]University of Hamburg, Germany; [2]University of Cologne, Germany; [3]CEMO, University of Oslo, Norway)
Classification of Mathematical Tasks to Study Subject–specific Aspects of Instructional Quality

20:30–20:40 **Berta Barquero[1]**, Sonia Esteve[2] ([1]Universitat de Barcelona, Spain; [2]Universitat de Vic–Universitat Central de Catalunya, Spain)
Collective Work on Task Design through Study and Research Path for Teacher Education

20:40–21:00 **Time for questions/discussion**

Session II

July 16, 21:30–23:00 **Location: T419**

21:30–21:40 **Ruchi Mittal[1]**, Alprata Ahuj[2] ([1]PhD Scholar, Department of Education, University of Delhi, India; [2]PhD Scholar, School of Education Studies, Ambedkar University, India)
Exploring Mathematical Task Designed by Pre–service Teachers

21:40–21:50 **Xuhua Sun** (University of Macau, Macao SAR, China)
The Fundamental Idea of Task Design in China for Algebraic Development

21:50–22:00 **Eugenio Chandia Muñoz** (Universidad de Concepción, Chile)
Schooling Experience as Mediating Variables in Preservice Teachers' Beliefs and Instructional Practice When Designing Mathematical Tasks

22:00–22:10 **Guillermina Avila–Garcia**, Liliana Suárez Téllez, Víctor Hugo Luna Acevedo (Instituto Politécnico Nacional, Mexico)
Transforming Mathematics Tasks: An Important Mathematics Teacher's Role

22:10–22:20 **Bjarnheidur Kristinsdottir[1]**, Freyja Hreinsdottir[1], Zsolt Lavicza[2] ([1] University of Iceland, School of Education, Iceland; [2]Johannes Kepler University Linz, Austria)
Developing Silent Video Tasks' Instructional Sequence

22:20–22:30 **Diego Lieban[1]**, Zsolt Lavicza[2], Sandra Reichenberger[2] ([1]IFRS, Brazil; [2]JKU, Austria)
3D Tessellation Triggering the Design of Open–ended Task Combining Physical and Digital Resources

22:30–22:40 **Koji Otaki[1]**, Hiroaki Hamanaka[2], Takeshi Miyakawa[3] ([1]Hokkaido University of Education,

Japan; [2]Hyogo University of Teacher Education, Japan; [3]Waseda University, Japan)
A Possible Pathway of Mathematical Inquiry: How to Calculate the Cube Root of a Given Number by Using a Simple Pocket Calculator?

22:40–22:50 **Erell Germia**, Nicole Panorkou (Montclair State University, USA)
Integrating Covariational Reasoning in the Learning of Science: The Case of Gravity

22:50–23:00 **Junyi Li[1],** Zhou Chao[2] ([1]Tin Ka Ping Experimental Senior High School, China; Soochow University, China[2])
Research on Designing and Teaching of Worked Examples in Reviewing of Sequence Based on the SOLO Taxonomy

Session III

July 17, 14:30–16:30 **Location: T419**

14:30–14:50 **Jonas Bergman Ärlebäck[1]**, Lluís Albarracín[2] ([1]Linköping Universitet, Sweden; [2]Universitat Autònoma de Barcelona, Spain)
Fermi Problems as a Hub for Task Design in Mathematics and STEM Education

14:50–15:00 **Luhuan Huang**, Michiel Doorman, Wouter van Joolingen (Freudenthal Institute for Science and Mathematics Education, Utrecht University, The Netherlands)
Opportunities for Inquiry–based Learning Provided by Chinese and Dutch Lower–secondary School Mathematics Textbook Tasks

15:00–15:10 **Meryansumayeka**, Zulkardi Zulkardi, Ratu Ilma Indra Putri, Cecil Hiltrimartin (Universitas Sriwijaya, Indonesia)
Developing Digital Mathematical Tasks to Promote Students' Higher Order Thinking Skills

15:10–15:20 **Luxizi Zhang[1]**, Luc Trouche[2], Jiansheng Bao[1] ([1]East China Normal University, China; [2]ENS de Lyon, France)
Potential, Actual and Practical Variations for Teaching Functions: Cases Study in China and France

15:20–15:30 **Linda Opheim** (University of Agder, Norway)
Discourse on Mathematical Tasks: A Perceived Difference between Teachers and Researchers

15:30–15:40 **Jonas Jäder** (Dalarna University, Sweden)
Students' Opportunities to Engage in Mathematical Problem Solving

15:40–15:50 **Hyman Bass** (University of Michigan, USA)
Task Design and the Unity of Mathematics

15:50–16:00 **Michiel Doorman**[1], Matija Bašić[2], Zeljka Milin Sipus[2], Rogier Bos[1] ([1]Utrecht University, The Netherlands; [2]University of Zagreb, Croatia)
Tasks and Scenarios for Promoting Inquiry Based Mathematics Teaching

16:00–16:10 **Ng Kit Ee Dawn[1]**, Lee Ngan Hoe[1], Cynthia Seto[2], Liu Mei[1], June Lee[1], Wong Zi Yang[1] ([1]National Institute of Education, Singapore; [2]Academy of Singapore Teachers, Singapore)
Towards Differentiated Instruction: Insights from Constructivist Learning Design Author:

16:10–16:30 **Time for Questions / Discussions**

Session IV

July 17, 21:30–23:00 **Location: T219**

21:30–21:40 **Sofia Paz Rodriguez**, Carlos Armando Cuevas Vallejo, & osé Orozco–Santiago Cinvestav (IPN, Mexico)
Task for Introducing the Vector Concept Using Technology

21:40–21:50 **Wenmin Zhao**, Samuel Otten (University of Missouri – Columbia, USA)
Enriching Word Problems: Examples from U.S. Prospective Secondary Teachers

21:50–22:00 **Galit Nagari–Haddif** (University of Haifa, Israel)
Design Tasks in MLR Environment: Constructing Examples for Proving Logical Statements

22:00–22:10 **Marta Martin Nieto**, Natalia Ruiz–Lopez (Universidad Autónoma de Madrid, Spain)
Didactic Sequence Planning for the Study of the Teaching and Learning of Isometries in Future Primary School Teachers

22:10–22:20 **Rosmawati Mohamed**[1], Munirah Ghazali[2] ([1]PhD Candidate, School of Educational Studies, Universiti Sains Malaysia, Malaysia; [2]School of Educational Studies, Universiti Sains Malaysia, Malaysia)
Analyzing Primary Two Pupils' Errors Answering Fractions' Task Using the Newman Procedure

22:20–22:30 **Franklin Falculan**, Maria Alva Aberin (Ateneo de Manila University, Philippine)
Effects of Low Floor High Ceiling Mathematical Tasks on Students' Mathematical Proficiency in Seventh–grade Geometry

22:30–23:00 **Conclusions and Discussion of TSG**

TSG39: Language and Communication in the Mathematics Classroom

Chair: Marcus Schütte (Technical University of Dresden, Germany)
Co–chair: Jenni Ingram (University of Oxford, UK)
Team members: Fengjuan Hu (Capital Normal University, China), Maíre Ní Riordáin (University College Cork, Ireland), Tran Vui (Hue University, Vietnam)
IPC Liaison Person: Frode Rønning (Norway)

Session I

July 13, 14:30–16:30 **Location: W313**

14:30–14:40 **Jenni Ingram,** Marcus Schütte, Fengjuan Hu, Máire Ní Ríordáin, Tran Vui (University of Oxford, UK; Technical University of Dresden, Germany; Capital Normal University, China; University College Cork, Ireland; Hue University, Vietnam)
Meeting the Challenges of Research Language and Communication in Mathematics Education

14:50–15:05 **Krummheuer, Götz** (Kassel, Germany)
TBA

15:05–15:20 **Elisa Bitterlich** (Technische Universität Dresden, Germany)
Lifeworld Connections in Mathematics Education – Unquestioned, Indispensable, and Undefined?

15:20–15:30 **Vui Tran** (Hue University, College of Education, Vietnam)
The Threshold of Multiple Representations for Students to Discover Possible Solutions for Communicating Their New Ideas in Integrated Closed–open Approach

15:30–15:40 **Kunihiko Shimizu** (Bunkyo University, Japan)
The Practice and Examination of Opportunities to Translate Representation through Problem–solving

15:40–15:50 **Piata Allen** (University of Auckland, Australia)
Tau Ke: A Software Solution for Capturing Multiple Representations of Pangarau (Mathematics) Language

15:50–16:00 **Li Wing–kwan,** Simon S. Y. Chan (The University of Hong Kong, Hong Kong SAR, China)

The Effects of Using a Modified Frayer Model to Teach Mathematics Vocabulary to Junior–form English Learners in a Chinese Medium–of–instruction Secondary School

16:00–16:15 **Cartwright,** Katherin (The University of Sydney, Australia)
It Always Equaled an Odd Number: Observing Mathematical Fluency through Students' Oral Responses

16:15–16:30 **Mary Jane A. Castilla,** Catherine P. Vistro–Yu (University of Santo Tomas and Ateneo de Manila University, Philipines)
Achieving Meaningful Statistics Classroom Learning through Bilingualism and Multilingualism: A Case of Selected Grade 10 Students in Marikina City

Session II

July 14, 19:30–21:00 **Location: W313**

19:30–19:45 **Judith Jung,** Marcus Schütte, Götz Krummheuer (Technische Universität Dresden, Leibniz University Hannover, Kassel, Germany)
Discourse as the Place for the Development of Mathematical Thinking through an Interactionist Perspective

19:45–20:00 **Annica Baiker,** Daniela Götze (TU Dortmund University, Germany & University of Siegen, Germany)
Language–responsive Support of Meaning–making Processes for Understanding Multiplicative Decomposition Strategies

20:00–20:10 **Zhihui Chen,** Yuting Tong (South China Normal University, Guangzhou; East China Normal University, Shanghai)
A Study on the Evaluating of Learning Opportunities in Mathematics Classes of Secondary Schools Based on Discourse Analysis Techniques

20:10–20:20 **Cris Edmonds–Wathen** (Charles Darwin University, Australia)
Mathematical Expression in Different Languages: The Need for Systematic Description

20:20–20:30 **Wang Si–kai,** Ye Li–jun (Jing Hengyi Teacher Education College of Hangzhou Normal University)
A Comparative Study on Teaching Language of Algebra Classroom between Novice Teachers and Expert Teachers Taking Linear Equation in One Unknown as an Example

20:30–20:40 **Rachel–Ann Böckmann,** Marcus Schütte (Leibniz Universität Hannover; Leibniz Universität Hannover, Germany)
Interactional Obligations for Collective Argumentation in Pair and Group Work

20:40–20:50 **Victoria Shure,** Bettina Rösken–Winter (Humboldt–Universität zu Berlin, Germany)
How Pre–service Primary Teachers Engage in Language Responsive Mathematics Teaching While Working on a Scriptwriting Task

20:50–21:00 **Ann–Kristin Tewes** (Leibniz Universität Hannover, Germany)
Support Systems as Intersubjective Processes between Teachers and Students

Session III

July 17, 21:30–23:00 **Location: W313**

21:30–21:55 **Beth Herbal–Eisenmann**
TBA

22:00–22:15 **Lauren Hickman McMahon** (University of Michigan – Ann Arbor, USA)
Epistemic (in)justice in Mathematical Communication between Teachers and Students

22:15–22:30 **Kirstin Erath** (TU Dortmund University, Germany)
Identifying Language Demands for Understanding the Meaning of Similarity

22:30–22:40 **Fatou Sey** (University of The Witwatersrand, South Africa)
Exploring a Teacher's Enactment of Explanatory Communication in a Mathematics Lesson

22:40–22:50 **Peter Ludes–Adamy,** Marcus Schütte (Leibniz–Universität Hannover, Germany)
Dissent and Consensus Situation Structures in Mathematics and Computer Science Learning Environments

22:50–23:00 **Candace Joswick,** Michael T. Battista (The University of Texas at Arlington, USA, The Ohio State University, USA)
Quadrilateral Woop–de–doos: Language Use and Geometric Property Development of Two Fifth Graders in a Dynamic Geometry Learning Environment

TSG40: Research and Development on Mathematics Curriculum

Chair: Masataka Koyama (Hiroshima University, Japan)
Co–chair: Jeremy Hodgen (University College London, UK)
Team members: Gulseren Karagoz Akar (Bogazici University, Turkey), Shelly Dole (University of the Sunshine Coast, Australia), Ruilin Wang (Capital Normal University, China)
IPC Liaison Person: Thomas Lowrie (Australia)

Session I

July 13, 19:30–21:00 **Location: W313**

19:30–20:25 Masataka Koyama[1], Jeremy Hodgen[2], Gulseren Karagoz Akar[3], Shelly Dole[4], Ruilin Wang[5] ([1]Hiroshima University, Japan; [2]University College London, UK; [3]Bogazici University, Turkey; [4]University of the Sunshine Coast, Australia; [5]Capital Normal University, China)
Opening Session of TSG 40

20:25–20:45 Lara K. Dick[1], **Amanda G. Sawyer**[2], Margaret A. MacNeille[3] ([1]Bucknell University, Department of Mathematics, USA; [2]James Madison University, Middle, Secondary, and Mathematics Education Department, USA; [3]Bucknell University, Education Department, USA)
Identifying the Quality of Teacher Created Curriculum Shared via the Teachers' Pay Teachers Online Platform

20:45–21:00 **Jon D. Davis** (Western Michigan University, USA)
Understanding U.S. Middle School Mathematics Teachers' Perceptions of the Official Curriculum through a Cultural Lens

Session II

July 16, 21:30–23:00 **Location: W313**

21:30–21:45 **Xinqi Zhang[1]**, Masataka Koyama[2] ([1]Graduate School of Education, Hiroshima University, Japan; [2]Graduate School of Humanities and Social Sciences, Hiroshima University, Japan.)
Comparative Study on Statistical Contents in Chinese and Japanese Mathematics Textbooks

21:45–22:00 **Anna Klothou[1]**, Charalampos Sakonidis[2] ([1]Department of Primary Education, Greece; [2]Democritus University of Thrace, Greece)
The Implementation of a Reformed Mathematics Curriculum: Mathematical Processes in Practice

22:00–22:15 **Eun Young Cho[1]**, Rae Young Kim[2] ([1]Graduate School, Ewha Womans University, South Korea; [2]Ewha Womans University, South Korea)
The Mathematical Literacy in Korean Mathematics Curricula

22:15–22:30 **Daniela Căprioară[1]**, Annie Savard[2], Alexandre Cavalcante[2] ([1]Ovidius University of Constanța, Romania; [2]McGill University, Canada)
Financial Education in the Romanian Mathematics Curriculum: Policy and Implementation in Elementary Textbooks

22:30–22:45 **Ellen Jameson**, Lynne McClure (Cambridge Mathematics, Cambridge Assessment, University of Cambridge, UK)
Formative Evaluation of a Tool for Representing Ideas in Mathematics Curriculum Design: A Delohi Study Example

TSG

22:45–23:00 **Laxman Luitel**, Bal Chandra Luitel (Kathmandu University School of Education, Department of STEAM Education, Nepal)
Images of Mathematics Curriculum and Pedagogical Influences

Session III

July 17, 14:30–16:30 **Location: W313**

14:30–14:45 **Catherine P. Vistro–Yu** (Mathematics Department, Ateneo de Manila University, Philippines)
A Participative Approach to Designing a New Mathematics Course for All College and University Students in the Philippines

14:45–15:00 **Lili Zhou,** Jinqing Liu, Jane–Jane Lo (Curriculum & Instruction, Purdue University, USA)
A Comparison of U.S. and Chinese Geometry Strands through the Lens of Van Hiele

15:00–15:15 **Francisco Antonio Mejia Ramos** (Ministry of Education of El Salvador)
Curriculum Proposal from El Salvador for Improving Math Learning, Description, Structure, First Results and Effectiveness

15:15–15:45 **Break**

15:45–16:00 **Yamei Zhu** (East China Normal University, China)
A Meta–analysis of the Effects of Standard–based Curriculum on USA Students Mathematics Achievement

16:00–16:15 **Dae S. Hong** (University of Iowa, United States)
Examining the Initial Treatment of the Area and Volume Measurement in the Selected Elementary Mathematics Textbooks from US and Korea

16:15–16:30 **Su Shengkui**[1,2], Miao Lin[1,3], Chen Qinghua[1] ([1]College of Mathematics and Informatics, Fujian Normal University, China; [2]Xiamen No.6 Middle School of Fujian, China; [3]Shanghai Hongkou Experimental School, China)
A Course Design for Mathematical Modeling in High School Based on STEM Education

TSG41: Research and Development on Textbooks and Resources for Learning and Teaching Mathematics

TSG

Chair: Sebastian Rezat (Paderborn University, Germany)
Co–chair: Jana Visnovska (University of Queensland, Australia)
Team members: Moneoang Leshota (National University of Lesotho, Lesotho), Hussein Sabra (Reims University, France), Guorui Yan (The University of Hong Kong, Hong Kong SAR, China)
IPC Liaison Person: Luc Trouche (France)

Session I

July 13, 14:30–16:30 **Location: W315**

14:30–14:40 **Opening and Introduction**

14:40–15:00 **Susanne Prediger** (Technical University Dortmund / IPN Kiel, Germany)
Textbooks as Teacher Support for Engaging Students in Active Knowledge Organization

15:05–15:10 **Xiang Gao, Gergely Balazs Wintsche, Wenbin Xu, Marc van Zanten, Jana Visnovska**

Report on the Discussion of the Following Contributions

Xiang Gao (East China Normal University, China)
An Analysis of Data and Probability Tasks in US and Chinese Elementary Mathematics Textbooks

Jana Visnovska, José Luis Cortina, Pamela Vale (The University of Queensland, Australia; Universidad Pedagógica Nacional, Colombia; Rhodes University, South Africa)
Learning to Design Resources for Teachers

Gergely Balazs Wintsche (Eötvös Loránd University, Budapest, Hungary)
The Effect of the Curricula on Textbooks for the Teaching of Probability and Statistis

Shiqi Lu, Wenbin Xu (Nanjing Normal University, China)
Constructing a Textbook Analysis Framework of Statistics and Probability Areas in Elementary Math

Marc van Zanten, Marja van den Heuvel–Panhuizen (Utrecht University, The Netherlands; Nord University, Norway)
Mathematics Education According to the Textbook: Opportunities to Learn Investigated

15:15–15:25 **Moneoang Leshota** (University of the Witwatersrand, South Africa)
Identifying Educative Features in Scripted Mathematics Lesson Plans

15:30–15:35 **Anatoli Kouropatov, Moneoang Leshota, Shuhui Li, Yang Shen, Fulin Liu**
Report on the Discussion of the Following Contributions

Anatoli Kouropatov, Regina Ovodenko, Michal Fraenkel, Maureen Hoch (Levinsky College of Education, Israel; Shenkar College of Engineering and Design & Center for Educational Technology, Israel; Center for Educational Technology, Israel)
Didactic Considerations Regarding the Iterative Development Design of Dynamic Digital Tools

Moneoang Leshota (University of the Witwatersrand, South Africa)
Identifying Educative Features in Scripted Mathematics Lesson Plans

Shuhui Li (Columbia University, USA)
A Comparative Study of Bidirectional Connections in U.S. and Chinese High School Mathematics Textbook Problems

Yang Shen, Jiansheng Bao (East China Normal University, China)
Translations of Function Representation in Different Textbooks

Fulin Liu, Yiming Cao, Dengfeng Liang (People's Education Press, Beijing Normal University, Beijing Technology Business University, China)
A Comparative Study on Fractions in Primary Schools Mathematics Textbooks of China and the United States

15:40–15:50 **Jana Visnovska,** José Luis Cortina, Pamela Vale (The University of Queensland, Australia; Universidad Pedagógica Nacional, Colombia; Rhodes University, South Africa)
Learning to Design Resources for Teachers

15:55–16:00 **Suijun Jia, Yao Li, Hongwei Ran, Sebastian Rezat**
Report on the Discussion of the Following Contributions

Suijun Jia (Zhejiang International Studies University, China)
A Comparative Study of Problem Solving in Chinese and U.S. Primary Mathematics Textbook

Yao Li, Lianchun Dong (Minzu University of China, China)
A Comparative Analysis of Tasks Contexts in Mathematics Textbooks in China and Singapore

Hongwei Ran, Lianchun Dong (Minzu University of China, China)
A Comparative of Mathematical Inquiry Activities in Textbooks in China and Singapore

TSG

Sebastian Rezat (Paderborn University, Germany)
Elements of a Theory of Textbook Design

16:05–16:15 **Sebastian Rezat** (Paderborn University, Germany)
Elements of a Theory of Textbook Design

16:20–16:30 **Discussion**

Session II

July 14, 19:30–21:00 **Location: W315**

19:35–19:55 **Birgit Pepin** (Eindhoven University of Technology, The Netherlands)
Digital Mathematics Curriculum Resources: Towards Design Principles of Educative Materials for Students and Teachers

20:00–20:10 **Anatoli Kouropatov,** Regina Ovodenko, Michal Fraenkel, Maureen Hoch (Levinsky College of Education, Israel; Shenkar College of Engineering and Design & Center for Educational Technology, Israel; Center for Educational Technology, Israel)
Didactic Considerations Regarding the Iterative Development Design of Dynamic Digital Tools

20:15–20:20 **Saba Gerami, Dewi Rahimah, Yi Wang, Lynda M. Wynn**
Report on the Discussion of the Following Contributions

Vilma Mesa, Saba Gerami (University of Michigan, USA)
Teaching and Learning with Dynamic Textbooks: Studying Student Uses at Scale

Dewi Rahimah, Jana Visnovska (The University of Queensland, Australia)
The Elements of Textbooks That Indonesian Mathematics Teachers Use

Yi Wang, Lianghuo Fan (Beijing Normal University, China; East China Normal University, China; University of Southampton, UK)
Investigating the Use of Mathematics Textbooks by Students in Shanghai and England: A Comparative Study

Lynda M. Wynn (California State University, USA)
Examining Curriculum and Teacher Supports for Engaging Second. Emergent Bilingual STDS in MATHEM. Practice

20:25–20:35 Vilma Mesa, **Saba Gerami** (University of Michigan, USA)
Teaching and Learning with Dynamic Textbooks: Studying Student Uses at Scale

20:40–20:45 **Karima Sayah, Dominic R. Oakes, Hendrik Van Steenbrugge, Maryna Rafalska**
Report on the discussion of the following contributions

Karima Sayah (Al AWAEL School of Education and Learning Annaba, Algeria)
Sesamath Resources and Collective Work from Mathematical Laboratory to Classes in Arabic Environment

Dominic R. Oakes, Sofya Lyakhova (Swansea University, UK)
Promoting the Teaching and Learning of Mathematics Through Visualising Connections in Post–16 Resources

Hendrik Van Steenbrugge, Andreas Ryve (Stockholm University, Sweden; Mälardalen University, Sweden)
A Method to Analyze Teachers' Collective Work Around Resources in the Context of PD

Maryna Rafalska, Chongyang Wang, Luc Trouche (Université Côte d'Azur, France; Beijing Normal University, China; ENS de Lyon, France)
Comparing Naming Systems Used by Chinese and Ukrainian Teachers: Exploring T's Resource System

22:45–21:00 **Discussion**

Session III

July 17, 21:30–23:00 **Location: W315**

21:35–21:45 **Yi Wang**, Lianghuo Fan (Beijing Normal University, China; East China Normal University, China; University of Southampton, UK)
Investigating the Use of Mathematics Textbooks by Students in Shanghai and England: a Comparative Study

21:50–21:55 **Guorui Yan, Ok–Kyeong Kim, Katiane de Moraes Rocha, Everaldo Silveira**
Report on the Discussion of the Following Contributions

Guorui Yan (The University of Hong Kong, Hong Kong SAR, China)
How Expert Mathematics Teacher Design Curriculum Based on Textbook Use: A Case Study in Beijing

Ok–Kyeong Kim (Western Michigan University, USA)
Toward Systematic Support for Preservice Teachers Learning of Productive Resource Use

Katiane de Moraes Rocha (University Center Anhanguera of Campo Grande, Brazil)
Analysing Teachers Indiv. and Coll. Resources Through the Lens of Their Digital Resources

Everaldo Silveira, Arthur B. Powell (Federal University of Santa Catarina, Brazil; Rutgers University–Newark, USA)
Student Understanding of Textbook Visual Representations of Natural and Fractional Numbers

22:00–22:05 **Maxim Brnic, Lisnet Mwadzaangati, Niamh O'Meara, Hilary Tanck**
Study of Construction by Quadratic Curve Addition Method

Maxim Brnic (University of Münster, Germany)
Long–term Use of a Digital Mathematics Textbook with Integrated Digital Tools: Investigating the Influence on Students' Achievement and Self–efficacy

Lisnet Mwadzaangati (University of Malawi, Malawi)
The Relationship Between Mathematical Examples in Malawian Grade 1 Primary School Mathematics Teachers' Guide and the Goals of Outcome Based Education

Niamh O'Meara, Olivia Fitzmaurice, Patrick Johnson (University of Limerick, Ireland)
Career Mathways: A Teaching & Learning Intervention to Show the Relevance of Mathematics in Careers

Hilary Tanck (Clemson University, USA)
Unbounding Curriculum Resources

22:10–22:30 Erin Henrick, **Paul Cobb** (Vanderbilt University, USA)
Instructional Materials as Tools for Instructional Improvement

22:30–22:50 **Discussion**

22:50–23:00 **Closing Remarks**

TSG

TSG42: Research and Development in Assessment in Mathematics Education

Chair: Abid Sohail (Aga Khan University Karachi, Pakistan)
Co–chair: Caroline Long (University of Johannesburg, South Africa)
Team members: Shai Olsher (University of Haifa, Isreal), Nathalie Sayac (University Paris Est Créteil, France), Xiong Wang (University of Alberta, Canada)
IPC Liaison Person: Anjum Halai (Pakistan/Tanzania)

Session I

July 13, 19:30–21:00 **Location: W215**

19:30–19:40 **Online Pre–recorded video**
Federica Ferretti (Free University of Bolzano–Bozen, Italy)
Students' Difficulties in the Management of Algebraic Expression Highlighted in Large–scale Assessment

19:40–19:50 **Online Pre–recorded video**
Alberto Arnal–Bailera[1], José M. Muñoz–Escolano[1], Antonio M. Oller–Marcén[2] ([1]Universidad de Zaragoza, Spain; [2]Centro Universitario de la Defensa de Zaragoza, Spain)
In–service Teachers Marking Students' Answers Containing Derivation Errors

19:50–20:00 **Online Pre–recorded video**
Valentina Vaccaro[1], Eleonora Faggiano[2], Federica Ferretti[3] ([1]University of Oviedo, INVALSI – Roma, Italy; [2]University of Bari Aldo Moro, Italy; [3]University of Ferrara, Italy)
Investigating Teachers' Awareness of the Reasons for Students' Math Errors at Primary School Level

20:00–20:10 **Online Pre–recorded video**
Emiliano Augusto Chagas[1], Mauricio Urban Kleinke[2] ([1]IFSP – Instituto Federal de São Paulo (Federal Institute of São Paulo), Brazil; [2]Unicamp – Universidade Estadual de Campinas (State University of Campinas), Brazil)
Cognitive Load Reduction in Math Items: Performance, Gender and Socioeconomic Status

20:10–20:20 **Online Power Point Presentation**
Priscila D. Corrêa (University of Windsor, Canada)
Expressions of Mathematical Proficiency in Students' Mathematical Work

20:20–20:30 **Online Power Point Presentation**
Timothy Sibbald (Nipissing University, Ontario, Canada)
Structural Features in Classroom Level Standardized Mathematics Achievement Results

20:30–20:40 **Online Pre–recorded video**
Ian Cantley (Queen's University Belfast, North Ireland)
Philosophical Insights into PISA and Mathematics Education Policy Issues

20:40–20:50 **Online Pre–recorded video**
Ya Mo, Laurie Cavey, Michele Carney, Tatia Totorica, Patrick Lowenthal (Boise State University, Idaho)
A Unique Item Format to Assess Attentiveness to Students' Mathematical Ideas

20:50–21:00 **Online Power Point Presentation**
Kim Koh, Olive Chapman, Shimeng Liu (Werklund School of Education, University of Calgary, Canada)
Developing Preservice Elementary Teachers' Capacity in the Design of Authentic Mathematics Assessment

Session II

July 16, 21:30–23:00 **Location: W215**

21:30–21:45 **Online Power Point Presentation**
Xiong Wang (University of Alberta, Canada)
Evaluating Mathematics Teachers' Professional Learning in a PLN: A Complex Systems Perspective

21:45–22:00 **Online Power Point Presentation**
Nadine Grapin (Laboratoire de Didactique André Revuz, Université Paris Est Créteil, France)
Validity of Assessments in Mathematical Textbooks: A Study of Beginning of Primary School Level Textbook Assessments

22:00–22:15 **Online Power Point Presentation**
Richelle Marynowski (University of Lethbridge, Canada)
Are the Stakes the Same? A Comparison of Three Types of Large Scale Assessments in Alberta, Canada

22:15–22:30 **Online Pre–recorded video**

Shai Olsher, Kawthar, **Nakhash Khalaila** (University of Haifa, Israel)
Factors Related to Mathematics Teachers Pedagogic Discretion, Specifically When Evaluating Parabolic Sketches

22:30–22:45 **Online Pre–recorded video**
Marta Barbarics (Budapest Semesters in Mathematics Education, Hungry)
Assessment Based on Gamification in Hungarian Secondary Mathematics Classes

22:45–23:00 **Online Power Point Presentation**
Anne D'Arcy–Warmington (Curtin College, Australia)
'I Know All about This Mathematical Topic, But I Cannot Answer This Question' Moment, Can I Have a Clue Please?

Session III

July 17, 14:30–16:30 **Location: W215**

14:30–14:45 **Online Power Point Presentation**
Caroline Long[1], Johann Engelbrecht[2], Vanessa Scherman[3], ([1]University of Johannesburg; [2]University of Pretoria; [3]University of South Africa)
Investigating the Treatment of Missing Data in an Olympiad–Type Test – The Case for Selection Validity

14:45–15:00 **Online Power Point Presentation**
Nathalie Sayac[1], **Michiel Veldhuis[2]** ([1]LDAR Université Paris–Diderot, ESPE Créteil; [2]iPabo University of Applied Sciences Amsterdam & Utrecht University, France)
Mathematics Assessment Practices of Primary School Teachers in France

15:00–15:10 **Online Power Point Presentation**
Adri van der Nest[1], Caroline Long[2], Johann Engelbrecht[3] ([1]University of South Africa; [2]University of Johannesburg; [3]University of Pretoria)
The Role of Formative Assessment Experiences in the Teaching and Learning of Mathematics

15:10–15:20 **Online Pre–recorded video**
Willem van der Vegt (Windesheim University of Applied Sciences, Zwolle, The Netherlands)
Assessing Math in Teacher Training; What to Learn from Our Students Research

15:20–15:30 **Online Power Point Presentation**
Basanta Raj Lamichhane (Saptagandaki Multiple Campus, Bharatpur, Chitwan, Nepal)
Transformative Assessment System in Mathematics Education: Engaging Mind, Body and Soul

15:30–15:40 **Online Pre–recorded video**
Ummy Salmah, Uki Rahmawati, Bungkus Dias Prasetyo (SEAMEO Regional Centre for QITEP in Mathematics, Indonesia)
Analyzing Students' Errors in Solving Context–based Problems in Marwa Assessment

15:40–15:50 **Online Power Point Presentation**
Hairon Salleh[1], **Foo Kum Fong[2]**, Koh Wei Xun[1] ([1]National Institute of Education, Singapore; [2]Academy of Singapore Teachers, Ministry of Education, Singapore)
Raw Scores or Rasch Measures? Lessons from Rasch Analysis of Secondary One Mathematics Test

15:50–16:00 **Online Pre–recorded video**
Hua Wu, **Junhan Liu**, Fengqi Zhai (LiaoNing Normal University, China)
Research on the Level Division of Mathematical Logical Reasoning Literacy Based on Solo Taxonomy Theory

16:00–16:10 **Online Power Point Presentation**
Vitus Paul L. de Jesus[1], Angela Fatima H. Guzon[2] ([1]La Salle Green Hills / Ateneo de Manila University, Philippines; [2]Ateneo de Manila University, Philippines)
Quality of Mathematical Reasoning in a Philippine Senior High School's Pre–calculus Examinations on Conic Sections

16:10–16:20 **Online Pre–recorded video**
Alessandro Gambini[1], **Roberto Capone[2]** ([1]Sapienza University of Rome, Rome; [2]University of Salerno, Rome)
The Results of Large–scale Assessment as Tools for Mathematics Activity Design

TSG

16:10–16:30 **Online Power Point Presentation**
Niu Jian–ren, Lai Li, Chen Chao–dong, He Zhi–rong, Yang Liang (College of Mathematics, Sichuan University, China)
Research on the Assessment System Combining Standardization and Non–standardization in the Mathematics Education of Top Talents

TSG43: Research and Development in Testing (National and International) in Mathematics Education

Chair: Ivan Vysotskij (Moscow Center for Teachers Excellence, Russia)
Co–chair: Fumi Ginshima (National Institute for Educational Policy Research, Japan)
Team members: Richard T. Houang (Michigan State University, USA), Maria Isabel Ramalho Ortigão (Universidade do Estado do Rio de Janeiro, Brazil), Lidong Wang (Beijing Normal University, China)
IPC Liaison Person: Ivan Yashchenko (Russia)

Session I

July 14, 19:30–21:00 **Location: T213**

19:30–19:50 Qi Chunxia[1], Wang Ruilin[2], Huang Qi[3], **Fu Yu[1]** ([1]Faculty of Education of Beijing Normal University, China; [2]Capital Normal University, China; [3]University of Wisconsin–Madison, USA)
On the Eighth Grade Mathematics Achievement and Its Effect Factors–based on Seven Areas Study

20:00–20:20 **Tibor Marcinek[1]**, Arne Jakobsen[2], Edita Partová[3] ([1]Central Michigan University, USA; [2]University of Stavanger, Norway; [3]Comenius University, Slovakia)
International Comparisons of Teacher Knowledge: The Case of the LMT Measures

20:30–20:50 Maria Isabel Ramalho Ortigão (Rio de Janeiro State University)
PISA Assessment of Brazilian Students' Mathematical Literacy

Session II

July 17, 21:30–23:00 **Location: T213**

21:30–21:40 Kuksa Ekaterina (Moscow Center for Continuous Mathematical Education, Russia)
On Composing Distractors for Multiple Choice Problems

21:50–22:00 Jiangong Dong (Wuhu Institute of Educational Science, Wuhu City, Anhui Province, China)
How Chinese Design Mathematics Test

22:10–22:20 **Bruno Damien da Costa Paes Jürgensen**, **Mara Regina Lemes De Sordi** (State University of Campinas (UNICAMP), Brazil)
Reflections on Large–scale Assessment and the Formatting Power of Mathematics

TSG44: Mathematics and Interdisciplinary Education

Chair: Carl Winsløw (University of Copenhagen, Denmark)
Co–chair: Rita Borromeo Ferri (University of Kassel, Germany)
Team members: Nicholas Mousoulides (University of Nicosia, Cyprus), Avenilde Romo–Vasquez (The National Polytechnic Institute of Mexico, Mexico), Guangtian Zhu (East China Normal University, China)
IPC Liaison Person: Takeshi Miyakawa (Japan)

Session I

July 13, 19:30–21:00 **Location: W211**

19:30–19:35 **WINSLØW**
Introduction and Welcome to TSG44

19:35–20:05 **Francisco Javier Garcia Garcia** (University of Jaen, Spain)
Interdisciplinary Mathematics Education: Some Reflections from the Anthropological Theory of the Didactic

20:05–20:35 **Yuichi Nezu** Takeshi Miyakawa (Joetsu University of Education, Japan; Waseda University, Japan)
Interdisciplinary Inquiry–based Learning with Queueing Situations: Investigating the Questions Triggering Mathematical Activities

20:35–20:40 **Viana Nallely Garcia**[1], Flor Monserrat Rodríguez Vásquez ([1]Universidad Autonoma De Guerrero, Mexico)
A Classroom Experience: Vector Concept

20:40–20:45 **Mehtap Kus**[1], Erdinc Cakiroglu ([1]Aksaray University, Turkey)
Students' Use of Geometric Cues in an Art Studio: Scaling of Artworks

20:45–21:00 **Discussion in Small Groups on Short Oral 1–2**

Session II

July 16, 21:30–23:00 **Location: W211**

21:30–22:00 **Avenilde Romo–Vazquez**[1], Lenin Augusto Echavarria Cepeda[1], Luis Ramon Siero González ([1]Instituto Politecnico Nacional, Mexico)
Posing a Generating Question with the Pedagogy of Questioning the World: The Case of GPS Coordinates

22:00–22:30 **Annie Savard** (McGill University, Canada)
Mathematics and Financial Education: How Do They Intersect Together?

22:30–22:35 **Debasmita Basu**[1], Nicole Panorkou[2] ([1]The New School, USA; [2]Montclair State University, USA)
Task Design Features for Integrating Covariational Reasoning with Science

22:35–22:40 **Aitzol Lasa**, Miguel R. Wilhelmi, Olga Belletich, Jaione Abaurrea, Haritz Iribas (Spain, Public University of Navarre)
STEM Projects as Didactical Situations in Mathematics: Theoretical Frame to Construct Algebraic Institutional Meanings

22:40–22:45 **Lubomira Valovicova,** Janka Medova (Constantine the Philosopher University in Nitra, Slovakia)
Physical Measurements as an Environment Supporting Primary Pupils Reasoning about Central Tendency

22:45–23:00 **Discussion in Small Groups on Short Oral 3–5**

Session III

July 17, 14:30–16:30 **Location: W211**

14:30–15:00 **Eleonora Barelli**[1], Laura Branchetti[2], Berta Barquero[3], Oscar Romero ([1]University of Bologna, Bologna; [2]University of Milan, Italy; [3]University of Barcelona, Spain)
Questioning Interdisciplinarity within Teacher Education: A Module on the Evolution of the COVID–19 Pandemic

15:00–15:30 **Thi Nga Nguyen**[1], Thien Thanh Lam, Minh Dung Tang ([1]Ho Chi Minh city University of Education, Vietnam)
A Situation of Interdisciplinary Mathematics Education in Context of Protecting Water Resources

15:30–15:35 **Break**

15:35–15:40 **Shan Chen** (Southwest university, China)
Integrating Mathematics into STEAM Education: Constructing Models and Developing

TSG

Measurement Scale of Students' STEAM Competence

15:40–15:45 **Sarah Christina Phillips**[1], Jan Mills[2] ([1]International Baccalaureate Organization, Canada; [2]International Baccalaureate, New Zealand)
Transdisciplinary and Interdisciplinary Mathematics in the International Baccalaureate

15:45–16:00 **Discussion in small groups on Short Oral 8–9**

16:00–16:30 **Common discussion, networking in small groups, publication plans**

TSG45: Mathematics for Non–specialist/mathematics as a Service Subject at Tertiary Level

Chair: Burkhard Alpers (Aalen University of Applied Sciences, Germany)
Co–chair: Mitsuru Kawazoe (Osaka Prefecture University, Japan)
Team members: Olov Viirman (University of Gävle, Sweden), Jing Zeng (Zhejiang Normal University, China)
IPC Liaison Person: Faïza Chellougui (Tunisia)

Session I

July 13, 14:30–16:30 **Location: T205**

14:30–15:00 **Burkhard Alpers** (Aalen University, Germany)
Mathematics as a Service Subject: Historical Development and Major Players from a European Perspective

15:00–15:30 **Wes Maciejewski** (San José State University, USA)
Conceptualizing Service and General Education Mathematics

15:30–16:00 **Mitsuru Kawazoe** (Osaka Prefecture University, Japan)
A Practice Report on Mathematical Modelling Education for Humanities and Social Sciences Students

16:00–16:30 **Deependra Budhathoki**, Gregory D. Foley, Stephen N. Shadik (Ohio University, USA)
Flexible Content, Instruction, and Assessment in a University–level Quantitative Reasoning Course

Session II

July 14, 19:30–21:00 **Location: T205**

19:30–20:00 **Olov Viirman**, Irina Pettersson (Uppsala University, Sweden, University of Gävle, Sweden)
A Small–scale Implementation of Inquiry–based Teaching in a Single–variable Calculus Course for First–year Engineering Students

20:00–20:30 **Jana Peters**, Reinhard Hochmuth (Leibniz University Hannover, Germany)
Sometimes Mathematics Is Different in Electrical Engineering

20:30–21:00 **Malte Lehmann** (Humboldt–Universität Berlin, Germany)
Which Mathematics Competences Are Relevant for Engineering Education? – A Mixed Methods Study

Session III

July 17, 21:30–23:00 **Location: T205**

21:30–22:00 **Farzad Radmehr**[1,2], Faezeh Rezvanifard[2], Michael Drake[3] ([1]University of Agder, Norway; [2]Ferdowsi University of Mashhad, Iran; [3]Victoria University of Wellington, New Zealand)
The Attitudes of Lecturers and Students towards Puzzle–based Learning: The Case of Differential Equations

22:00–22:30 **Svitlana Rogovchenko** (University of Agder, Norway)

Can We Make Mathematics Interesting for Engineering Students? Modelling Tasks in an Ordinary Differential Equations Course

22:30–23:00 **Satoru Takagi**, Kesayoshi Hadano, Sei–ichi Yamaguchi (Waseda University, Kyushu Sangyo University, Rikkyo University, Japan)
Teaching Materials on Calculus as Seen from the Application to Engineering

TSG46: Mathematical Competitions and Other Challenging Activities

Chair: Boris Koichu (Weizmann Institute of Science, Israel)
Co–chair: Peter Taylor (University of Canberra, Australia)
Team members: Sergey Dorichenko (Moscow Center for Teachers Excellence, Russia), Ingrid Semanišinová (Pavol Jozef Šafárik University in Košice, Slovakia), Yijun Yao (Fudan University, China)
IPC Liaison Person: Ivan Yashchenko (Russia)

Session I

July 13, 19:30–21:00 **Location: W101**

19:30–19:45 **Boris Koichu** (Weizmann Institute of Science, Israel)
A Short Overview of the History of TSG46 and Introductions of the Participants

19:45–20:30 **Maria Falk de Losada** (Universidad Antonio Nariño, Bogotá, Colombia)
What Competitions Can Tell Us about Theories in Mathematics Education

20:30–20:45 **Ingrid Semanišinová**, Ľubomír Antoni, Stanislav Krajči, Daniela Víťazková (Pavol Jozef Šafárik University in Košice, Slovakia)
How to Identify Multiple Solution Tasks for Mathematical Competitions

20:45–21:00 **Hoyun Cho** (Capital University, Columbus, Ohio, USA)
Challenging Math Tasks for Teaching through Problem Solving Approach

Session II

July 16, 21:30–23:00 **Location: W101**

21:30–22:15 **Roza Leikin** (University of Haifa, Israel)
Unravelling the Construct of Mathematical Challenge Based on Conceptual Characteristics of Mathematical Tasks

22:15–22:30 **Reut Parasha**, Boris Koichu, Michal Tabach (Weizmann Institute of Science, Israel)
A Challenge of Deciding Who Is Right and Why

22:30–22:45 **Elisabeth Roan**, Jenifer Czocher (Texas State University, USA)
Students' Expected Gains from a Modeling Competition

22:45–23:00 **Rosa Antonia Thomas Ferreira** (University of Porto & CMUP, Portugal)
Math Trails: Opportunities to Learn Rich Mathematics outside the Classroom

Session III

July 17, 14:30–16:30 **Location: W101**

14:30–15:15 **Kiril Bankov** (University of Sofia, FMI, Bulgaria)
Cutting a Polygon: From Mathematics Competition Problems to Mathematical Discovery

15:15–15:30 **Yijie He**, Tianqi Lin (East China Normal University and Shanghai Key Laboratory of Pure Mathematics and Mathematical Practice, China)
An Introduction of Shanghai Grade 11 Mathematics Competition

15:30–15:45 **Eszter Bora** (Eötvös Loránd University, Budapest, Hungary)
POSA Weekend–camps: A Challenging Mathematical Environment for the Highly Gifted in Hungary

15:45–16:00 **Valorie Lynn Zonnefeld**, Ryan Glenn Zonnefeld (Dordt University, Iowa, USA)

TSG

Competitions Promoting the Mathematical Science

16:00–16:30 Boris Koichu[1], Sergei Dorichenko[2] ([1]Weizmann Institute of Science, Israel; [2]Moscow Center for Teachers Excellence, Russia)
Whole–group Discussion of Where We Are in Relation to the Questions Posed in the Call for Papers of TSG46, and with an Eye on the Future Plans

TSG47: Mathematics Education in a Multilingual Environment

Chair: Eva Norén (Stockholm University, Sweden)
Co–chair: Anthony Essien (University of the Witwatersrand, South Africa)
Team members: Nancy Chitera (University of Malawi, Malawi), Mun Yee Lai (University of Technology Sydney, Australia), Alexander Schüler–Meyer (Technical University of Dortmund, Germany)
IPC Liaison Person: Jill Adler (South Africa)

Session I

July 13, 14:30–16:30 **Location: W101**

14:30–14:45 **Welcome to TSG 47, Short Presentation of the Participants**

14:45–15:00 **Hao** (Ateneo de Manila University, Philippines)
Code–switching: Proposing Linguistic Relativity as Lens in Multilingual Mathematics Education Research

15:00–15:15 **Rabih El Mouhayar** (American University of Beirut, Lebanon)
Practices and Functions of Colloquial Arabic Use to Generalize Patterns in Multilingual Classrooms

15:15–16:05 **Katabua** (University of the Witwatersrand, Johannesburg, South Africa)
Localised Instructional Mathematics Application Programmes: Providing Access into Mathematics in Multilingual Classrooms

16:05–16:20 **Paolucci** (University of Florida, USA)
Fostering Mathematics Teacher Development through Experiential Learning in Multilingual Communities

16:20–16:30 **Kimura** (Waseda University, Tokyo, JAPAN)
Study on Difficulties of Math Word Problems in English–international Baccalaureate in Japanese High School

Session II

July 14, 19:30–21:00 **Location: W101**

19:30–20:00 **Uribe**, Prediger (TU Dortmund University, Germany)
Activating Multilingual Resources in a Superdiverse Covariation Classroom – A Design Research Study

20:00–20:10 **Ryan** (Malmö Univ, Sweden)
Non–shared Language Translanguaging in Math Class

20:10–20:25 **Zahner** (San Diego State University, USA)
Examining Equitable Participation and Positioning in Multilingual Classrooms: Tasks, Language(s), and Norms

20:25–20:40 **Robertson** (Rhodes University, South Africa)
The Importance of Students' First Language as a Sense–making Resource in Multilingual Mathematics Classrooms

20:40–20:50 **Tshabalala** (Gauteng department of education, Johannesburg, South Africa)
Exploring the Enablement of Mathematical Proficiency in Grade Four English Second Language Mathematics Classrooms

20:50–21:00 **Baschek** (Justus Liebig University, DE, German)

Webquests in Content and Language Integrated Learning Classes on Primary Level

Session III

July 17, 21:30–23:00 **Location: W101**

21:30–21:55 **Barwell** (University of Ottawa, Canada)
Language Positive Classrooms: An Example

21:55–22:05 **Svensson Källberg** (Malmö University, Sweden)
Implementing Translanguaging as Pedagogy in Mathematics Classrooms a Dilemma

22:05–22:15 **Essien** (University of Witwatersrand, Johannesburg, South Africa)
Towards a Framework for Understanding the Choice and Use of Examples in Teacher Education Multilingual Mathematics Classrooms

22:15–22:30 **Ji Yeong I** (Iowa State University, South Korea)
Impact of an Online Course of Teaching Mathematics to Emergent Bilinguals on Teacher Perspectives

22:30–22:40 **Yee Lai** (University of Technology Sydney, Australia)
Language–related Barriers to Mathematics Learning: An Alternative Diagnosis

22:40–22:50 **Mohamed** (Beni–Suief University, Egypt)
The Problems of Bilingual Mathematical Learners when Using Mathematics in Arabic

22:50–23:00 **Zollman** (Indiana University Southeast, USA)
A Student May Speak with an Accent, but No Student Thinks with an Accent in Mathematics

TSG48: Mathematics Education in a Multicultural Environment

Chair: Florence Glanfield (University of Alberta, Canada)
Co–chair: Anthony Fernandes (The University of North Carolina at Charlotte, USA)
Team members: Qin Jing (Tsinghua International School, China), Peter Kajoro (The Aga Khan University, Tanzania), Annica Andersson (University of Southeastern Norway, Norway)
IPC Liaison Person: Anjum Hailai (Pakistan/Tanzania)

Session I

July 16, 21:30–23:00 **Location: T209**

21:30–21:35 **Welcome to TSG 48 and Overview of Engagement.**
TSG organizers: **Florence Glanfield** (University of Alberta, Canada)

21:35–22:05 **Kathleen Nolan** (University of Regina, Canada)
Conceptualizing a Framework for a New (Disruptive) Form of Culturally Responsive Pedagogy in Mathematics/Teacher Education

22:05–22:25 **Anthony Fernandes** (The University of North Carolina Charlotte, USA)
Preservice Teachers Engaging with Traffic Stop Data to Examine Issues of Bias

22:25–22:45 **Florence Glanfield** (University of Alberta, Canada)
Intersections of Indigenous Knowledge Systems and Mathematics Education

22:45–23:00 **Discussion of the Papers**
TSG Organizers: **Peter Kajoro**[1], Qin Jin[2], Anthony Fernandes[3], Florence Glanfield[4] ([1]Aga Khan University, Institute of Educational Development, East Africa, Tanzania; [2]Tsinghua International School, China; [3]The University of North Carolina at Charlotte, USA; [4]University of Alberta, Canada)

Session II

July 17, 14:30–16:30 **Location: T209**

14:30–14:35 **Welcome to TSG 48 and Overview of Engagement.**
TSG organizers: **Anthony Fernandes** (The University of North Carolina Charlotte, USA)

TSG

14:35–15:05 **Marta Civil[1], Roberta Hunter[2]** ([1]The University of Arizona, USA; [2]Massey University, New Zealand)
Taking a Strengths Based Approach to Learning and Teaching Mathematics

15:05–15:25 **Andreas Ulovec[1], Jarmila Novotná[2]**, Hana Moraová[3] ([1]University of Vienna, Austria; [2]Charles University Prague, Czechoslovakia; [3]Charles University Prague, Czechoslovakia)
Developing Concepts for Mathematics Teaching Units with a Focus on Migrant and Minority Students

15:25–15:45 **Michael Alexander** (University of the Witwatersrand, Johannesburg Wits School of Education, South Africa)
The Use of Dominant Discourse Practices in Secondary Multilingual Mathematics Classrooms: A Comparison of Lessons Given by Two Teachers

15:45–16:30 **Discussion of the Papers**
TSG Organizers: **Qin Jing[1]**, Peter Kajoro[2], Anthony Fernandes[3], Florence Glanfield[4] ([1]Tsinghua International School, China; [2]Aga Khan University (Institute of Educational Development, East Africa), Tanzania; [3]The University of North Carolina at Charlotte, USA; [4]University of Alberta, Canada)

TSG49: Distance Learning, E–learning and Blended Learning of Mathematics

Chair: Marcelo Almeida Bairral (Federal Rural University of Rio de Janeiro, Brazil)
Co–chair: Tracey Muir (University of Tasmania, Australia)
Team members: Veronica Hoyos (Universidad Pedagogica Nacional, Mexico), Xinbing Luo (Shaanxi Normal University, China), Philippe R. Richard (Université de Montréal, Canada)
IPC Liaison person: Thomas Lowrie (Australia)

Session I

July 13, 14:30–16:30 **Location: T124**

14:30–14:45 **Jennifer Rothe** (Universitaet Leipzig, DE, Germany)
Fostering Higher Order Thinking in the Flipped Classroom – An Analysis of Students Proof Schemes

14:50–15:05 **Mustafa Cevikbas**, Gabriele Kaiser (University of Hamburg, Germany)
Student Engagement in a Mathematics Classroom

15:10–15:25 **Cameline Nafula Orlendo** (Maseno University, Kenya)
Delivery of Electronic Assessments in a First Year Basic Mathematics Course at Maseno University, Kenya

15:30–15:45 **Veronica Hoyos**, Estela Navarro, Victor Raggi, Sergio López (National Pedagogical University, Mexico)
Hybrid Environments of Learning: Teacher Efficiency and Potential for Student Learning by Collaboration

15:50–16:30 **Questions/Discussion**

Session II

July 14, 19:30–21:00 **Location: T124**

19:30–19:45 **Rosie Lopez Conde[1]**, Merlyn M. Lingo, Jurdil Faith D. Salas ([1]Philippine Normal University, The Philippines)
Students' Enhancements and Praxeologies on Learning Integer Operations Using GeoGebra

19:45–20:00 **Leicha Bragg**, Chris Walsh, Tracey Muir (Deakin University, Australia)
Transforming Numeracy Professional Development for Pre- and In-service Mathematics Teachers and Families through E-learning

20:05–20:20 **Peter Joseph Esperanza**, Ma Khristin Fabian (Barstow Community College, USA)

Gender Difference in Mathematics Performance: Online vs Face-to-face

20:20–20:35 **Ilya Alexandrovich Posov**, Dmitry Irikovich Mantserov (Saint Petersburg State University, Russia)
Using Free Software to Implement Verification Problems with Parameters

20:40–20:55 **Marcelo A. Bairral**, Alexandre Assis (Federal Rural University of Rio de Janeiro, Brazil)
Designing Tasks to Improve Plane Transformation Using DGE with Touchscreen

Session III

July 17, 14:30–16:30 **Location: T222**

14:30–14:45 **Tracey Muir** (University of Tasmania, Australia)
The Role of the Lecturer in Facilitating Productive Mathematical Conversations in Online Mathematics Pre–service Teacher Education

14:50–15:05 **Heather Allmond Barker**, Karen Hollebrands, Gemma Foust Mojica (North Carolina State University, USA)
Participants Patterns of Interaction within and across Social Networks in a Massive Open Online Course for Educators

15:10–15:25 **Haoyi Wang** (University of Illinois at Urbana Champaign, USA)
A Reflective Practice on an Online Mathematics Class

15:35–16:00 **Dovie Louise Kimmins**, Rongiin Huang (Middle Tennessee State University, USA)
Exploratory Study of Technology Assisted Lesson Study

Session IV

July 17, 21:30–23:00 **Location: T124**

21:30–21:55 **Philippe Richard** (Universite de Montreal, Canada)
Understanding and Creating to Better Understand Instrumental Proofs in Mathematics Class

22:00–22:25 **Stefanie Schallert**, Robert Weinhandl (Johannes Kepler University Linz, Austria)
Case Study on the Change Process of a Mathematics Teacher in an Online Professional Development Course

22:30–22:55 **Niroj Dahal** (Kathmandu University, Nepal)
Workshop Activity in Online Courses of Mathematics Education: Insights for Learning and Assessment

TSG50: Mathematics Education in and for Work; Continuous Mathematics Education including Adult Education

Chair: Lisa Björklund Boistrup (Malmo University, Sweden)
Co–chair: Geoff Wake (University of Nottingham, UK)
Team members: Maria da Conceição Ferreira Reis Fonseca (Universidade Federal de Minas Gerais, Brazil), Pradeep Kumar Misra (Chaudhary Charan Singh University, India),Haixia Si (Hangzhou Normal University, China)
IPC Liaison Person: Gabriele Kaiser (Germany)

TSG

Session I

July 13, 19:30–21:00 **Location: T213**

No.1 **Introduction**

No.2 **Geoff Wake** (University of Nottingham, UK)
Designing for the Learning of Mathematics for Vocational Competence

No.3 **Li Xiaocheng** (Huaibei Normal University, China)
Construction of Mixed Training Model for Rural Mathematics Teachers in Junior Middle School

No.4 **Trude Sundtjønn** (Oslo Metropolitan University, Norway)

Sociomathematical Norms in Vocational Mathematics Education

No.5 **Lauro Chagas e Sá**[1], Guilherme Guilhermino Neto[2], Maria Auxiliadora Vilela Paiva ([1]Instituto Federal do Espirito Santo, Brazil; [2]Ifes, Vila Velha, Brazil)
Infographics about the World of Work: An Experience with Students of Vocational Education Integrated to High School (poster)

No.6 **Joint Discussion on Considerations in Designing for Me in and for Work**

Session II

July 16, 21:30–23:00 **Location: T213**

No.1 **Introduction**

No.2 **Lisa Björklund Boistrup** (Malmo University, Sweden)
Investigating Interfaces between Mathematics and Vocational Content: Logos and Praxis in Education

No.3 **Maria da Conceicao Ferreira Reis Foncesca**[1], Valdenice Leitão da Silva[2] ([1]Universidade Federal de Minas Gerais, Brazil; [2]Secretaria da Educacao de Pernambuco, Brazil)
"Here We Are the Boss": Numeracy Practices as Resistance Tactics of Clothing Factory Workers in Brazilian Northeast

No.4 **Joint Discussion on the Role of Theory**

Session III

July 17, 14:30–16:30 **Location: T213**

No.1 **Introduction**

No.2 **Linda Marie Ahl**[1], Lars Ola Helenius[2] ([1]Kriminalvrden, Sweden; [2]University of Gothenburg, Sweden)
Adults' Proportional Reasoning in a Volume Scaling Situation

No.3 **Javier Diez–Palomar**[1], Kees Hoogland[2], Isabelle Demonty[3] ([1]University of Barcelona, Spain; [2]HU University of Applied Sciences Utrecht, Netherlands; [3]Université de Liège, Belgium)
Re–thinking the Assessment of Adults' Numeracy Skills: New Challenges, New Responses

No.4 **Pradeep Kumar Misra** (Chauhary Charan Singh University, India)
Moocs for Lifelong Mathematics Learning of Adults in India: Promises and Strategies

No.5 **Joint Discussion on How to Support the Learning of Mathematics by Adults**

No.6 **Discussion on a Possible Post–publication from TSG50**

TSG51: Mathematics Education for Ethnic Minorities

Chair: Aldo Parra (Aalborg University in Denmark, Colombia)

Co–Chair: Robin Averill (Victoria University of Wellington, New Zealand)

Team members: Aditya Adiredja (University of Arizona, USA), Lianchun Dong (Minzu University of China, China), Nancy Nui (CEMASTEA Nairobi–Kenya, Kenya)

IPC Liaison Person: Marta Civil (USA)

Session I

July 13, 14:30–16:30 **Location: T209**

14:30–14:34 **Opening Words by TSG Team**

14:35–15:05 **John Griffith Tupouniua**, Jodie Hunter (Massey University, New Zealand)
How Does a Teacher Sustain Collective Mathematizing among Non–dominant Students?

15:06–15:25 **Lianchun Dong,** Wei He (Minzu University of China, China)
Chinese Ethnic Minorities Students Performance in Mathematical Problem Posing

15:26–15:45 **Aoxue Su** (Minzu university of china, China)
Study on Influencing Factors of Math Achievements of Ethnic Minority Senior High School Students in Mainland China

15:46–15:55 **Hsueh–Yun Yu**, Huey–Lien Kao, Kuo–Hua Wang (Changhua University of Education, Taiwan, China)
The Implementation of Culturally Responsive Teaching Practices into the Mathematics Course

15:56–16:30 **Round of Debate**

Session II

July 14, 19:30–21:00 **Location: T209**

19:30–20:00 **Chang–Jun Zhou** (Dehong Teachers College, China)
A Case Study on the Application of "Situational Problems" Teaching Model in the Mathematics Education of Ethnic Primary School Students

20:01–20:20 **Mudan Chen**, Ida A.C. Mok (The University of Hong Kong, Hong Kong SAR, China)
Investigation on Teacher Professional Development in Minority Areas: Taking Yao Autonomous County of Liannan, Qingyuan as an Example

20:21–20:30 **Christine Darling Thomas**, Natalie Simone King (Georgia State University, USA)
Renegotiating Recruitment and Retention Efforts: Promoting Teacher Diversity in Mathematics and Science Classrooms

20:31–21:00 **Round of Debate**

Session III

July 17, 21:30–23:00 **Location: T209**

21:30–22:00 **Carolina Tamayo**[1], Aldo Parra[2] ([1]Universidade Federal de Minas Gerais, Brazil; [2]Universidad del Cauca, Colombia)
Rethinking Ethnography in Mathematics Education of Ethnic Minorities

22:01–22:20 Jun Wu, **Jing Ting** (Yunnan Normal University, Kunming, China)
Investigation and Research on Mathematical Culture Accomplishment of Primary School Mathematics Teachers in Ethnic Minority Areas

22:21–22:30 Daniela Cabrera, **Jose David Fonseca**, Gerardo Lopez (University of Arizona, USA)
Preparing the Next Generation of STEM Innovators

22:31–23:00 **Round of Debate**

TSG52: Ethnomathematics and Mathematics Education

Chair: Gelsa Knijnik (Universidade do Vale do Rio dos Sinos, Brazil)
Co–chair: Marcos Cherinda (UNESCO–Maputo, Mozambique, Mozambique)
Team members: Arindam Bose (Tata Institute of Social Sciences, India), Cynthia Nicol (University of British Colombia, Canada), Aihui Peng (Southwest University, China)
IPC Liaison Person: Celi Espasandin Lopes (Brazil)

TSG

Session I

July 13, 19:30–21:00 **Location: T523**

19:30–20:10 **Welcome Intro and Tribute to Ubiratan D'Ambrosio**
TSG Team Members

20:10–20:40 **Arindam Bose** (Tata Institute of Social Sciences (TISS), Mumbai, IN)
Revisiting Ethnomathematics: Another Social Turn?

20:40–21:00 **General Discussion**

Session II

July 16, 21:30–23:00 **Location: T523**

21:30–21:40 **Welcome and Plan for the Day**
TSG Team Members

21:41–21:46 **Aihui Peng** (Faculty of Education, Southwest University, China)
A Framework for Examining the Quality of Mathematics Teaching for Mathematical Understanding in Ethnic Minority Cultural Contexts

21:47–21:52 Daniel Clark Orey, **Milton Rosa** (Universidade Federal de Ouro Preto, Ouro Preto, BR)
Ethnomathematics and Ethnomodelling Research: Glocalizing Educational Systems from Exclusion to Inclusion at Local and Global Levels

21:52–22:02 **Discussion**

22:02–22:07 **Vanessa SenaTomaz**, Ozirlei Teresa Marcilino (Universidade Federal de Minas Gerais, Belo Horizonte, BR)
Ethomathematics as Pedagogical and Political Tool in an Indigenous School Curriculum

22:08–22:13 **Fany Salazar,** Marta Civil (University of Arizona, Tucson, US)
Mexican American Women Talking about Graphs: A Focus on Their Lived Experiences

22:13–22:23 **Discussion**

22:23–22:28 **Ma. Elena Gavarrete,** Milton Rosa, Daniel Clark Orey (Universidad Nacional, Heredia, CR)
Regaining Cultural Signs through Ethnomathematical Descriptors: Artifacts, Sociofacts and Mentifacts

22:29–22:32 **Thomas E Gilsdorf** (Central Michigan University, Mt. Pleasant, US)
Perspectives of Mathematics by Traditional Purhpecha Artists

22:33–22:36 **Maria del Carmen Bonilla** (International Study Group on Ethnomathematics, Lima, PE)
A Study of the Quechua Weaving Elaboration Process and Mathematics Teaching in Basic Education

22:36–22:46 **Discussion**

22:46–22:49 **Toyanath Sharma** (Center for Activity Based instruction, Lalitpur, NP)
Math Trail Activity on Machchhindranath Chariot: Cultural Perspective on Mathematics Education in Nepal

22:50–22:53 **Jaya Bishnu Pradhan** (Tribhuvan University, Mahendra Ratna Campus, Kathmandu, NP)
Ethnomathematical Study on Cultural Artefacts: An Ethnographic Field to Classroom Practice

22:53–22:58 **Discussion**

22:58–23:00 **Wrap–Up**

Session III

July 17, 14:30–16:00 **Location: T523**

14:30–14:35 **Welcome and Plan for the Day**
TSG Team Members

14:35–14:55 **Wilfredo Alangui** (University of the Philippines Baguio, Baguio City, PH)
Coming Together, Research and Desire in the Field of Ethnomathematics

14:55–15:05 **Discussion**

15:05–15:10 **Anthony Benjamin Trinick**, Tamsin Meaney (The University of Auckland, Auckland, NZ)
Waka Migrations: Reclaiming Cultural Traditions and Identity

15:11–15:16 **Fe Reston Janiola** (Holy Name University, Tagbilaran City, PH)
Exploring Mathematics in the Eskaya Tribe: An Ethnolearning Theory

15:16–15:26 **Discussion**

15:26–15:31 **Mega Teguh Budiarto,** Rini Setianingsih, Rudianto Artiono (Universitas Negeri Surabaya, Surabaya, ID)

Ethno–mathematics of Banyuwangi Culture: Bamboo Woven

15:37–15:42 **Georgios Kyriakopoulos** (University of Thessaly, Athens, GR)
Towards Mathematics Curriculum Recontextualisation: Developing a Rhizocurrere with Roma Students

15:42–15:52 **Discussion**

15:52–15:57 **Eirini Lazaridou,** Anna Chronaki (University of Thessaly, Volos, GR)
Mathematics as Venture for Learning and Apprenticeship in a Collective for the Commons

15:58–16:01 **Marc Sauerwein** (University of Bonn, Germany)
An International Class in Germany: The Need for Ethnomathematical Considerations

16:01–16:11 **Discussion**

16:11–16:14 **Solomon Abedom Tesfamicael,** Anne H. Nakken, Tirillo, Peter Grey (Teacher Education Department, NTNU, Kattem, NO)
Ethnomathematics in Ethiopia Using Glocal Approach: The Case of Gebeta Playing

16:15–16:18 **Epsi Deme** (University of port harcourt, Port Harcourt, NG)
Ethnomathematics Constructs of IBO Society in Chinua Achebes "Things Fall Apart"

16:18–16:28 **Discussion**

16:28–16:30 **Wrap–Up**

TSG53: Equity in Mathematics Education

Chair: Jayasree Subramanian (Tata Institute of Social Sciences, India)

Team members: Changgen Pei (Southwest University, China), Darinka Radovic (Universidad de Chile, Chile), Constantinos Xenofontos (University of Stirling, UK)

IPC Liaison Person: Marta Civil (USA)

Session I

July 13, 14:30–16:30 **Location: T222**

14:30–14:35 **Welcome and Introduction by Jayasree Subramanian (Chair)**

14:35–14:47 **Frederick Koon Shing Leung** (The University of Hong Kong, Hong Kong SAR, China)
Education Equity in Hong Kong: Factors that Contribute to Hong Kong Students' Mathematics Performance in Trends in International Mathematics and Science Study (TIMSS) 2015.

14:47–14:55 **Discussion**

14:56–15:08 **Theodore Chao**, Melissa Adams–Corral, Youmna Deiri, Joanne Vakil (The Ohio State University, US)
Critical Mathematics Teacher Noticing: Exploring Pre–service Teachers' Noticing of Power, Privilege, and Identity Using Online Video.

15:08–15:16 **Discussion**

15:17–15:22 Desiree Ippolito, **Weverton Ataide Pinheiro**, Jinqing Liu (Indiana University, BR)
Gender Differences in Student–student Interactions

15:22–15:27 **Itzel H. Armenta** (Tecnologico de Monterrey, MX)
Socioeconomic Differences Delimited by Gender: Students' Perceptions about Mathematics in Mexican Schools.

15:27–15:32 **Chiara Giberti** (University of Bergamo, IT)
Gender Differences on Specific Issue: The Case of Misconceptions in Operating with Percentage

15:32–15:37 **Phil Kane** (The University of Auckland, NZ)
Support for Students with Mathematics Learning Dis/abilities on Bridging Programmes in New Zealand Universities

15:37–15:53 **Discussion**

15:54–15:59 **Ram Krishna Panthi** (Tribhuvan University, Nepal)
Coping with the Challenges while Promoting Social Justice in Mathematics Classroom

15:59–16:04 **Nina Ines Bohlmann**, Ralf Benölken, Timo Dexel (Leipzig University, Leipzig, DE)
Adapting Tasks between Including and Excluding Students.

16:04–16:09 **Anne Cawley**, Max Adam Altman (California State Polytechnic University, US)
Supporting Students at Multiple Levels in Accessing and Succeeding in College Credit Mathematics.

16:09–16:14 Ruthmae Sears, Marilyn Strutchensy, Brian Lawler, Lakesia Dupree, Caree Pinder, **Cynthia Castro–Minnehan** (University of South Florida, BS)
Teacher Candidates Perspectives of Means to Facilitate Equitable Learning Opportunities during a High School Mathematics Methods Course

16:14–16:19 **Ana Carolina Faustino** (Universidade Federal do Mato Grosso do Sul, BR)
Children, Dialogue and Mathematics Education

16:19–16:30 **Discussion**

Session II

July 14, 19:30–21:00 **Location: T222**

19:30–19:32 **Chenggen Pei** (Southwest University, China)
Introduction

19:32–19:57 **Luis Leyva** (Vanderbilt University, Nashville, US)
A Framework for Detailing White, Heteropatriarchy in Mathematics Education

19:57–20:15 **Discussion**

20:18–20:30 **Darinka Radovic** (Universidad de Chile, Santiago, CL)
Disentangled Narratives: Exploring Institutional and Students' Gendered Discourses in an Engineering Faculty.

20:30–20:38 **Discussion**

20:40–20:52 **Weverton Ataide Pinheiro**, Vanessa Franco Neto (Indiana University, Brasilia, BR)
Gender Issues and Consequences for Undergraduate Mathematics Women Students

20:52–21:00 **Discussion**

Session III

July 16, 21:30–23:00 **Location: T222**

21:30–21:32 **Introduction by Constantinos Xenofontos**

21:32–21:57 **Luz Valoyes–Chavez** (CIAE–University of Chile, Santiago, CL)
Cultural Power and the Fabrication of Race Difference in the Mathematics Classroom

21:57–22:15 **Discussion**

22:18–22:30 **Jayasree Subramanian** (SRM University, Amaravati, Andhra Pradesh, India)
History of Whose Mathematics for Teaching: Raising the Caste Question in Mathematics Education in India

22:30–22:38 **Discussion**

22:40–22:52 **Kishorkumar Darak** (Tata Trusts, Pune, India)
From Invisible to Domestic Gender in Mathematics Textbooks in India

22:52–23:00 **Discussion**

Session IV

July 17, 21:30–23:00 **Location: T222**

21:30–21:32 **Introduction by Darinka Radovic**

21:32–21:57 **Charoula Stathopoulou** (University of Thessaly, Volos, Greece)
Challenging the Abyssal Line between Roma and Non–Roma, in and out of the (Mathematics) Classroom, through Common Spaces

21:57–22:15 **Discussion**

22:17–22:28 **Constantinos Xenofontos** (University of Stirling, Stirling, Great Britain)
Teaching Practices in Diverse Mathematics Classrooms of the Republic of Cyprus: Equitable or Not?

22:28–22:36 **Discussion**

22:37–22:49 **Amanda Queiroz Moura** (University of Klagenfurt, Klagenfurt, AT)
Micro–exclusions as a Challenge to Dialogue among Deaf and Hearing Students

22:49–22:57 **Discussion**

22:57–23:00 **Closing Remarks**

TSG54: Social and Political Dimensions of Mathematics Education

Chair: Paola Valero (Stockholm University, Sweden)
Co–chair: Kate Le Roux (University of Cape Town, South Africa)
Team members: Andrew Brantlinger (University of Maryland, USA), Murad Jurdak (American University of Beirut, Lebanon), Xuhui Li (California State University Long Beach, USA)
IPC Liaison Person: Marta Civil (USA)

Session I

July 13, 19:30–21:00 **Location: T323**

19:30–19:40 **Paola Valero**[1], Kate Le Roux[2], Andrew Brantlinger[3], Murad Jurdak[4], Xuhui[5] ([1]Stockholm University, Sweden; [2]University of Cape Town, South Africa; [3]University of Maryland, USA; [4]American University of Beirut, Lebanon; [5]California State University, Long Beach, USA)
Mathematics, Mathematics Education and Research in the New Climatic Regime

19:40–19:45 **Alf Coles** (University of Bristol, United Kingdom)
Mathematics Education and the Anthropocene: Educating in Precarious Times

19:45–19:50 **Paola Valero** (Stockholm University, Sweden)
The Cultural Politics of Mathematics Education in the "New Climatic Regime"

19:50–19:55 **Ayşe Yolcu** (Hacettepe University, Turkey)
Promised 'Land' of Mathematics Education: Towards a Sociomaterial Tracing of Research on Children's Mathematics

19:55–20:00 **Dionysia Pitsili–Chatzi** (University of Ottawa, Canada)
Thinking about Mathematics Education and the Political with Laclau and Mouffe

20:00–20:05 **Dalene Swanson** (University of Stirling, UK)
Critical, Reflexive, Justice–informed Mathematics Education: Troubles of Justice and Decolonial Possibilities

20:05–20:30 **Small Group Discussion**

20:30–21:00 **Plenary Discussion on the Topic of the Panel, and Questions to All Participants**

TSG

Session II

July 16, 21:30–23:00 **Location: T323**

21:30–21:35 **Welcome Back to the Group and the Sessions of the Day**

21:35–21:40 **Shintia Revina**, Goldy Fariz Dharmawan, Florischa Ayu Tresnatri (The SMERU Research Institute, Indonesia)
Within–school Tracking and Mathematics Learning Outcomes: A Case Study in Yogyakarta

21:40–21:45 Natalia Ruiz–López, **José Bosch Betancor** (Autonomous University of Madrid, DICEMA–GICE Research group, Spain)
Teacher Conceptions on Social Justice and Democracy in Mathematical Education

21:45–21:50 **Gustavo Nicolas Bruno**, Natalia Ruiz–López (Autonomous University of Madrid, Spain)
Maths vs. Letters: A Systematic Delirium

21:50–21:55 **Sabrina Bobsin Salazar** (Universidade Federal de Pelotas, Brazil)
Making Mathematical Talk Possible: A Case of Teaching Calculus in Our Contemporary World

21:55–22:00 **Melissa Andrade–Molina** (Pontificia Universidad Católica de Valparaíso, Chile)
Black Holes in Chilean Teachers Training Programs: Mathematics Teacher Practices and Educational Policies

22:00–22:05 **Yasmine Abtahi** (Western Norway University of Applied Science, Norway)
About the Mathematics that We Teach

22:05–22:10 **Dale Aldrinn Pradel**[1], Catherine Vistro–Yu[2] ([1] Xavier School, Philippines; [2] Ateneo de Manila University, Philippines)
Crests and Troughs: The Use of Trigonometric Modeling towards a Critical and Realistic Mathematics Education

22:10–22:30 **Small Group Discussion**

22:30–23:00 **Plenary Discussion on the Topic of the Panel, and Questions to All Participants**

Session III

July 17, 14:30–16:30 **Location: T323**

14:30–14:35 **Welcome Back to the Group and the Sessions of the Day**

14:35–14:40 Effie Manioti[1], Anna Chronaki[1&2], **Eirini Lazaridou**[1] ([1]University of Thessaly, Greece; [2] Malmö University, Sweden)
Mathematics Education, Citizenship and the Commons in Our Global World?

14:40–14:45 **Jian Li**[1], Lili Song[1], Na Tang[2], Zhentian Mao[2], Yueyuan Kang[2], Hong Yan[3], Han Yu[4] ([1] People's Education Press; [2]Tianjin Normal University; [3] Guizhou Normal University; [4] Chifeng Erzhong International Experimental School)
The Presentation of Core Socialist Values in Chinese Junior Middle School Mathematics Textbooks: Based on the Analysis of Five Series of PEP Textbooks

14:45–14:50 **Lisa Jean Darragh** (University of Auckland, New Zealand)
Interrogating the Promise of Online Mathematics Instructional Programs

14:50–14:55 **Mariam Makramalla**, Andreas J. Stylianides (University of Cambridge, United Kingdom)
Contextual Barriers to the Integration of Problem Solving in the Egyptian Mathematics Classroom

14:55–15:00 **Daniela Steflitsch** (Alpen–Adria University Klagenfurt, Austria)
Teaching Critical Mathematics: Obstacles from the Teacher's Perspective

15:00–15:05 **Anita Rampal** (University of Delhi, India)
The Globalisation of Testing and Learning Outcomes

15:05–15:10 **Satoshi Kusaka** (Hiroshima University, Japan)
Transition of Mozambique's Primary Mathematics Intended Curriculum in Post–colonial Period: A Focus on Adaptation from Exogenous Curriculum

15:10–15:15 **Kate le Roux** (University of Cape Town, South Africa)
A Southern Perspective on Sociopolitical Mathematics Education Research in the New Climatic Regime

15:15–15:40 **Small Group Discussion**

15:40–16:00 **Kate le Roux**[1], **Paola Valero**[2] ([1]University of Cape Town, South Africa; [2]Stockholm University, Denmark)
Gathering General Points from the Sessions and Connecting Back to the Theme of the Topic Study Group

16:00–16:30 **Final General Discussion**

TSG55: The History of the Teaching and the Learning of Mathematics

Chair: Wagner Rodrigues Valente (Universidade Federal de São Paulo, Brazil)
Co–chair: Alexander Karp (Teachers College, Columbia University, USA)
Team members: Toya Frank (George Mason University, USA), Chunlan Li (Inner Mongolia Normal University, China), Naomichi Makinae (University of Tsukuba, Japan)
IPC Liaison Person: Daniel Chazan (USA)

Session I

July 13, 14:30–16:30 **Location: T319**

14:30–14:40 **Opening**
Alexander Karp (Teachers College, Columbia University, USA)

14:40–14:55 **Vasily Busev**, Alexander Karp (Mathematical institute, Russian Academy of Sciences, Russia; Teachers College, Columbia University, USA)
Pafnuty Chebyshev as a Mathematics Educator

14:55–15:10 **Dirk De Bock** (KU Leuven, Belgium)
Frédérique Papy–Lenger, the Mother of Modern Mathematics in Belgium

15:10–15:20 **Ildar Safuanov** (Moscow City University, Russia)
The History of Mathematics Education of Tatar Nation

15:20–15:30 **María José Madrid**[1], Carmen León–Mantero[2], Alexander Maz–Machado[2] ([1]Universidad Pontificia de Salamanca, Spain; [2]Universidad de Córdoba, Spain)
Mathematics and Mathematics Education in the 18th Century Spanish Journal "Semanario De Salamanca"

15:30–15:45 **José Manuel Matos** (Universidade Federal de Juiz de Fora, Brasil and Universidade Nova de Lisboa, Portugal)
Interweaving Past and Present — Historical Research in the Field of Mathematics Education

15:45–16:00 **Karolina Karpińska** (Institute for the History of Science Polish Academy of Sciences, Poland)
Gnomonics in Mathematics Secondary School Education on the Territories of Poland in the 17th–20th Century

16:00–16:15 **Antonio M. Oller–Marcén** (Centro Universitario de la Defensa de Zaragoza, Spain)
The Beginning of Modern Mathematics in Spanish Primary Education. A Look through Textbooks and Curriculum

16:15–16:30 **Shinnosuke Narita**[1], Naomichi Makinae[2], Kei Kataoka[3] ([1]Tokyo Gakugei University, Japan; [2]University of Tsukuba, Japan; [3]Kwansei Gakuin University, Japan)
Approach of an Early–1940s Japanese Secondary Mathematics Textbook to Teaching the Fundamental Theorem of Calculus

Session II

July 14, 19:30–21:00 **Location: T319**

19:30–19:45 **Maja Cindrić** (University of Zadar, Department of Teacher and Preschool Teacher Education, Croatia)
Arithmetic Textbooks in Croatia in the Premodern Period

19:45–19:55 Bernardo Gómez–Alfonso[1], **María Santágueda–Villanueva**[2] ([1]Universitat de València

(UVEG), Spain; [2]Universitat Jaume I, Spain)
Missing Arithmetic Methods: "On the Rules for the Mixing of Analogous Things"

19:55–20:10 **Pilar Olivares–Carrillo**, Dolores Carrillo–Gallego (University of Murcia, Spain)
The Calculation in the First Commercialized Decroly's Games

20:10–20:20 **Yoshihisa Tanaka[1]**, Eiji Sato[2], Nobuaki Tanaka[3] ([1]Hirosaki University, Japan; [2]Meiji University, Japan; [3]Mie University, Japan)
Mathematical Activities Focusing on Japanese Elementary Arithmetic and Secondary Mathematics Textbooks in the Early 1940s

20:20–20:30 **Zhang Hong** (Sichuan Normal University, China)
Development History and Course Setting of Mathematics Department in Early Universities in Sichuan Province in Modern Times (1896–1937)

20:30–20:45 **Li Wei Jun** (Inner Mongolia Normal University, China)
A Probe into Compiling Mathematics Textbooks by Christian Missionaries in Late Qing Dynasty

20:45–21:00 **Discussion**

Session III

July 17, 21:30–23:00 **Location: T319**

21:30–21:45 **Sian E. Zelbo** (The Brearley School, New York; Stern College for Women, New York, USA)
Building an American Mathematical Community from the Ground Up: Artemas Martin and the Mathematical Visitor

21:45–22:00 **Elisabete Zardo Búrigo** (Universidade Federal do Rio Grande do Sul, Brazil)
The Discarding of the Rule of Three in the 1960s: Changes in Elementary Education in France and Brazil

22:00–22:15 **Yana Shvartsberg** (Pace University, USA)
Mathematics Education for Young Women During Progressive Era: Historical Overview

22:15–22:30 **Alexei Volkov[1]**, Viktor Freiman[2] ([1]Taiwan Tsing–Hua University, Taiwan, China; [2]Université de Moncton, Canada)
David Eugene Smith (1860–1944) and His Work on Mathematics Education

22:30–22:45 **Alexander Karp** (Teachers College, Columbia University, USA)
College Entrance Exams in Mathematics in Russia before the Second World War: Development, Role, Objectives

22:40–23:00 **Discussion and Closing Remarks**
Alexander Karp (Teachers College, Columbia University, USA)

TSG56: Philosophy of Mathematics and Mathematics Education

TSG

Chair: Bronislaw Czarnocha (The City University of New York, USA)
Co–chair: Maria Aparecida Viggiani Bicudo (Universidade Estadual Paulista "Júlio de Mesquista Filho", Brazil)
Team members: Piotr Blaszczyk (Pedagogical University of Cracow, Poland), Gang Peng (Guangxi Normal University, China)
IPC Liaison Person: Abraham Arcavi (Israel)

Session I

July 13, 19:30–21:00 **Location: W203**

19:30–19:50 **Introduction**

19:50–20:20 **Ole Skovsmose** (Universidade Estadual Paulista (UNESP), Brazil)
Mathematics and Ethics

20:20–20:30 **Discussion**

20:30–20:40 **Min Bahadur Shrestha** (Tribhuvan University, Nepal)
Philosophy, Rigor and Axiomatics in Mathematics: Intimately Related or Imposed?

20:40–20:50 **Yenealem Ayalew** (Dire Dawa University, Ethiopia)
Imagination in the Philosophy of Mathematics and Its Implication for Mathematics Education

20:50–21:00 **Discussion**

Session II

July 16, 21:30–23:00 **Location: W203**

21:30–21:45 Regina D. Möller[1], **Peter Collignon[2]** ([1]Humboldt University of Berlin, Germany; [2]University of Erfurt, Germany)
Towards a Philosophy of Algorithms as an Element of Mathematics Education

21:45–21:55 **Mitsuru Matsushima** (Kagawa University, Japan)
Appropriation Mediates between Social and Individual Aspects of Mathematics Education

21:55–22:05 **Nadia Kennedy** (CUNY, NYC, USA)
Philosophical Inquiry for Critical Mathematics Education

22:05–22:15 **Discussion**

22:15–22:30 **Theodore Savich** (Indiana University, USA)
Towards Critical Mathematics

22:30–22:40 **Thomas Ricks** (Louisiana State University, USA)
Recognizing Mathematical Anthropocentrism

22:40–22:50 **YanYaqiang**, XueSuyue, MaJunfeng (Soochow University, China)
Curriculum System of the Philosophy of Mathematics Education for Normal Students

22:50–23:00 **Discussion**

Session III

July 17, 14:30–16:30 **Location: W203**

14:30–14:45 **Maria Bicudo[1]**, Verilda Speridião Kluth[2] ([1]São Paulo State University, Rio Claro Campus, São Paulo, Brazil; [2]Federal University of Sao Paulo, São Paulo, Brazil)
Research Procedures to Understand Algebraic Structures: Hermeneutic Approach.

14:45–15:00 **David Kolosche** (University of Klagenfurt, Austria)
2+2=4? Mathematics Lost between Two Pitfalls of Essentialism and Alternative Truths

15:00–15:15 **Bronislaw Czarnocha** (Hostos Community College, CUNY, NYC, USA)
Does Constructivism Tell Us How to Teach?

15:25–15:40 **Karla Sepúlveda Obreque[1]**, Javier Lezama Andalón[2] ([1]Centro de Investigación Escolar y Desarrollo, Catholic University of Temuco, Chile; [2]Instituto Politécnico Nacional, México)
Teachers Epistemology on the Origin of Mathematical Knowledge

15:40–15:55 **Maurício Rosa[1]**, Danyal Farsani[2], Caroline Antunes da Silva[3] ([1]Federal University of Rio Grande do Sul, Brazil; [2]University of Chile, Chile; [3]Federal University of Rio Grande do Sul, Brazil)
Mathematical Education, Body and Digital Games: Play the Ball in This Way So That It Goes, It Goes Further than the Floor

15:55–16:05 **Marli Regina dos Santos** (Federal University of Ouro Preto, Minas Gerais, Brazil)
Internet, Teaching Mathematics: Weaving the Web

16:05–16:30 **Discussion**

TSG

TSG57: Diversity of Theories in Mathematics Education

Chair: Angelika Bikner (University of Bremen, Germany)
Co–chair: Ivy Kidron (LEV Academic Center, Jerusalem College of Technology, Israel)
Team members: Erika Bullock (University of Wisconsin, USA), Yusuke Shinno (Osaka Kyoiku University, Japan), Qinqiong Zhang (Wenzhou University, China)
IPC Liaison Person: Takeshi Miyakawa (Japan)

Session I

July 13, 14:30–16:30 **Location: T128**

14:30–14:40 **Introduction to the TSG57**

14:40–15:10 **Michèle Artigue** (LDAR, Université Paris–Diderot, France)
Facing the Challenge of Theoretical Diversity: The Digital Case

15:10–15:30 **Angelika Bikner–Ahsbahs,** Estela Vallejo–Vargas, Steffen Rohde (Bremen University, Faculty of Mathematics, Germany)
Role of Feedback When Learning with an Artifact

15:30–15:50 **Ivy Kidron** (Jerusalem College of Technology, Jerusalem, Israel)
Constructing Mathematical Knowledge by Means of Analogy: Connecting Fischbein's Theory on the Role of Intuition in Mathematics and the Theory of Abstraction in Context

15:50–16:00 **Marcel Klinger** (University of Duisburg–Essen, Germany)
A Theoretical Framework for Students' Conceptual Understanding in the Early Calculus Classroom

16:00–16:20 **Yusuke Shinno**, Tatsuya Mizoguchi (Hiroshima University, Japan; Tottori University, Japan)
Seeking a 'THEORY' of Networking Praxeologies in Mathematics Education: A Meta–theoretical Discussion

16:20–16:30 **Final discussion of Session 1**

Session II

July 14, 19:30–21:00 **Location: T128**

19:30–19:40 **Introduction**

19:40–20:00 **Arthur Bakker**[1], William R. Penuel[2] ([1]Utrecht University, the Netherlands; [2]University of Colorado, USA)
Networking Theories and Methodology: Identifying Argumentative Grammars in Design Research

20:00–20:20 **Ulises Salinas–Hernández**[12], Luis Moreno–Armella[2], Isaias Miranda[3] ([1]ENS de Lyon, France; [2]Cinvestav IPN, Mexico, Cinvestav IPN, Mexico; [3]IPN–CICATA, Legaria)
Configuration of the Theoretical–methodological Construct «The Teaching Model» by Affinity between Theories

20:20–20:30 **Jessica Lajos**, Sepideh Stewart (University of Oklahoma, USA)
Mathematical Intuition in Formal Proof Construction: Developing an Approach to Theoretical Research

20:30–20:40 **ShiQi Lu**, Wenbin Xu (Nanjing Normal University, China)
The Holistic Instructional Design Model of the Unit Knowledge Structure of Elementary School Mathematics Based on Core Competencies

20:40–20:50 **Anna Shvarts**, Arthur Bakker (Utrecht University, the Netherlands)
Vertical Analysis as a Strategy of Theoretical Work: From Philosophical Roots to Instrumental and Embodied Branches

20:50–21:00 **Final discussion of Session 2**

Session III

July 17, 21:30–23:00 **Location: T128**

21:30–21:40 **Introduction**

21:40–22:00 **Luis Radford** (Laurentian University, Ontario, Canada)
Mathematics Teaching and Learning as an Ethical Event

22:00–22:10 **Tatsuya Mizoguchi[1]**, Yusuke Shinno[2], Toru Hayata[3] ([1]Tottori University, Japan; [2]Hiroshima University, Japan; [3]Naruto University of Education, Japan)
How Can We Classify Teachers' Paradidactic Praxeologies in Different Institutional Settings?

22:10–22:20 **Sun Young Ban** (Merritt College, USA)
The Effect of Pedagogical Knowledge on Mathematics Anxiety in Developmental Mathematics Course

22:20–22:30 **Lena Lindenskov** (Danish School of Education, Aarhus University, Denmark)
Theoretical Networking in a Large–scale Danish and a Large–scale Norwegian Intervention Study: TMTM and PBG

22:30–23:00 **Final Discussion:**
Ethical Issues in the Use of Theories in Mathematics Education, in Design Research and the Diversity of Theories Relating to Technology.

TSG58: Empirical Methods and Methodologies in Mathematics Education

Chair: Christine Knipping (The University of Bremen, Germany)
Co–chair: Soo Jin Lee (Korea National University of Education, Korea)
Team members: Christian Bokhove (University of Southampton, UK), Bagele Chilisa (University of Botswana, Botswana), Na Li (Central China Normal University, China)
IPC Liaison Person: Yufeng Guo (China)

Session I

July 13, 19:30–21:00 **Location: T128**

19:30–19:50 **Christine Knipping[1]**, Soo Jin Lee[2] ([1]University of Bremen, Germany; [2]Korea National University of Education, Korea)
Introduction to TSG 58

19:50–20:20 **Zhenzhen Miao[1]**, David Reynolds[2], Christian Bokhove[3] ([1]Jiangxi Normal University, China; [2]Swansea University, UK; [3]University of Southampton, UK)
First Voyage of the Integrated Paradigm: The Case of an International Study on Effective Mathematics Teaching

20:20–20:35 **Na Li[1]**, Ida Ah Chee Mok[2] ([1]Central China Normal University, China; [2]The University of Hong Kong, Hong Kong SAR, China)
The Teaching of Mathematical Thinking: The Conceptualization of a Special Class Teacher in China

20:35–20:50 **Fan Weiyuan** (Jiading No.1 High School, Shanghai, China)
Teaching Design of Combination from HPM Perspective

20:50–21:00 **Christine Knipping[1]**, Soo Jin Lee[2] ([1]University of Bremen, Germany; [2]Korea National University of Education, Korea)
Summarizing Discussion

TSG

Session II

July 16, 21:30–23:00 **Location: T128**

21:30–22:00 **Ann–Kristin Adleff**[1], Natalie Ross[1], Gabriele Kaiser[1], Johannes König[2], Sigrid Blömeke[3] ([1]University of Hamburg, Germany; [2]University of Cologne, Germany; [3]University of Oslo, Norway)
Understanding the Relations between Instructional Quality and Task Quality in Mathematics Classrooms

22:00–22:15 Ying Zhou, Xiaofeng Lan, **Tommy Tanu Wijaya** (Guangxi Normal University, China)
What Is Six–questions Cognitive Model?

22:15–22:30 **Soo Jin LEE**, Jaehong SHIN (Korea National University of Education, Korea)
Units Coordination as a Theoretical Construct to Understand Students Mathematical Activities

22:30–22:45 **Zhenrong Xiong**, Ying Zhang, Bo Li, Na Li (Central China Normal University, China)
The Influence of ICT on the Students' Science Literacy at the National and Student Level Based on ITU IDI Index and PISA2015

22:45–22:50 **Try Kimhor** (National Institute of Education, Phnom Penh, Cambodia)
Poster Presentation I: The Effectiveness of Teaching Mathematics in Circle Equation by Using 5E Instructional Model in Inquiry-based Learning

22:50–22:55 Lin Yi, **Tommy Tanu Wijaya**, Zhou Ying (Guangxi Normal University, Guilin, China)
Poster Presentation II: The Trend of Mathematics Teaching Method Has Changed from Fragments to Systematics

22:55–23:00 **Christine Knipping**[1], Soo Jin Lee[2] ([1]University of Bremen, Germany; [2]Korea National University of Education, Korea)
Summarizing Discussion

Session III

July 17, 14:30–16:30 **Location: T128**

14:30–15:00 **Markku S. Hannula**[1], Enrique Garcia Moreno–Esteva[1], Miika Toivanen[2] ([1]University of Helsinki, Finland; [2]SeeTrue Technologies, Finland)
Eye Movements and Collaborative Problem Solving: What Do Long Fixations Tell about Student Cognition?

15:00–15:15 **Ann Sophie Stuhlmann** (Universität Hamburg, Germany)
Examining the Phenomenon of Interlocutors Talking past Each Other in Collaborative Proof Constructions

15:15–15:30 Christine Knipping[1], **Soo Jin Lee**[2] ([1]University of Bremen, Germany; [2]Korea National University of Education, Korea)
Summarizing Discussion

15:30–15:45 **Christian Bokhove**[1], Jasperina Brouwer[2], Chris Downey[1] ([1]University of Southampton, UK; [2]University of Groningen, The Netherlands)
Using MRGQAP to Analyse the Development of Mathematics Pre–service Trainees' Communication Networks

15:45–16:00 **Lei Wang**, Yong Zhang, Na Li, Bo Li (Central China Normal University, China)
Case Study of Personalized Teaching Based on the Q-learning Algorithm in the Era of Big Data

16:00–16:15 **Man Ching Esther Chan**, David Clarke (Melbourne Graduate School of Education, The University of Melbourne, Australia)
Learning Research in a Laboratory Classroom: Advancing Methodology and Technology

16:15–16:30 Christine Knipping[1], **Soo Jin Lee**[2] ([1]University of Bremen, Germany; [2]Korea National University of Education, Korea)
Summarizing Discussion

TSG59: Mathematics and Creativity

Chair: Chronis Kynigos (University of Athens, Greece)
Co–chair: Roza Leikin (Haifa Uiversity, Israel)
Team members: Thorsten Fritzlar (Martin Luther University, Germany), Theodosia Prodromou (University of New England, Australia), Hongyu Su (South China Normal University, China)
IPC Liaison Person: Thomas Lowrie (Australia)

Session I

July 13, 14:30–16:30 **Location: T519**

14:30–14:40 **Roza Leikin** (Haifa Uiversity, Israel)
Introduction: Different Faces of Creativity: On the Program and Participants of the TSG–59 ICME–14

14:40–14:55 **Chronis Kynigos** (University of Athens, Greece)
Opening: Individual vs Social Perspectives of Mathematical Creativity

Collaborative Creativity:

14:55–15:05 **Malgorzata Aneta Marciniak** (City University of New York, Long Island City, US)
Fostering Creativity in a Diverse Classroom of a Community College

15:05–15:15 **M. Alicia Venegas–Thayer** (Pontificia Universidad Catolica de Valparaiso, Valparaiso, Chile)
Collaborative Creation between University Students from Mathematics and Music

15:15–15:25 **Erik Ottar Jensen** (Aalborg University, Virum, Denmark)
Understanding Students Everyday Play Experiences when Designing Games in the Mathematics Classroom

15:25–15:35 Dimitris Diamantidis, **Chronis Kynigos** (National and Kapodistrian University of Athens, Athens, Greece)
Creative Design of Digital Tools for Teaching in a Mathematics' Teachers' Community

15:35–15:45 **Irina Lyublinskaya**[1], Marta Cadral[2] ([1]Teachers College, Columbia University, New York, US [2]CUNY College of Staten Island, US)
Creative Art Processes to Deepen Geometrical Thinking of Middle School Mathematics Teachers

15:45–15:55 **Jeffrey J Wanko** (Miami University, Oxford, US)
Beyond Sudoku: Creating a Course for Developing Deductive and Creative Skills

15:55–16:05 Chronis Kynigos, **Dimitris Diamantidis** (National and Kapodistrian University of Athens, Athens, Greece)
Social Creativity in a Constructionist Classroom Context

16:05–16:30 **Discussion**

Session II

July 14, 19:30–21:00 **Location: T519**

Round table 1: Cognitive Perspective of Creativity (Chair: Kynigos)

19:30–19:37 **Jiali Xing**[1]**,** Qiaoping Zhang[2], Xuanzhu Jin[3] ([1]Zhejiang New Thought Educational Science Academy, Hangzhou, China; [2]The Education University of Hong Kong, Hong Kong SAR, China; [3]The Education University of Hong Kong, Hong Kong SAR, China)
Exploring Primary Students' Creativity in Hands–on Mathematical Activities

19:37–19:44 **Shin Watanabe** (The Mathematics Certification Institute of Japan, Japan)
A Leap from in School to out School – Possibility is Creativity Development

19:44–19:51 **Aditya P. Adiredja**[1], Michelle Zandieh[2] ([1]The University of Arizona, US; [2] Arizona State University, Polytechnic Campus, US)
Creativity in Linear Algebra through Interactions

19:51–19:58 **Mariia Pavlova**[1], Maria Shabanova[2] ([1]Northern (Arctic) Federal University, Arkhangelsk, Russia; [2]Moscow Center of the Development of Human Resources for Education, Russia)
Students Make Interactive Exhibition "Experimental Mathematics" for the Museum of Entertaining Sciences

TSG

Round Table 2: Creativity in the World (Chair: Leikin)

19:58–20:05 **Lady Angela Mico Rocena**[1], Ma. Nympha B. Joaquin[1], Manabu Sumida[2], Naomichi Yoshimira[2] ([1]University of the Philippines, Quezon City, Philippines; [2]Ehime University, Japan)
Mathematical Creativity of Filipino and Japanese Students: A Comparative Study

20:05–20:12 **Yi Chu,** Haiyue Jin (Nanjing Normal University, Nanjing, China)
An Exploration into Chinese High School Students' Consciousness of Enquiring and Innovation

20:12–20:19 **Deborah Sarah Sutch**, Helen Thomas (International Baccalaureate Organization, Den Haag, Netherlands)
Promoting Creativity in the International Baccalaureate Diploma Programme Mathematics

20:19–20:26 **Anzhi Wang** (Beijing Normal University, China)
Establishment of Evaluation Index System for Primary School Students' Mathematical Innovation Competency: Investigation and Analysis Based on Delphi Method

20:26–20:33 **Valentina Gogovska** (University "Ss. Cyril and Methodius", Institute of Mathematics, 1000 Skopje, N. Macedonia)
Brain Exercises for Improving Math Creativity and Physical Health

20:33–21:00 **Discussion**

Session III

July 17, 14:30–16:30 **Location: T132**

14:30–14:55 Invited Lecture: Speaker and Title to Be Announced

Cognitive Abilities and Development of Creativity (Session chair: Kynigos)

14:55–15:05 **Theodosia Prodromou**[1], Chronis Kynigos[2] ([1]University of New England, Armidale, Australia; [2]National and Kapodistrian University of Athens, Greece)
Designing Games to Foster Creativity Thinking about Randomness

15:05–15:15 **Svenja Bruhn** (Bielefeld University, Germany)
Creativity Varies from Task to Task, Doesn't It? – A Qualitative View on First Graders' Individual Creativity

15:15–15:25 **Torsten Fritzlar**, Karin Richter (University of Halle–Wittenberg, Germany)
"Rethinking the World" with Mathematics: The Geometric Chess from Bauhaus as a Basis for Creating Mathematical Ideas and Materials

15:25–15:35 **Daniela Assmus**, Torsten Fritzlar (Martin Luther University of Halle–Wittenberg, Germany)
Inventing Growing Patterns by Primary School Students – A Creativity Provoking Task

15:35–15:45 **Anastasia Datsogianni**[1], Pantelitsa Eleftheriou[3], Nektaria Panagi–Louka[2], Athanasios Gagatsis[2] ([1]University of Munich (LMU), Munich, Germany; [2]University of Cyprus, Cyprus; [3]Cyprus Ministry of Education and Culture, Cyprus)
The Relation between Spatial Ability and Creativity in Geometry in Primary School

15:45–15:55 **Bruce Stuart Ferrington** (Radford College, Canberra, Australia)
How Long is Half a Piece of String? – The Journey Continues

15:55–16:05 Haim Elgrably, **Roza Leikin** (University of Haifa, Haifa, Israel)
Strategy–related and Outcome–related Mathematical Creativity in All as Compared to That in Gifted

16:05–16:30 **Discussion**

Session IV

July 17, 21:30–23:00 **Location: T519**

Round Table 3: Collaborative and Interactive Creativity (Chair: Prodromou)

21:30–21:37 **Motshidisi Gertrude van Wyk** (Central University of Technology, Free State, South Africa)
A Survey of Mathematics Teachers' Perceptions on Mathematically Gifted Learners in Thaba Nchu Primary Schools in South Africa

21:37–21:44 **Hanna Zdziarska Slabikowska** (University South–Estern Norway, Solbergmoen, Norway)

Inquiry Dialogues in Mathematics Classroom and Mathematical Representations and Their Role in Learning Mathematics

21:44–21:51 **Matheus Delaine Teixeira Zanetti**[1], Mateus G. Fonseca[12], Cleyton H. Gontijo[1] ([1]University of Brasilia, Brasilia, Brazil; [2]Federal Institute of Brasilia, Brazil)
Mathematical Creativity Workshop to Review Elements of Geometry with High School Students

21:51–21:58 **Nataly Essonnier**[1], Mohamed El–Demerdash[2], Jana Trgalová[3] ([1]University of Geneva, Switzerland; [2]Menoufia University, Egypt; [3]University of Lyon, France)
Comparing Social Creativity among Designers with Creativity of Mathematical Digital Resources Produced

21:58–22:05 **Ayman Eleyan Aljarrah**, Jo Towers (Acadia University, Wolfville, Canada; University of Calgary, Canada)
Expanding Possibilities: A Metaphor for the Co–construction of Students' Creative Acts

22:05–22:12 **Hye–Yun Jung**, Kyeong–Hwa Lee (Sejong Science High School, Korea; Seoul National University, Korea)
Developing Mathematical Group Creativity through Mathematical Modelling

Round Table 4: Evaluation of Creativity (Chair: Fritzlar)

22:12–22:19 **Emili Cilli–Turner**[1], Miloš Savić[2], Gail Tang[1] ([1]University of La Verne, US; [2]University of Oklahoma, US)
Sources of Evolution of University Students Views on Mathematical Creativity

22:19–22:26 **Mateus Gianni Fonseca[1]**, Cleyton H. Gontijo[2] ([1]Federal Institute of Education, Science and Technology of Brasilia, Brazil; [2]University of Brasilia, Brazil)
Mathematical Creativity Workshops to High School Brazilian Students and Their Effects on Motivation and Performance in Mathematics

22:26–22:33 **Noriko Tanaka** (Asahigaoka Senior High School, Japan)
Research Problems and Assessment by Students

22:33–22:55 **Discussion**

22:55–23:00 **Closing: Summary and Future Plans**
Chronis Kynigos (University of Athens, Greece)

TSG60: Semiotics in Mathematics Education

Chair: Ricardo Nemirovsky (Manchester Metropolitan University, UK)
Co–chair: Christina Krause (University of Duisburg–Essen, Germany)
Team members: Suanrong Chen (Yangzhou University, China), Francesca Ferrara (University of Turin, Italy), Kazuya Kageyama (Hiroshima University, Japan)
IPC Liaison Person: Faïza Chellougui (Tunisia)

TSG

Session I

July 13, 19:30–21:00 **Location: T205**
Embodied Aspects, Gestures / Movement, Technology

19:30–19:45 **Introduction**

19:45–20:00 **Candace Walkington[1]**, Min Wang[1], Mitchell Nathan[2] ([1]Southern Methodist University, USA; [2]University of Wisconsin–Madison, USA)
Collaborative Gestures among Secondary Students Conjointly Proving Geometric Conjectures

20:00–20:15 **Kazuma Kageyama**, Masataka Koyama (Hiroshima University, Japan)
Conceptualization of Co–emergent Curriculum in a Mathematics Lesson

20:15–20:30 **Laurie D. Edwards** (Saint Mary's College of California, USA)

Proof, Conditionals and Gesture

20:30–20:45 **Giulia Ferrari**, Francesca Ferrara (Università degli Studi di Torino, Italy)
Can a Movement Notation Be a Mathematical Notation?

Session II

July 16, 21:30–23:00 **Location: T205**

Language, Meaning Making, Social Factors

21:30–21:45 **Introduction**

21:45–22:00 **Hiroaki Hamanaka**, Masayoshi Yoshikawa, Hisae Kato, Mitsunobu Kawauchi (Hyogo University of Teacher Education, Japan)
Semiotic Character and Issues in the Learning and Teaching of Linear Functions in Japan: The Influence of Terminology

22:00–22:15 **Christina M. Krause**[1], Annika M. Wille[2] ([1]University of California Berkeley, USA / University of DuisburgEssen, Germany; [2]Universität Klagenfurt, Austria)
A Semiotic Lens on Learning Math in Sign Languages

22:15–22:30 **Hamide Dogan** (University of Texas at El Paso, USA)
Semiotic Chaining in Linear Algebra

22:30–22:45 **Andrea Maffia**, Mirko Maracci (University of Pavia, Italy)
Interference between Artifacts in Semiotic Chains

Session III

July 17, 14:30–16:30 **Location: T205**

Christina Krause, Ricardo Nemirovsky, Tam Dibley
Workshop: Semiotics and Abstraction: Exploring Potential Relationships by Means of Two Cases of Mono Printing and Sign Languages

14:30–15:00 **General Discussion of the Papers Presented and Transition towards the Workshop**

TSG61: International Cooperation in Mathematics Education

Chair: Uihock Cheah (Methodist Council of Education, Malaysia)

Co–Chair: Masami Isoda (University of Tsukuba, Japan)

Team members: Bernadette Denys (Paris Descartes University, France), Jiwei Han (Northeast Normal University, China), Arne Jakobsen (University of Stavanger, Norway)

IPC Liaison Person: Thomas Lowrie (Australia)

TSG

Session I

July 13, 14:30–16:30 **Location: W111**

14:30–14:35 **Welcome and Introduction**

14:35–14:47 **Maitree Inprasitha**[1]; Masami Isoda[2] ([1]Khon Kaen University, Thailand; [2]University of Tsukuba, Japan)
Adapting Lesson Study in Thailand through International Cooperation

14:47–14:59 **Kim Hong Teh**[1], Masami Isoda[2] ([1]SEAMEO RECSAM, Malaysia; [2]University of Tsukuba, Japan)
An Experience in Developing the Regional Mathematics Curriculum Standards

14:59–15:11 **Russasmita Sri Padmi**[1], Gabriel Matney[2] ([1]SEAMEO QITEP in Mathematics, Yogyakarta, Indonesia; [2]Bowling Green State University, Ohio, USA)

Fostering Global Citizenship in Mathematics Classrooms

15:11–15:26 **Discussion**

15:26–15:38 **Ileen Palan**[1], Steven Tandale[1], Gandhi Lavaki[1], Masami Isoda[2], Satoshi Kusaka[3], Akinori Ito[4] ([1]Department of Education, Papua New Guinea; [2]CRICED, University of Tsukuba, Japan; [3]Hiroshima University, Japan; [4]Waseda University, Japan)
Development of the National Mathematics Textbook in Primary Schools in Papua New Guinea

15:38–15:50 **Lambas**[1], Masami Isoda[2], Wahyudi[3] ([1]Center for Curriculum and Instruction, Republic of Indonesia); [2]CRICED, University of Tsukuba, Japan; [3]SEAMEO, Bangkok, Thailand)
The Challenges of Improving Mathematics Education through Translated Textbook

15:50–16:02 **Wahid Yunianto**[1], Uki Rahmawati[1], Masami Isoda[2] ([1]SEAMEO QITEP in Mathematics, Indonesia; [2]University of Tsukuba, Japan)
Developing Mathematical Thinking through Robot Programming

16:02–16:14 **James Musyoka**[1], Michael Obiero[1], David Stern[2], Danny Parsons[2] ([1]Maseno University, Kenya; [2]IDEMS International, UK)
An Electronic Assessment Workshop for 1st & 2nd Year Mathematics & Statistics Course Lecturers from East African Universities

16:14–16:30 **Discussion**

Session II

July 14, 19:30–21:00 **Location: W111**

19:30–19:34 **Welcome and Introduction**

19:34–19:47 **Ui Hock Cheah**[1]; Masami Isoda[2] ([1]Penang Math Platform, Malaysia; [2] University of Tsukuba, Japan)
Understanding Narratives: A Pathway towards Resolving Issues and Challenges in International Cooperation in Mathematics Education

19:47–20:00 **Masami Isoda**[1], Maitree Inprasitha[2], Roberto Araya[3], Sofian Tajul Arus[4] ([1]University of Tsukuba, Japan; [2]Khon Kaen University, Thailand; [3]University of Chile, Chile; [4]Ministry of Education, Malaysia)
APEC Lesson Study Project (2006–2018) for Mathematics Education and AI Era Curriculum Project (2019–)

20:00–20:13 **Arne Jakobsen**[1], Mercy Kazima[2] ([1]University of Stavanger, Norway; [2]University of Malawi, Malawi)
Improving Quality and Capacity of Mathematics Education in Malawi through Collaboration – Lessons from a Collaboration between University of Malawi and University of Stavanger

20:13–20:26 **Discussion**

20:26–20:39 **Bernadette Denys**[1], Jannick Trunkenwald[2] ([1]Paris Diderot University, France; [2]French High School, Algiers)
Informal International Collaboration and Its Potentialities: The Example of Grema

20:39–20:52 **Calvin Swai**[1], Joyce Mgombelo[2], Andrew Binde[1], Florence Glanfield[3], Elaine Simmt[3] ([1]University of Dodoma, Tanzania; [2]Brock University, Canada; [3]University of Alberta, Canada)
Capacity Development for Mathematics Teaching in Tanzania: A Follow Up of Impact on Participants

20:52–21:00 **Discussion**

Session III

July 17, 21:30–23:00 **Location: W111**

21:30–21:43 **Norihiro Nishikata** (Japan International Cooperation Agency, Japan)
How El Salvador Improved Student Learning Achievement in Mathematics? A Principle Methodology of JICA toward Achieving SDGS 4

21:43–21:56 **Takashi Itoh**[1], Isamu Imahori[2], Koji Takahashi[2] ([1]Gunma University, Japan; [2]PADECO Co., Ltd., Japan)
The Development of Mathematics Textbooks in Myanmar: Under the Create Project

TSG

21:56–22:09 **Raimundo Olfos**, Soledad Estrella (Pontifical Catholic University of Valparaíso, Institute of Mathematics, Chile)
Impact of APEC Lesson Study Project (2006–2018) in Chile

22:09–22:22 **Elsa Santaolalla Pascual**, Belén M. Urosa Sanz, Olga Martín Carrasquilla (Universidad Pontificia Comillas, Spain)
Guatematics in Action. A Service Learning Project for Mathematics Education between Spanish Preservice Teachers and Teachers from Rural Schools in Guatemala

22:22–22:39 **Discussion**

22:39–23:00 **Wrap–up of TSG 61: The way forward**

TSG62: Popularization of Mathematics

Chair: Christian Mercat (Université Lyon 1, France)
Co–chair: Clara Grima (Universidad de Sevilla, Spain)
Team members: Pan Liu (East China Normal University, China), Abolfazl Rafiepour (Shahid Bahonar University of Kerman, Iran), Patrick Vennebush (University of Maryland, College Park, USA)
IPC Liaison Person: Abraham Arcavi (Israel)

Session I

July 13, 19:30–21:00 **Location: T206**

19:30–19:50 **Maria Shabanova**[1], Mariia Pavlova[2] ([1]Northern (Arctic) Federal University M. V. Lomonosov; [2]Moscow Center for Educational Quality, Russia)
Students Make Interactive Exhibition Experimental Mathematics for the Museum of Entertaining Sciences

19:50–20:10 Iwan Gurjanow[1], **Joerg Zender**[2], Matthias Ludwig[1] ([1]Goethe University Frankfurt; [2]University of Applied Science Rhein Main, Germany)
Mathcitymap – Popularizing Mathematics around the Globe with Maths Trails and Smartphone

20:10–20:30 **Abdu Mohammed Seid**[1], Yismaw Abera Wassie[1], Danny Parsons[2], Haile Yideg[1], Assaye Walelign[1] ([1]Bahir Dar University, Ethiopia; [2]IDEMS International, Ethiopia)
Beyond the Classroom and Curriculum: The Annual Maths Camp at Bahir Dar University, Ethiopia 2013 – 2019

20:30–20:40 Rose Mbewe, Sue Ellen Richardson, **Lili Zhou** (Purdue University, USA)
Reconsidering the M in STEM: Leaders Conceptions of Mathematics to Empower Girls in GEMS Clubs

Session II

July 16, 21:30–23:00 **Location: T206**

21:30–21:50 **Lynn Liao Hodge**[1], Shande King[2], Qintong Hu[2] ([1]University of Tennessee, USA; [2]Shandong University of Science and Technology, China)
Creating Access to Engaged Views of Mathematics and Teaching through Informal Learning Spaces

21:50–22:00 **Manmohan Kaur** (Benedictine University, Chicago, USA)
Increasing Math Appreciation Using the Upper Levels of Blooms Taxonomy

22:00–22:20 **Violeta Vasilevska** (Utah Valley University, USA)
Math + Origami + Puzzles + Magic –> The Odds Are Always in Favor of Fun

Session III

July 17, 14:30–16:30 **Location: T206**

14:30–14:40 Junfeng Ma, **Yaqiang Yan** (School of Mathematical Sciences, Soochow University, China)
Some Suggestions on School–based Curriculum Construction of Mathematics Culture for Middle School

14:40–15:00 **Xinyu Liu**, Pan Liu, Jiachen Zou (East China Normal University, China)
Mathematical Drama: A New Form of Popularization of Mathematics at East China Normal University, China, 2012 – 2019

15:00–15:20 **Abolfazl Rafiepour** (Shahid Bahonar University of Kerman, Iran)
Mutual Role of Mathematics and Culture

15:20–15:40 Elham Ebrahim Zadeh, Hasan Hoseinpoor, **Einollah Shokrpourrodbari**, Younes Karimi Fardinpour (Islamic Azad University, Ahar, Iran)
Keeping Popularization of Mathematics on Track: Formative Assessment

15:40–16:00 **Younes Karimi Fardinpour**[1], Akram Bagheri Gheibi[2], Fahimeh Kolahdouz[2] ([1]Islamic Azad University, Iran; [2]Farhangian University, Esfhan, Iran)
On the Impact of Popularization Oriented Assessment: Creating Excitement

TSG

July 17, 13:00–14:00
July 18, 13:30–14:30
Location: G1
For online participants, please go to https://www.icme14.org/static/en/news/102.html?v=1625134718511
*It is possible that some groups do not have posters

TSG 1 Mathematics Education at Preschool Level

Xiujie Yang (School of Psychology, China)
Visual Processing Matters in Chinese Early Mathematics and Reading Acquisition

Dan Kang (Hunan Normal University, China)
Impact of Preschool Children's Spatial Skill on Their Block Building Construction Level-Mediating Role of Spatial Language

TSG 2 Mathematics Education at Tertiary Level

Maria Sergeevna Artyukhina (National Research Lobachevsky State University, Russian Federation)
Interactive Teaching of Mathematics for Humanitarian Students

Janine Hechter (University of Pretoria, South Africa)
The Relationship between Conceptual and Procedural Knowledge

Sarah Dorothy Castle (Michigan State University, USA)
Constructing Confidence: A Student's Perspective on Groupwork

Claudio Fuentealba (Universidad Austral de Chile, Chile)
Errors and Difficulties in the Resolution of Tasks on the Basic Calculus Concepts

Seyed Hadi Afzali Borujeni (Bu-Ali Sina University, Iran)
Meaning of Good Mathematics Teaching from the University Students Point of View

Ciriaco Taroma Ragual (Mariano Marcos State University, The Philippines)
College Readiness in Mathematics of Senior High School Graduating Students in Schools District of Paoay, Ilocos Norte, Philippines

Ling Li (Shaoxing University, China)
The Instructional Design of College Mathematics Curriculum

Chao Dong Chen (Sichuan University, China)
Study on the Influence of Class Size on the Teaching Effect of College Mathematics

TSG 3 Mathematics Education for Gifted Students

Marianne Nolte (Faculty of Education, Germany)
Questions about Identifying Students with High Mathematical Potential

Philipp Guillaume Girard (WWU Muenster, Germany)
'LemaS' - A Joint Initiative of Germanys Federal Government and Germanys Federal States to Foster High-Achieving and Potentially Gifted Pupils

Patricia Edith Guillen Aparicio (Universidad De San Martn De Porres, Peru)
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

Mirela Vinerean Bernhoff (Karlstad University, Sweden)
University Students Self-evaluation: Digital Solutions for Identifying Highly Motivated Students

Chan Xiangrui (Northeast Yucai School, China)
Discovering and Educating the Gifted Students with Excellent Problems

Hideyo Makishita (Shibaura Institute of Technology, Japan)
Study of Construction by Quadratic Curve Addition Method

Yuwen Li (Mathematical Research Institute, Dezhou College, China)
Experimental Study on Intellectual Development in Elementary School Students

Yanchun Liu (Dezhou No.2 Experimental Primary School, China)
Mathematical Culture and Teaching of Equation

TSG 4 Mathematics Education for Students with Special Needs

Dake Zhang (Rutgers University, USA)
Effects of Number Line Experiences on Students Negative Number Arithmetic Performance in Students with Varying Ability Levels

Kehinde Emmanuel Adenegan (Adeyemi College of Education, Nigeria)
Mathematics Education for Students with Special Needs: A Special Focus on Autism and Dysgraphia

Liljana Vasilevska (Gorgi Sugarev Primary school, Republic of Macedonia (FYROM))
Two Case Studies of Primary Students with Special Needs

Irina Aryal (The Celebration Co-Ed, School, Nepal)
An Initiation to Improve the Mathematics of the Slow Learning Students

Fernanda Malinosky Coelho da Rosa (Mato Grosso do Sul Federal University, Brazil)
The Formation of the Teacher Who Teaches Mathematics: Reflections and Challenges of Special Education in Brazil

Laura Delgado-Martin (University of Salamanca, Spain)
Teach Math through Manipulative Materials to Students with Autism Spectrum Disorder

TSG 5 Teaching and Learning of Number and Arithmetic

Neila Tonin Agranionih (Universidade Federal Do Parana, Brazil)
Third Grade Elementary School Children's Resolution of Involving Fractions

Miguel Diaz (Universidad Pedagogica Nacional, Mexico)
Elementary Teacher's Understanding Mathematics in Mexico. Rate of Change

Tionge Weddington Saka (Malawi Institute of Education, Malawi)
The Teaching and Learning of Number in Early Grade Classes in Malawi

Shuyuan Yu (The Ohio State University, Usa)
Fraction Frequency in the Wild Helps Fraction Estimation

Maria T. Sanz (Universidad De Valencia, Spain)
A Teaching Model to Solve Additive Word Problems

Maria Leticia Rodriguez Gonzalez (Cinvestav-Ipn, Cinvestav-Ipn)
A Von Neumann-based Teaching Model to Observe the Difficulties of Learning Natural Numbers with Students 6-7 Years Old

Katsunori Matsuoka(Naragakuen University, Japan)
Development of "Theory-dependent Teaching" in Math Education

TSG 6 Teaching and Learning of Algebra at Primary Level

Carlos Nicolas Gomez Marchant (Clemson University, USA)
Elementary Students Strategies for Extending A Growth Pattern

Yoshiki Nisawa (Bukkyo University, Japan)
Research to Improve Education Guidelines for Promoting Children's Understanding of Mathematical Functions

Adam Ross Scharfenberger (The Ohio State University, USA)
Elementary Patterning Problems: The Case of Miles TSG 6 Teaching and Learning of Algebra at Primary Level

TSG 7 Teaching and Learning of Algebra at Secondary Level

Teck Hock Gan (Seameo Recsam, Malaysia)
Making Sense of Algebraic Expression through Inquiry

Zachary Anthony Stepp (University of Florida, USA)
The Impact of an Online Learning Platform in Algebra

TSG 9 Teaching and Learning of Geometry at Secondary Level

Luis Carlos Vargas Zambrano (Center for Research and Advanced Studies of NPI, Mexico)
Conics: An Epistemological and Historical Study about Their Geometrization

Emmanuel Nti-Asante (University of Cape Coast, Ghana)
"Geome-tree": PSMTS Working with Tree Trunks to Understand Circle Theorems

Maiko Sawada (Gunma University, Japan)
Effect of Drawing Solid Figures Based on Parallel Projection

Preety Tripathi (State University of New York at Oswego, USA)
Using Deductive Logic Embedded in Straightedge-and-compass Constructions to Promote Preservice Teachers Cognitive Skills

Hak Ping Tam (Taiwan Normal University, Taiwan, China)
Potential Conceptual Barriers to Junior High School Students in Learning Knot Theory

Mohammad Bahrami (University of Texas, United States)
Using Origami to Improve Spatial Thinking in a Rural Area of Tehran

Shen Xinyuan (Shaoxing University, China)
A Comparative Study on High School Mathematics Textbooks between Pep Edition and IBDP Edition: A Case-based Analysis on Vector

Minjie Chen (Junior High School Affiliated Nanjing Normal University, China)
Promoting Students Deep Learning by Focusing on Problems Design: An Explorative Study

Zingiswa Mybert Jojo (University of South Africa, South Africa)
Instructional Design in the Teaching of Geometry: Mathematics Teachers Reflections

TSG 10 Teaching and Learning of Measurement

Lanjie Sun (Dongshahu Primary School of SIP, China)
An Explorative Study of Using Picture Books to Support Students Learning of Measurement in Primary Education

TSG 11 Teaching and Learning of Probability

Beatriz Adriana Rodriguez Gonzalez (Universidad Politecnica de Zacatecas, Mexico)
Use of The Empirical Rule in the Course of Probability: An Application Proposed by Students

Praveen Kumar Tripathi (Banasthali Vidyapith, Rajasthan, India, India)
Understanding of Probability

TSG 12 Teaching and Learning of Statistics

Ida Kukliansky (Ruppin Academic Center, Israel)
Ogive's Interpretation by College Students

PO

Maren Hattebuhr (Karlsruhe Institute of Technology (KIT), Germany)
Does Climate Change Really Exist? High School Students Discover Statistical Methods by Solving a Modeling Problem
Hiroto Fukuda (Okayama University of Science, Japan)
Do Students in Grade 10 Generate Ideas of Statistical Hypothesis Testing Spontaneously?

Gregory Eugene Chamblee, Ha Ngoc Nguyen (Georgia Southern University, USA)
Preservice Teachers' Conceptual Understanding of Mean and Median: Findings from a K-8 Statistics Course

Miguel Andres Diaz Osorio (Universidad Antonio Narino, Colombia)
Model Proposal to Promote the Construction of the Strong Meaning of Volatility

Enriqueta Deguit Reston (University of San Carlos, The Philippines)
Improving Statistical Pedagogy among K to 12 Mathematics Teachers in the Philippines

Teresita Evelina Teran (National University of Rosario, Argentina)
Analysis of the Most Frequent Errors in Practical Works on Tables and Graphs in Biostatistics

Yuqi Li (Beihua University, China)
Comparing the Statistical Content of Elementary School Mathematics Textbooks from Japan, India and China

Zhemin Zhu (Beihua University, China)
Comparing the Statistical Content of Elementary School Mathematics Textbooks from Japan, India, the United States, Singapore and China

Naoki Ohta (Fukuyama City University, Japan)
Aspects of Critical Thinking in Statistical Education-research Survey on Sixth-grade Elementary School

TSG 13 Teaching and Learning of Calculus

Marcela Ferrari (Universidad Autonoma de Guerrero, Mexico)
A Study of Logarithmic Covariation in Polar Coordinates: The Case of Logarithmic Spiral

Lok Bahadur Basnet (Nepal Open University, Nepal)
Use of Sine and Cosine Curves in Local Maxima and Minima

Pheary Cheng (Single, Cambodia)
Increasing the Effectiveness in Studying Mathematics through Educational Game

PO

Roque Aquino Batulan (Higher Colleges of Technology, Abu Dhabi, UAE, The Philippines)
Integrating TPACK Framework in Teaching and Learning of Calculus at the Tertiary Level

Jocelyn Noelle Rios (University of Arizona, USA)
The Teaching Methods of Calculus Recitation Leaders

Sakamoto. Kenji Sakamoto/Kenji (Seitoku University, Japan)
Intuitive Understanding of Infinite Geometric Series Convergence Values for Student Support

Xuefen Gao (Science School Zhejiang Sci-tech University, China)
The Activity Design and Effect of Flipped Classroom in Teaching Calculus

Tonghao Zhang (Liaoning Normal University, China)
Research on Function Teaching Design of High School Based on STEAM Education Concept

TSG 14 Teaching and Learning of Programming and Algorithms

Allyson Hallman-Thrasher (Ohio University, USA)
Engaging Prospective Teachers and Students in Programming Activities

Yevgeny Gayev (National Aviation University, Kyiv, Ukraine, Ukraine)
MATLAB as a Tool for Experimental Mathematics

TSG 15 Teaching and Learning of Discrete Mathematics

Anton Chukhnov (Saint-Petersburg Electrotechnical University, Russian Federation)
Alternative Options for Introducing of Discrete Mathematics Ideas into the School Education: Olympiads and Tools

Mickael Da Ronch (University of Grenoble, Ukraine)
Learning of the Scientific Approach at University: The Case of Research Situations from Problems of Discrete Mathematics

TSG 16 Reasoning, Argumentation and Proof in Mathematics Education

Betul Barut (Anadolu University, Turkey)
The Last Decade of Proportional Reasoning: A Systematic Review

Masanori Obayashi (Hyogo University of Teacher Education, Japan)
The Transient Stages of Inductive and Deductive Reasoning

Joyati Debnath (Winona State University, USA)
The Game of Proof That Works in Foundation of Mathematics Course

Jeffrey David Pair (California State University Long Beach, USA)
Perceptions of the Two-column Proof

Flavia Marcatto (Universidade Federal de Itajuba, Brazil)
Developing the Mathematic Reasoning Capacity of Future Teachers in Brazilian Teaching Initiation Programs

Heng Limalin (New Generation Pedagogy Center, Cambodia)
The Effective of Emplimenting High-order Thinking in Teaching Mathematics: Case in Hun Sen KPC Secondary School

TSG 17 Problem Posing and Solving in Mathematics Education

Nicolina Antonia Malara (Fim Depatment University of Modena 6 Reggio Emilia, Italy)
Innovations about the Teaching of Verbal Problems: The Intertwining of Problem Solving and Problem Posing

Kristina Bulkova (Constantine The Philosopher University in Nitra, Slovakia)
Identification of Crucial Skills in Solving Complex Problem in Probability within the Mathematical Contest in Teams

Joanna Mamona-Downs (University of Patras, Greece)
Instances of Problem Posing

Angelina Matinde Bijura (Inspire Secondary School, Tanzania)
When Problem Posing Challenges Problem Solving: A Case of One Secondary School in Kibaha, Tanzania

Muhui Li (East China Normal University, China)
Students' Mathematical Problem Posing Ability in China: From History to Reality

Nielce Meneguelo Lobo Da Costa (Universidade Anhanguera De Sao Paulo, Brazil)
Functions and Interplays between Different Settings in Problem Solving

Yanhui Xu (Wenzhou University, China)
How Do Teachers Pose Problems by Transformations in Classroom from Proof to Investigation

Sicheng Xie (East China Normal University, China)
The Effect of the Use of Concept-Mapping on Students Problem-posing Ability: An Exploratory Study

Li Meijuan (Beijing Academy of Educational Sciences, China)
The Effect of Teaching Strategies on Mathematical Problem Solving: A Longitudinal Experimental Study

Yeliz Gunal Aggul (Bogazici University, Turkey)
Eliciting the Metaphors for Problem-solving: A Critical Review of Mathematical Problem-solving Research

Adriano Alves Da Silveira (UEPB, Brazil)
Problem Posing and Combinatory Analysis: Classroom Vignettes

Mingyu Su (Tianjin Normal University, China)
The Change of Student Identity: From Problem Solver to Problem Proposer

TSG 18 Students' Identity, Motivation and Attitudes towards Mathematics and Its Study

Pauline Wong Wing Man Kohlhoff (University of Technology Sydney)
Applying the Theory of Planned Behaviour to 2012 Australian PISA data

Tomoaki Shinobu (Sakata First Junior High School, Japan)
A Case Study of Mathematical Research Presentation in a Public Junior High School; Focus on the Relationship of Assumption of Others and the Quality of Learning

Huiyan Ye (East China Normal University, China)
Case Study: Children's Attitudes Development to Mathematics between Formal and Informal Mathematics Learning

Jingjing Liang (Hunan Normal University, China)
Effect of Mathematics Anxiety on Probabilistic Reasoning among Junior Middle School Students: A Moderated Mediation Model

Meng GUO (The University of Hong Kong, Hong Kong SAR, China)
Classroom Goal Structures, Chinese Students Goal Orientations and Mathematics Achievement

Zhi-Cheng (Yen-Ting) Chen (Department of Mathematics Education, Taiwan, China)
The Action Research of 'Math Table Game' in Teaching and Learning

TSG 19 Mathematical Literacy, Numeracy and Competency in Mathematics Education

PO

Qiuchan Li (Guangwai Meizhou Experimental School, China)
A Survey on Primary School Mathematics Teachers Conceptions of Mathematics Core Literacy in the Context of Chinese Curriculum Reform

TSG 20 Learning and Cognition in Mathematics (Including the Learning Sciences)

Yuka Oyama (Shimane University Japan, Japan)
Research on the State of Interaction in the Formation of the Concept of Quantity Fraction in Elementary Mathematics

TSG 21 Neuroscience and mathematics education / Cognitive Science

Daniela Escobar Magarino (Havana University, China)
Training the Number Sense through "The Number Race" in Preschoolers and School-aged Cuban Children

Li Wang (Peoples Education Press, China)
Relation between Approximate Number System Acuity and Mathematical Achievement: The Influence of Fluency

TSG 22 Mathematical Applications and Modelling in Mathematics Education

Sanskar Dhakal (SOS Hermann Gmeiner School, Madhyapur Thimi, Nepal)
STEAM Project: Engagement in Higher Secondary Level

Tomas Nakakuwa (Rhodes University, Namibia)
Using GeoGebra as a Dynamic Mathematics Software Tool for Mathematical Modelling in School Mathematics

Jeannette Galleguillos (Universidad de Valparaiso, Chile)
Modeling Activities in the Primary School: Healthy Eating and Awareness of the Garbage Produced

Anju Saini (Graphic Era (Deemed to be University), India)
Mathematical Modelling in Mathematics Education

Gaston Perez (Fa. M. A. F, Argentina)
Future Mathematics Teachers Engaged in Mathematical Modeling Process: Models, Challenges and Learning

Roque Aquino Batulan (Higher Colleges of Technology, Abu Dhabi Mens Coll, The Philippines)
Modeling and Computing of World Population

Hao Chen (East China Normal University, China)
China as a Beginner in Teaching and Learning Mathematical Modelling in Elementary Education

TSG 23 Visualization in the Teaching and Learning of Mathematics

Abongile Happy Ngwabe (Rhodes University, South Africa)
Exploring How Geogebra Software Can Be Used as a Visual Mediator between Preservice Teachers Mathematical Pedagogical Content Knowledge and Their Teaching Practice

Tadashi Nomachi (Tsuda University, Japan)
Enjoyable Lessons

Lemmy Kangwa (Chalimbana University, Zambia)
The Incorporation of GeoGebra as a Visualisation tool to teach Calculus in Teacher Education Institutions: The Zambian Case

Zsuzsanna Dardai (Poly-Universe Ltd, India)
PUSE (Poly-universe in School Education) Methodology - Visual Experience Based Mathematics Education 2019

Toshimasa USUI (Ishibashi High School, Japan)
Concrete Models for Promoting Students Understanding of High School Mathematics

Shereen Abd El Halim El Bedewy (Johannes Kepler University Linz, Egypt)
Physical and Digital Transformation Using Augmented Reality and 3D Printing

Maria Elisa Galvao (Universidade de Sao Paulo, Brazil)
Revisiting Perspective Techniques in a Dynamical Environment For High School Students

Zhiqiang Yuan (Hunan Normal University, China)
A Study on Improving Preservice Mathematics Teachers Knowledge of Technology-integrated Instructional Representation through GeoGebra Summer Camp

Wanqiu Tang (Hunan Normal University, China)
Mathematics Learning Visualization: Embodied Cognition Theory or Socio-cultural Theory?

Meiling Zheng (Hunan Normal University, China)
The Influence of Graphic Representation on Bayesian Reasoning for Junior Middle School Students: The Role of Problem Context and Space Ability

PO

Jonatan Muzangwa (Great Zimbabwe University, Zimbabwe)
A Mixed Methods Case Study Exploring Visual Thinking in Proving Theorems in Mathematical Analysis. The Case of Mean Value Theorem for Derivatives.

TSG 24 The Role and the Use of Technology in the Teaching and Learning of Mathematics at Primary Level

Juei-Hsin Wang (National Chiayi University, Taiwan, China)
The Case Study of Math Remedial Teaching Policy and Technology Application in Elementary School

Heather Sherwood (Education Development Center, USA)
Building Computational Thinking (CT) Readiness: A Self-assessment Framework and Tools for Integrating CT in Primary Math Classrooms

Oi-Lam Ng (The Chinese University of Hong Kong, Hong Kong SAR, China)
The Integration of Programming into Mathematics Education: A Pilot Study on Problem Solving through Digital Making

An-Sheng Jhang (Stoneware Technology, Taiwan, China)
GOBOT: A Flexible and Tangible Programming Instrument for Early Mathematical Education

Qian Liu (University of Cambridge, China)
Exploring the Use of Digital Platforms in Supporting Dialogue in Primary Mathematics Classrooms

TSG 25 The Role and the Use of Technology in the Teaching and Learning of Mathematics at Lower Secondary Level

Hoi Kei Melody Wong (Good Hope School, Hong Kong SAR, China)
Students Mathematics Experience of the Technology Self-directed Learning (TSDL) Pedagogy

Satoru Sakanashi (Tokyo Metropolitan Minato Municipal Odaiba Gakuen Koyo Junior High School, Japan)
Possibilities and Potentiality of Teaching-materials Cooperation of a Function Which Are Taught in an Elementary School and a Junior High School

Simon Plangg (Pdagogische Hochschule Salzburg, Austria)
A Pedagogical-constructionistic Approach to Mathematical Ideas with Digital Expressive Media

Alejandro Miguel Rosas Mendoza (Instituto Politecnico Nacional, Mexico)
Technology in Classroom: A Report of 3 Researches

Simon Barlovits (Goethe University Frankfurt, Germany)
The MathCityMap App: Improving Students Motivation

Carlos Eduardo Leon (La Gran Colombia University, Colombia)
The Mathema Kids Research Seed: A GeoGebra Youth Club That Tells Stories

Santosh Paudel (Adarsha Secondary School, Layaku Thimi Bhaktapur, Nepal)
Role of ICT To Enhance Mathematics Teaching

Erin Herz (University of Witwatersrand, South Africa)
Perspectives on the Use of ICT in the High School Mathematics Classrooms

Siller Hans-Stefan (Faculty of Mathematics and Computer Science, Germany)
EVA: An Educational Tool to Simulate Evacuations of Buildings

Meiling Zheng (Instituto Federal Do Piaui, Brazil)
Application of GeoGebra in the Function Study: The Use of ICT in Teaching Mathematics

TSG 26 The Role and the Use of Technology in the Teaching and Learning of Mathematics at Upper Secondary Level

Hua Wu (Liaoning Normal University, China)
The Study of Mathematic Classroom Teaching Integrated Information Technology and Mathematic Multi-representations

Paul Georges Igodt (KU Leuven, Belgium)
A Blended Approach to Support Aspiring Engineering Students

Na Han (Liaoning Normal University, China)
The Study of Mathematical Multi-representations and Teaching Scaffolding in the Smart-classroom Environment

My-Lhassan Riouch (Education Minister-Inspector Training, Morocco)
Integration of ICT in Modeling and Experimentation of Interdisciplinary Problems

Daysi Julissa Garcia Cuellar (Pontifical Catholic University of Peru (IREM-PUCP), Peru)
Instrumentation of the Symbolic Artifact Quadratic Function

Xue Huang (Northeast Yucai School, China)
Application of GeoGebra Based on AR/VR Technology in High School Solid Geometry Teaching

Gerald Cristobal Apostol (Central Luzon State University / Department of Science and Technology / FEU Institute of Technology, Nepal)
Students Self-regulated Learning Strategies, Perceptions and Mathematics Performance in a Mobile Technology-integrated Mathematics Classroom

Leangsim Im (National Institute of Education, Cambodia)
The Effective Strategies of Teaching Trigonometry Function Using ICT Applications: GeoGebra and Wolfram

Xiayan Shao (Shanghai JIn Yuan High School, China)
Practical Research on the Application of Information Technology in Function Reviewing Lectures

Huishi YE (Foshan Foreign Language School, China)
A Case Study on TPACK Performance of Chinese Middle School Mathematics Teachers

TSG 27 The Role of the History of Mathematics in Mathematics Education

Deepak Basyal (University of Wisconsin-Milwaukee, Nepal)
Three Books of Mathematical Poetry

Slim Mrabet (Carthage University, Tunisia)
The Development of Thales Theorem throughout History

Ying An (Beijing Normal University, China)
Research on HPM Classroom Teaching Action Oriented by Core Literacy

Mary Flagg (University of St. Thomas, USA)
Using Original Chinese Sources to Teach Gaussian Elimination

TSG 28 Preservice Mathematical Teacher Education at Primary Level

Cristina Cerda Runnalls (California State Polytechnic University, Pomona, USA)
Examining PSTs' Responses to Students' Area and Volume Misconceptions

Laurent Vivier (Universit de Paris, France)
The Measurement of Quantities in the Decimal System for Primary Teacher Training

Yutaka OHARA (Kanto-Gakuin University, Japan)
Using Case Method on Prospective Arithmetic Teachers' View for Social Construction of Mathematics

Heather Howell (Educational Testing Service, USA)
Unnatural Teaching: Simulated Teaching in Teacher Education

Wellington Lima Cedro (Universidade Federal De Goias, Brazil)
Action Sharing and Math Teachers Learning in Groups

Younes Farid Aberkane (University of Cergy-Pontoise, France)
Mathematics and Living Together in Peace in the Classroom, in the Society and across the Borders: Some Examples of Primary Classroom Practices of Preservice Teachers

Azimehsadat Khakbaz (Bu-Ali Sina University, Iran)
The Role of Teachers Mathematical Knowledge in Primary Teacher Education Curriculum in Iran

Penina Adhiambo Kamina (SUNY Oneonta, USA)
Investigation of Preservice Teachers Conceptual Understanding via Creation and Development of Mathematical Kits

Cheng-Yao Lin (Southern Illinois University, USA)
Preservice Teachers Formal and Informal Strategy Use

Beth Anne Lilly Gregory (Graceland University, USA)
Making Math Meaningful for Pre-service Teachers through Collaboration

Roger Evans Howe (Texas A&M University, USA)
Helping Pre-service Teachers to Develop a Structural Perspective in Understanding and Solving Arithmetic Word Problems

Anna Wan (The University of Southern Mississippi, USA)
Integrating Specialized Experiences to Facilitate Preservice Teachers TPACK

Huan Yu (Capital Normal University, China)
A Deep Perspective of Teachers' Distinguish Errors Based on Embolism

Maria Teresa Bixiro Neto (University of Aveiro, Portugal)
Augmented Reality in Outdoor Games as a New Teaching Approach Experienced by Future Teachers in Training

TSG 29 Preservice Mathematical Teacher Education at Secondary Level

Jayaluxmi Naidoo (University of KwaZulu-Natal, South Africa)
Encouraging Student Success: Exploring the Use of Technology Based Pedagogic Strategies within Mathematics Higher Education Milieus.

Tipparat Noparit (Chiang Mai University, Thailand)
Assessment Processes for Summarizing and Connecting Students Ideas in an Open Approach Classroom

Osvaldo Jesus Rojas Velazquez (Universidad Antonio Narino, Colombia)
A Didactic Model to Favor the Positive Use of Error in the Initial Teacher Training

Jennifer Oloff-Lewis (California State University, Chico, USA)
Longitudinal Study of a Co-teaching Residency as a Model of Field Experience for Secondary Preserve Mathematics Teachers

Sheunghyun Yeo (University of Missouri, South Korea)
Difference between Microteaching and Classroom Teaching

Kristi Renea Martin (Sam Houston State University, USA)
Pre-service Teachers Problem Solving in Trigonometry

Xiaofeng Lan (Guangxi Normal University, China)
Common Construction of Pre-service Mathematics Teachers Practical Capacity

Maria Slavickova (Comenius University in Bratislava, Slovakia)
Development of TPACK of Preservice Secondary Mathematics Teachers

Peijie Jiang (East China Normal University, USA)
Online Live Teaching of Mathematics Methodology Course with Tencent Classroom

Hongyu Su (South China Normal University, China)
Developing Pre-service Mathematics Teachers' Lesson Evaluation Skills through Online Lesson Study

TSG 30 In-Service Mathematical Teacher Education and Mathematical Teacher Professional Development at Primary Level

Laura Andrea-Marion Abt (University of Education Schwaebisch Gmuend, Germany)
Online Tutorials in Mathematics Teacher Training

Rumiati Rumiati (PPPPTK Matematika, Indonesia)
Indonesian In-service Primary Teachers Ability to Solve Mathematical Problems

Leonor Santos
Mathematical Reasoning and Teacher Education

Youngyoul Oh (Seoul National University of Education, South Korea)
Rethinking Teachers Professional Development of Mathematics: From the Practical Perspective

Maria Madalena Dullius (Univates, Brazil)
Continuing Education and Integrated School Context to Qualify Mathematic Teaching in Early Years

TSG 31 In-service Mathematical Teacher Education and Mathematical Teacher Professional Development at Secondary Level (Focus on Scaling Up)

Colleen McLean Eddy (University of North Texas, USA)
Model for Scaffolding the Scale Up of a Mathematical Functions Professional Development Program Utilizing Lesson Study

Minji Park (Chonnam National University, South Korea)
A Study on Self-study Practice Activities: Focusing on a Case of First Grade Function Instruction in Middle School

Johann Orn Sigurjonsson (University of Iceland, Iceland)
Improving Quality of Teaching with Video Review Group Sessions

Danyang Li (East China Normal University, China)
Partnerships in Teacher Training through the Lens of Teacher Noticing

Diwash Shakya (Glacier International School and College, Nepal)
Challenges of Managing Mathematics Instruction in Nepal

Lin Miao (Shanghai Hongkou Experimental School, China)
Research on the Training of Mathematical Modeling Teachers from the Perspective of Emergence Generation Theory

Zhigui Duan (Yancheng Teachers University, China)
Professional Development of Novice Mathematics Teachers: Present Situation and Guidance a Case Study of 8 Mathematics Teachers

Wen Yang (Chengdu Qizhong Yucai Middle School Sichuan, China)
Design and Experiment of Research-based Teacher Cultivation Model from the Perspective of Teacher Professional Learning Community

TSG 32 Knowledge in/for Teaching Mathematics at Primary Level

Huey Lei (University of Saint Joseph, Macao SAR, China)
Developing Analytical Models of Pedagogical Content Knowledge: A Case Study of Mathematics Teachers in Macao

Sheila Oyeila Amuko (Kenyatta University, Kenya)
Teacher Knowledge on Students Thinking towards Learning Mathematical Concepts of Area in Primary Schools in Kiambu, County, Ruiru Sub-county.

Yury Marcela Cano Murillo (Secretaria De Educacion De Medellin, Colombia)
Mathematics Curriculum in the Context of Didactic Knowledge: The Case of the Elementary Teacher

Aleksandra Kaplon-Schilis (Durham Academy, USA)
Unpacking Performance Indicators in the TPACK (Technological Pedagogical Content Knowledge) Levels Rubric to Examine Differences in the TPACK Levels for Teaching Mathematics in Primary Schools

TSG 33 Knowledge in/for Teaching Mathematics at Secondary Level

Lay Hoon Goo (Ministry of Education, Singapore, Singapore)
Solving Different Problem Types on Simultaneous Equations

Mihyun Jeon (Indiana University, USA)
The Validation of An Assessment Instrument for Measuring Mathematical Knowledge for Teaching (MKT)

Jenny Patricia Acevedo-Rincon (Universidad del Norte, Colombia)
The Specialized Knowledge of a New Generation of Mathematics Teachers Under STEM Training

Ruifang Zhao (Liaoning Normal University, China)
A Case Study on MPCK of Junior Middle School Mathematics Teachers with Different Characteristics

TSG 34 Affect, Beliefs, and Identity of Mathematics Teachers

Paola del Carmen Quinones (PUCV, Chile)
STEM, a Proposal from an Emerging Interdisciplinary Look in a Relational Dynamics

Steven Kamaluddin Khan (University of Alberta, Canada)
Curating to Promote Flourishing Elementary Pre-service Mathematics Teacher Identities

Juan Gabriel Molina Zavaleta (INSTITUTO POLITECNICO NACIONAL, Mexico)
Beliefs and Conceptions of Math Teachers, and about Math Teachers

Damjan Kobal (University of Ljubljana, FMF, Slovenia)
Acta, Non Verba - Actions, Not Words

Xiayu Zhang (Changzhou College of Information Technology, China)
Compilation of Core Competencies Scale for Vocational College Mathematics Teacher

Xiaonan Han (No.2 Experimental Primary School of NCC, China)
A Study on the Consistency of Primary School Mathematics Teacher Beliefs and Teaching Behaviors

TSG 35 Knowledge and Practice of Mathematics Teacher Educator

Etienne Lautenschlager (Federal University of Rio Grande do Norte (UFRN), Brazil)
Professional Learning Tasks to Discuss the Quadrilateral: Mobilization of Specialized Knowledge of Teachers Who Teach Mathematics in the Early Years

Anette Maria de Ron (Stockholm University, Sweden)
How Is Problem Solving Understood in Teacher Education?

TSG 36 Research on Classroom Practice at Primary Level

Manabu SATO (Akita University, Japan)
Model Plates That Support Developmental Thinking and Attitudes

Gabrielle Bernal (University of Michigan, USA)
Supporting Collective Perseverance Through Teaching Practices And Communication Patterns

Umida Baltaeva (Khorezm Mamun academy, Uzbekistan)
Increasing the Efficiency of the Lessons by Using Interactive Methods in Primary School Math Classes

Bo Yu (Chengdong Primary School of Xiaoshan, China)
"Problem posing" Makes Learning Really Occur - Taking the Teaching of "Moving More and Supplement Less" as an Example

Yan Chen (South China Normal University, China)
Re-Construction of the Mathematics Classroom Evaluation In Primary School Aiming At Key Competencies

Jiuhong Wang (Tianzheng Primary School, Gulou District, Nanjing, China)
The Connotation, Performance and Characteristics of Mathematics Teaching Wisdom in Primary School

Guangming Wei (Experimental Primary School Attached to Jingling H, China)
An Explorative Study of Identifying and Teaching the Starting-Point Core Mathematics Knowledge in Primary Education

TSG 37 Research on Classroom Practice at Secondary Level

Sikeme Raphoka (Mabathoana High School, Lesotho)
The Relationship of the Students Math Anxiety to the Teachers Classroom Instructional Practices

Wei Tan (East China Normal University Faculty Of Education, China)
A Study on the Blackboard Writing Behavior of Math Teachers in Senior High School

Kgomotso Gertrude Garegae (University of Botswana, Botswana)
Understanding Mathematics Teachers Instructional Practices through Students Eyes

Brigitte Johana Sanchez Robayo (Virginia Tech, USA)
Teachers' Reasons to Change Their Teaching Practices

Hao Li (Huaibei Normal University, China)
Research on the Effect of Teacher-students Interaction in the Mathematics Instruction Model of L-H-C-P

Ezgi Senger Altintas (Bogazici University, Turkey)
Instruction on Altitude Enriched with Sociomathematical Norms and Technology Integration

Qiongling Jin (Wenzhou China, China)
Logical Problems and Solutions in Mathematical Teaching

Deissy Milena Narvaez Ortiz (Universidad Distrital Francisco Jose de Caldas, Colombia)
The Didactical Contract, Its Effects and Clauses: Where Are They Revealed?

Jian Wang (No. 2 High School of East China Normal University, China)
Data Literacy-minded Teaching of Topics in Functions

Chiharu Kanamori (Shibaura Institute of Technology High School, Japan)
Proposal for a Lesson Plan to Create a Video of Students Explaining a Math Problem that They Made

Han Wang (East China Normal University, China)
A Study on the Blackboard Writing Behavior of Math Teachers in Senior High School

TSG 38 Task Design and Analysis

Fernando Mejia Rodriguez (ISCEEM, Mexico)
Task Design to Foster Solution Strategies

Douglas McDougall (OISE, University of Toronto, Canada)
Designing Tasks to Assess Middle School Students Critical Thinking in Mathematics

Ida Ah Chee MOK (The University of Hong Kong, Hong Kong SAR, China)
Creating a Rich Classroom Learning Experience via a Pedagogical Design Integrating the Approaches of Game-based Learning, Blended Learning and Self-directed Learning

Yaqi Zhang (South Dongchang Middle School Attached to Ea, China)
A Survey Research on Strategies of Junior Middle School Students' Solving Problems Related to Equal Area based Transformation-A Case Study from School D in Shanghai

Simone Passarella (University of Padova, Italy)
Design as Intention and as Implementation to Introduce Distributivity Property

Carlos Segura (Valencia University, Spain)
Contextualized Estimation Task Sequence to Promote Flexibility in Problem Solving

TSG 39 Language and communication in the mathematics classroom

Hikaru KAWANOUE (Graduate School of Education, Waseda University, Japan)
Investigation of CLIL on Elementary School Mathematics

Fengjuan Hu (hfj302@163.com, China)
The Relationship between the Problems Given by the Teacher and the Depth of Communication between Teachers and Students: Taking the Zero Point of Function as an Example

Shu Zhang (Beijing Normal University, China)
Studying Student Participation in Collaborative Mathematics Problem Solving Based on One Group of Four Chinese Students

Zhiling Wang (Hangzhou Normal University, China)
Teaching Study on 6th Graders Mathematical Communicating Reasoning Competency

Mozart Edson Lopes Guimaraes (Universidade Estadual da Paraiba, Brazil)
The Mathematics Classroom in Its Discursive Arena Form

PO

Eszter Kovacs-Koszo (University of Szeged, Hungary)
Supporting Students Interactions through Pair Work

TSG 40 Research and Development on Mathematics Curriculum

Shi Yun Huang (Primay School Affiliated to Tongji University, China)
Primary Mathematics Book Reading Course Based on the Cultivation of Core Accomplishment

Fiona Catherine Faulkner (Technological University Dublin, Ireland)
Investigating Third Level Lecturers Awareness of Second Level Curriculum Reform Four Years on

Yu Jr Tsai (Taitung College, Taiwan, China)
Mathematical Curriculums for Five-Year Junior College Programs in Taiwan

Jefferson Biajone (Fatec Itapetininga, Brazil)
The Curricular Statute of the Discrete Mathematics Discipline in the Brazilian Systems Analysis and Development Technology

TSG 41 Research and Development on Textbooks and Resources for Learning and Teaching Mathematics

Vladimir I. Igoshin (Saratov state University, Russian Federation)
About Textbooks on Mathematical Logic and Theory of Algorithms for Prospective Mathematics Teachers

Fulin Liu (People Education Press, China)
A Comparative Study of Fractions in Primary Schools Mathematics Textbooks of China and the United States

Mohan Thapa (UWM at Washington County, Nepal)
The Extent of Creative Reasoning Opportunities and Aspects of Cognition Demand in Textbooks in Nepal: A Case of High School Mathematics Textbooks

Paulo Diniz (UNIVERSIDADE LICUNGO - BEIRA, Mozambique)
Educative Curriculum Materials: Teachers Continuous Training in the Step by Step of the Materials Designing Process

Na Li (Asian Centre for Mathematics Education, East China Normal University, China)
The Presentation of Linear Function in Chinese School Mathematics Textbooks

Tianzhuo Jiang (Northeast Normal University, China)
The Presentation of Core Knowledge Acquisition Process in Junior Middle School Mathematics Textbooks

Ya Cheng (Zhuang yuan fang Primary School, China)
This Is the Way I Use Textbooks and Other Resources for Design Mathematics Lessons: A Case of Teaching the Area of Circle

Yihan Wang (Liaoning Normal University, China)
A Comparative Study of “Figures and Geometry” in Junior Middle School Mathematics Textbook by PEP Edition and Kangxuan Edition

TSG 42 Research and Development in Assessment in Mathematics Education

Toni A. Sondergeld (Drexel University, USA)
Standardized Testing Administration Time Differences on Problem-solving Outcomes

Gregory Ethan Stone (University of Toledo, USA)
Handling Missing Data on Advanced Problem Solving Measures

Jonathan David Bostic (Bowling Green State University, USA)
Development of A Problem-solving Measure for Grade 5

Satoshi Enomoto (Hokkaido University of Education, Japan)
Contents-specifics in Teachers Assessment of Non-cognitive Skills in Mathematics Education

Philip Slobodsky (Halomda Educational Software, Israel)
E-training and E-assessment of Mathematical Courses by Xpress-Tutor

Fumiko Yasuno (National Institute for Educational Policy Research, Japan)
Development of Mathematics Items with Dynamic Objects for Computer-based Assessment Using Tablet PC

Shigeki Kitajima (Meisei University, Japan)
A Case Study of the Assessment Process in Japanese Math Classes

Beatriz Elena Martinez Diaz (Cinvestav-IPN, Mexico)
Impact of the Standardized Test in the Classroom: A Proposal from the Socio-epistemological Theory of Educational Mathematics

Shiva Datta Dawadi (Tribhuvan University, Nepal)
Existing Assessment Practices: A Detrimental Factor for The Value of Cognitive Diversity in Mathematics Classroom

Michael Obiero Oyengo (Maseno University, Kenya)
Providing Student Feedback through Electronic Assessment for Linear Algebra at MASENO University, Kenya

Yuan-Horng Lin (National Taichung University of Education, Mexico)
Analysis on Mathematics Reading Assessment Calibration and Students Performance Based on Multidimensional IRT

Filip Moons (University of Antwerp, Belgium)
Semi-automated Assessment for Mathematical Proficiency: The Ultimate Time-saver for Extensive Feedback and Reliable Grades?

Lingchun Kong (Experimental Primary School Affiliated Jinling Sec, China)
Making Classroom Assessment Happen in Novice Teachers Class through Assessment Techniques Design

TSG 43 Research and Development in Testing (National and International) in Mathematics Education

DongXue TU (Huaibei Normal University, China)
Research on College Entrance Examination of "Probability and Statistics" Under the View of Data Analysis Literacy

Joaquim Pinto (Universidade de Aveiro, Portugal)
Factors Influencing the Performance of Portuguese, Singaporean, Dutch, Spanish and Brazilian Students in Mathematical Literacy in Pisa: Integrative Revision

TSG 44 Mathematics and Interdisciplinary Education

Attilio Ferrini (Matematica Valdarno, Italy)
The Role of Play in Maths Learning

Itumeleng Phage (Central University of technology, Free State, Portugal South Africa)
Investigating Pre-service Teachers Mathematics Skills in the Study of Sound and Sound Waves

PO

TSG 45 Mathematics for Non-specialist/mathematics as a Service Subject at Tertiary Level

William Man Yin Cheung (The University of Hong Kong, Hong Kong SAR, China)
Peer Assisted Learning in Less Structured Courses: A Case Study in a First-Year Course on Mathematical Modelling

Luis Eduardo Amaya (University of Costa Rica, Costa Rica)
Implementation of Projects about Scheduled in Software R in a Linear Algebra Course for Students of Business Computing Career at the University of Costa Rica

Jiao Liu (East China Normal University, China)
On the Mathematical Knowledge, Skills and Related Information Technology Needed to Pay the Way for Students Career Development

TSG 46 Mathematical Competitions and Other Challenging Activities

Stephanie Lynn Hurtt (University of Northern Colorado, USA)
Math Circles Program to Facilitate Challenging Tasks

Valorie Lynn Zonnefeld (Dordt University, USA)
COMPETITIONS PROMOTING THE MATHEMATICAL SCIENCES

TSG 47 Mathematics Education in a Multilingual Environment

Shagufta Yasin Raja (University of North Carolina at Charlotte, USA)
Social and Linguistic Semiotics of Mathematics in Public Schools

TSG 49 Distance Learning, E-learning and Blended Learning of Mathematics

Siu Ping Ng (The Chinese University of Hong Kong, Hong Kong SAR, China)
An Investigation of How Flipped Classroom Help Students to Learn Vector

Yasuyuki Nakamura (Nagoya University, Japan)
Math E-learning Question Specification and XML Exporter for Stack by Using Visual Programming Language

Kentaro Yoshitomi (Osaka Prefecture University, Japan)
Auto-generated Multiple-choice Questions and Their Applications

Pei-Duo Yu (City University of Hong Kong, Taiwan, China)
Educational Software for Mathematics Learning

Haile Yideg Zeleke (Bahir Dar University, Ethiopia)
Introducing Electronic Assessment Using Stack to a Linear Algebra Course in Bahir Dar University

Ines Hukic (Windesheim university of applied sciences, Netherlands)
How Math Teacher Trainers Can Support Their Distance Students?

Alberto Conte (University of Turin - Academy of Sciences of Turin, Italy)
Asynchronous Discussion and Collaboration to Enhance Problem Solving in Mathematics

Anna Mirny (Russian School of Mathematics, USA)
Blended Learning in The Professional Development of Math Teachers: Lessons from Russian School of Mathematics

Marcelo de Carvalho Borba (Sao Paulo State University, Brazil)
Digital Videos Festival, Mathematics Education and the Evolving Classroom: Between Face-to-face and Virtual

TSG 50 Mathematics Education in and for Work; Continuous Mathematics Education Including Adult Education

Maxwell Fundi (Maseno University, Kenya)
Impacting Kenyan Form Four Leavers with 21st Century Skills for the Future of Work

Lauro Chagas e Sa (Instituto Federal do Espirito Santo, Brazil)
Infographics about the World of Work: An Experience with Students of Vocational Education Integrated to High School

TSG 51 Mathematics Education for Ethnic Minorities

Hsueh-Yun Yu (Changhua University of education, Taiwan, China)
The Implementation of Culturally Responsive Teaching Practices into the Mathematics Course

Christine Darling Thomas (Georgia State University, Georgia)
Renegotiating Recruitment and Retention Efforts: Promoting Teacher Diversity in Mathematics and Science Classrooms

Jose David Fonseca (The University of Arizona, USA)
Preparing the Next Generation of STEM Innovators

TSG 52 Ethnomathematics and Mathematics Education

Martha Raquel Alquinga Chango (Universidad Central del Ecuador, Ecuador)
Taptana Canari or Contador Indigena

Yuhong Shen (School of Education, Dehong Teachers College, China)
The Practice of Minority Culture of Dehong into the Mathematic Teachings in Primary School-Take the "Data Collection and Arrangement"

Laurie H Rubel (University of Haifa, USA)
Building with Mathematics in an Israeli Youth Movement

Steven Eduardo Quesada Segura (Ministerio de Educacion, Costa Rica)
Evolution of Ethnomathematics Analysis of Dance Palo De Mayo in Costa Rica

TSG 53 Equity in Mathematics Education

Ning Li (AMSI, Australia)
Trends in Participation and the Underlying Factors Year 12 Mathematics Education in Australia

Lorraine Minette Howard (Women and Mathematics Education, USA)
How to Increase Girls' Sustaining Interest, Performance and Career Choices in Mathematics: A High-quality Project-based Learning Approach

Kimberly Ann Powers (California State University, Long Beach, USA)
If You Start from behind the Race Isn't Fair: Math Placement of Language Minority High School Students

Xiangyi Kong (Beihua University, China)
Rural Elementary Students' Mathematics Academic Performance in China: What Are the Influencing Factors?

Yuriko Kimura (Tsukuba University, Japan)
Theoretical Framework of Gendered Mathematical Identity

TSG 55 The History of the Teaching and the Learning of Mathematics

Francisco Filho (Universidade Federal de Sao Paulo, Brazil)
Professor Lucilia Bechara Santos: An Expert for the Education Activity

Kei Kataoka (Kwansei Gakuin University, Japan)
Geometrical Drawing at Secondary Schools in the Subject Arts during the Late 19th to Mid-20th Century in Japan

Wagner Alexandre do Amaral (SEED PR, Brazil)
The Teaching of Mathematics in the Perspective of the New School in State of Parana

Ramesh Prasad Awasthi (Council for Mathematics Education, Nepal)
Historical Development of Mathematics Education in Nepal

Edilene Simoes Costa Dos Santos (Universidade Federal de Mato Grosso do Sul, Brazil)
An Expert in Mato Grosso Do Sul (Brazil) during the 1980's

TSG 56 Philosophy of Mathematics and Mathematics Education

Marli Santos (UFOP, Brazil)
The Perception of a Polyhedron in a Generalized Kaleidoscope: A Perceptive Experience

TSG 57 Diversity of Theories in Mathematics Education

Shiqi Lu (Nanjing Normal University, China)
The Holistic Instructional Design Model of the Unit Knowledge Structure of Elementary School Mathematics Based on Core Competencies

Sun Young Ban (Merritt College, USA)
The Effect of Pedagogical Knowledge on Mathematics Anxiety in Developmental Mathematics Course

TSG 58 Empirical Methods and Methodologies in Mathematics Education

Tommy Tanu Wijaya (Guangxi Normal University, China)
The Trend of Mathematics Teaching Method Has Change from Fragments to Systematics

Kimhor Try (NGPRC, Cambodia)
The Effectiveness of Teaching Mathematics in Circle Equation by Using 5E Instructional Model in Inquiry-based Learning

TSG 59 Mathematics and Creativity

Alexandre Tolentino de Carvalho (Universidade de Brasilia, Brazil)
Creative Performance Test in the Field of Mathematics: A Study with Brazilian Students

Valentina Jovance Gogovska (Faculty of Natural Sciences and Mathematics, UKIM, Republic of Macedonia (FYROM))
Brain Exercises for Improving Math Creativity and Physical Health

TSG 60 Semiotics in Mathematics Education

Pierre JOB (ICHEC, Belgium)
Use of Signs in Young Adults Modelling Linear Optimization Problems

Corin Dessan Mathews (University of the Witwatersrand, South Africa)
Renaming Division Sharing Actions within Signification Pathways: An Example from a Grade 3 Classroom in South Africa

TSG 61 International Cooperation in Mathematics Education

Christian Barthel (University of Passau, Germany)
Smartphone Math-Apps in Learning Environments (SMILE) within the Global Teacher Research and Education Exchange Program (GLOBAL.TREX) Passau

Bhesh Mainali (Rider University, Nepal)
Supporting Mathematics Instruction Nepal

Meixia Ding (Temple University, USA)
Collaborating to Develop Algebraic Knowledge for Teaching

Yiran Li (Teachers College, Columbia University, USA)
The Effect of Professional Development in US-Kazakhstan Collaboration to Integrate STEM into Discrete Mathematics Course for Aspiring Mathematics Teachers on Faculty Perceptions and Teaching Practices

TSG 62 Popularization of Mathematics

Junfeng Ma (School of Mathematical Sciences, Soochow University, China)
Some Suggestions on School-based Curriculum Construction of Mathematics Culture for Middle School

DG1: Computational and Algorithmic Thinking, Programming and Coding in the School Mathematics Curriculum: Sharing Ideas and Implications for Practice

July 14, 21:30–23:00 **Location: T205**

Organizers: Max Stephens (The University of Melbourne, Australia); Djordje M. Kadijevich (Institute of Educational Research, Belgrade, Serbia); Zhang Qinqiong (Wenzhou University China)

Description:
Computational/algorithmic thinking, programming and coding are emerging areas of importance for mathematics thinking, increasingly being located across the school mathematics curriculum in some countries worldwide. This Discussion Group is intended to provide a forum for bringing together these international trends and their growing impact on the curriculum – both in the compulsory years of schooling as well as in the senior high school years. It is aimed at teachers, mathematics curriculum experts, and teacher educators who are engaged or keenly interested in these issues, mostly from a practical point of view.

Participants are invited to share recent developments from their own countries or their own teaching experience in one or more of the following three areas: 1) current or proposed curriculum provisions/developments from their home country; 2) relevant classroom/ teaching activities; and 3) resources to support teachers.

Planned Activities & Working Format & Responsible Person

21:30–21:45 **Short Introduction**
Introduction to the DG and its website

21:45–22:05 **Current/Proposed Curriculum Provisions**
Discussion on four or more selected national examples (Max Stephens)

22:05–22:25 **Classroom/Teaching Activities**
Presentation and discussion on selected classroom/teaching activities (Zhang Qinqiong)

22:25–22:45 **Resources to Support Teachers**
Discussion of available resources to support teaching of CT/AT (Djordje M. Kadijevich)

22:45–23:00 **Post Conference Developments**
Recommendations for continuing collaboration/discussion (Max Stephens)

DG2: Discussion Group on Mathematics Houses and Mathematics Museums throughout the World

July 14, 21:30–23:00 **Location: T206**

Organizers: Albrecht Beutelspacher (Justus Liebig University Giessen and Mathematikum, Giessen, Germany); Ali Rejali (Isfahan University of Technology and Isfahan Mathematics House, Isfahan, Iran); Christian Mercat (Lyon House for Mathematics and Informatics, Lyon, France); Abolfazl Rafiepour (Shahid Bahonar University of Kerman and Kerman Mathematics House, Kerman, Iran); **Yahya Tabesh** (Sharif University of Technology, Tehran, Iran)

Description:
After a fruitful Discussion Group at ICME-13 in Germany and the establishment of an International Network of Mathematics Houses [INMH] in 2016 [1], we are trying to work on the official structure of the network and discuss forms of cooperation between mathematics houses and mathematics museums throughout the world. Their success in enhancing mathematical awareness among their communities and their impact on mathematics education, as well as their challenges, can be discussed.

Questions:

1. What are the benefits of such institutes for popularizing mathematics and improving mathematics education? Do s Houses and Museums have a role beyond
2. What are the challenges they face?
3. How can mathematics institutions share activities and cooperate with each other?
4. How can their members benefit from other institutes in other parts of the world?
5. What are the effects of these institutes in mathematics education of the region around these institutes?
6. What is the network [INMH] and what could be its structure?

Planned Activities & Working Format & Responsible Person

21:30–21:35 **Opening Statements**
Lecture (Ali Rejali)

21:35–21:45 **What Are the Museums of Mathematics**
Lecture (Albrecht Beutelspacher)

21:45–21:55 **Opportunities for Innovative Multidisciplinary Learning at Mathematics Houses**
Lecture (Yahya Tabesh)

21:55–22:05 **What are the other roles of mathematics houses and mathematics museums for the society**
Lecture (Albrecht Beutelspacher)

22:05–22:20 **Challenges for Mathematics Houses**
Lectures (Abolfazl Rafiepour, Christian Mercent)

22:20–22:30 **A Report on the Belgium Mathematics House**
Presentation (Their representative)

22:30–22:40 **What are the effects of mathematics houses on education and the society**
Lecture (Christian Mercent)

22:40–22:45 **The Network and Its Structure**
Presentation (Ali Rejali)

22:45–23:00 **Discussion by the Audience and the Members of the Panel**
Discussion (Albrecht Beutelspacher)

DG3: Revisiting Shulman's Notion of Pedagogical Reasoning: Looking Back and Looking Forward

July 14, 21:30–23:00 **Location: T209**

Organizers: Ban Heng Choy (National Institute of Education, Nanyang Technological University); Jaguthsing Dindyal (National Institute of Education, Nanyang Technological University); Joseph Boon Wooi Yeo (National Institute of Education, Nanyang Technological University)

Description:
Pedagogical reasoning is not a new concept. More than three decades ago, Shulman (1987) expounded this idea in his seminal paper, well known for its elaboration of pedagogical content knowledge (PCK). Shulman stated that teaching begins as an act of reason and continues as a process of reasoning. He also added that pedagogical reasoning forms the basis for all actions by the teacher. In his model for pedagogical reasoning and action, Shulman proposed that teaching begins with the act of comprehending what has to be taught, followed by the transformation of that knowledge for teaching the students, which is followed by actual instruction, and an evaluation of the students' learning. Finally teachers engage in reflections, which may lead to new comprehensions by the teacher.

Although the notion of PCK has been quite well-understood, the notion of pedagogical reasoning is still under-theorised (Loughran et al., 2016). Yet, pedagogical reasoning has been seen as an important component of teaching expertise (e.g., see Choy, 2016). If teaching actions are based on pedagogical reasoning, then how do we enhance the pedagogical reasoning of teachers to improve teaching? Or more

fundamentally, is there a need to reinterpret the components of pedagogical reasoning in light of the current contexts of teaching and learning? In this DG, we will discuss these questions. More specifically, we will critique this construct and propose possible modifications to the framework of pedagogical reasoning. In addition, we will also discuss the issues and challenges related to the development of teachers' pedagogical reasoning.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **What is pedagogical reasoning and action?**
The organisers will facilitate the introduction of the participants of this DG and present the key ideas needed in this DG.

21:40–22:00 **What are the components of pedagogical reasoning and what are the roles of each component in teacher education and professional development? What can we say about its relationship to Shulman's notion of pedagogical reasoning?**
The participants will work in groups to critique one of the following components: Comprehension, Transformation, Instruction, Evaluation, Reflection, and New Comprehension.

22:00–22:30 The participants will present their critique and suggest ideas to modify/enhance/clarify the notion of pedagogical reasoning.

22:30–22:40 **What are some issues and challenges with enhancing teachers' pedagogical reasoning?**
The organisers will summarise the ideas shared by the participants and lead a discussion on the issues and challenges to prepare for session 2.

22:40–23:50 **How can we move forward in our endeavor to enhance teachers' pedagogical reasoning?**
The organisers will summarise the ideas and discussion to set up possible collaboration opportunities in the future.

22:50–23:00 **Summary and Closing**

DG4: Roles for Mathematicians in Math Education

DG

July 14, 21:30–23:00 **Location: T213**

Organizers: Solomon Friedberg (Boston College); Patricio Felmer (Universidad de Chile); Carlos Kenig (University of Chicago); JongHae Keum (Korea Institute for Advanced Study); Jürg Kramer (Humboldt-Universität zu Berlin

Description:
Aims: Mathematicians have played an important role in math education for many years; for example, mathematicians Felix Klein (the first President of ICMI), Hans Freudenthal, and Georg Pólya have contributed fundamentally. In the present landscape, with the emergence of many specialists in education and math education, sometimes grounded in other disciplines, there are more voices and more perspectives—both a challenge and an opportunity. The goal of this discussion group is to take stock of ways that mathematicians are presently contributing to math education, to consider what they can add to the field of math education as mathematicians and among these what roles are most important, and to ask what experiences and structures would be most useful in promoting future cooperation and contributions.

Underlying Ideas: Mathematicians have played many roles in math education, including the training of future teachers in the university, the support of in-service teachers (e.g. helping to promote their on-going engagement with mathematics), roles in public policy such as writing or reviewing K-QO math standards and ensuring that there is a close articulation between K-QO math and university-level math, and roles in advocacy for math education. There appears to be quite a bit of variation from country to country, with some countries having many mathematicians involved in K-QO math education and some having practically none. We believe it would be valuable to discuss the contributions of mathematicians explicitly (they are not mentioned in any of the TSGs), to reflect on what they are contributing as mathematicians with their specific training and perspectives, to discuss what can be done to promote involvement going forward (taking stock as well of obstacles and pitfalls), and to ask whether or not this could be a source of

the improvement of K-QO math in countries where there has been little connection between university level mathematicians and mathematics educators to date.

Planned Activities & Working Format & Responsible Person

21:30–21:55 **Discussion of the Involvement of Mathematicians in Pre-service Education**
Short introduction followed by participants' descriptions of involvement and discussion of roles for mathematicians in the preparation of future teachers (Organizing team)

21:55–22:15 **Discussion of the Involvement of Mathematicians with In-service Teachers**
Short introduction followed by participants' descriptions of involvement and discussions of contexts, roles and best practices for the involvement of mathematicians in work with in-service teachers (Organizing team)

22:15–22:35 **Discussion of the Involvement of Mathematicians in Math Education Policy**
Short introduction followed by participants' descriptions and discussion of the involvement of mathematicians in math education policy (Organizing team)

22:35–23:00 **Discussion of Connecting Mathematicians and Mathematics Educators Going Forward: Roles, Opportunities, Obstacles and Potential Pathways**
Overall discussion of the involvement of mathematicians in math education and possibilities for future engagement (Organizing team)

DG5: 70 Years' Development of Mathematics Textbooks in Primary and Secondary Schools in China

July 14, 21:30–23:00 **Location: W215**

Organizers: Li haidong (The Curriculum and Teaching Material Research Institute, People's Education Press); Zhou xiaochuan (The Curriculum and Teaching Material Research Institute, People's Education Press)

Description:
The theme is 70 years' development of Mathematics Textbooks in primary and secondary schools inChina

We will introduce 70 years' development of mathematics textbooks，especialy recent twenty years. The Chinese characteristics of textbook development，the method of textbook research，and the exploration of practical reform of textbook，will be mainly expounded. Finally, we will express our understanding of mathematics and mathematics education.

Planned Activities & Working Format & Responsible Person

21:30–21:45 **70 Years Development of Mathematics Textbooks in Primary Schools in China**
Ding Guozhong, The Curriculum and Teaching Material Research Institute People's Education Press

21:45–22:05 **Mathematical Thoughts and Methods of Mathematics Textbooks in Primary Schools in China**
Zhou Xiaochuan, The Curriculum and Teaching Material Research Institute People's Education Press

22:05–22:25 **The Reform and Development of Chinese Mathematics Textbook in Secondary School Of 21st Century**
Li Haidong, The Curriculum and Teaching Material Research Institute People's Education Press

22:25–22:45 **Development of Digital Technology in Secondary School Mathematics Textbook**
Zhang Jinsong, The Curriculum and Teaching Material Research Institute People's Education Press

22:45–23:00 **Mathematics Culture in Secondary School Mathematics Textbook**
Song Lili, The Curriculum and Teaching Material Research Institute People's Education Press

DG6: Variations and Series of Tasks, Crossing the Approaches

July 14, 21:30–23:00 **Location: W111**

Organizers: Katalin Gosztonyi (Eötvös Loránd University of Budapest, Hungary); Charlotte de Varent (Université de Rennes 2, France); Luxizi Zhang (École Normale Supérieure de Lyon, France, East China Normal University, China); Alessandro Ramploud (University of Pisa, Italy)

Description:

This discussion group aims to extend a discussion led by some senior and young researchers from four different countries since some years about variations and series of tasks. Katalin Gosztonyi wrote her PhD (2015) on the comparison of the Hungarian reform of mathematics education led by Varga (pointing out the importance of structuring problems in series and networks) and the French "mathématiques modernes" reform. Charlotte de Varent wrote her PhD (2018) on the use of history in mathematics education, pointing out the importance of small numerical variations in Mesopotamian scholarly context. Luxizi Zhang is working on her PhD (Zhang, 2019) towards an analytic model of "teaching mathematics through variation" from the analysis of teachers' documentation work (Gueudet & Trouche, 2009) in China and France, making profit of the variation theory (Gu, Huang, & Marton, 2004) and the notion of didactic variable in the theory of didactical situations (Brousseau, 2002).

As the above mentioned examples illustrate, the 'variation perspective' (what will mean in the followings: variation as well as sequencing and networking of tasks and problems) appears as an important issue in various traditions of mathematics education, and at the core of teachers' documentation work. International discussions where launched on this topic since some years: the "Series of problems" interdisciplinary historical research project (2012-2019) (Bernard 2015), the first (2018, Budapest) and the second (2019 Lyon) "Variations and series of problems" workshop, and the Varga100 conference (2019 Budapest, https://varga100.sciencesconf.org/). The aim of these discussions was to confront different implementations of this 'variation perspective', towards a common model, or a diversity of models, allowing on one hand to develop analytical tools for researchers, and on the other hand to support teachers design work. We consider that the ICME14, in the country of the Chinese "variations method" and thanks to the diversity of the conference's public, would be a particularly well adapted context for the continuation of this collective work.

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Planned Activities & Working Format & Responsible Person

21:30–21:40 **Introduction**
(The coordinators, plenary)

21:40–21:55 **Presentation of the Chinese, Hungarian and French Handouts**
(L. Zhang, K. Gosztonyi plenary)

21:55–22:15 **Analyzing the Data, Extracting Principles with Special Focus on the Structure of the Task Sequences. Comparing to the Participants' Teaching Traditions**
Work in small groups.

22:15–22:35 **Sharing the Results of the Four Groups**
Collective discussion

22:35–22:45 **Italian Adaptation of the Chinese Variation**
(A. Ramploud, plenary)

22:45–23:00 **General Conclusions + Potential Plans for Further Research**
(The coordinators, plenary)

DG7: The Future of Mathematics Education Research:Discussion of an International Survey

July 14, 21:30–23:00 **Location: W315**

Organizers: Arthur Bakker (Utrecht University, the Netherlands); **Jinfa Cai** (University of Delaware, USA)

Description:
Mathematics education research as a discipline is celebrating several milestones. ESM and JRME have recently celebrated their 50th anniversaries. To mark this auspicious occasion, this DG focuses on the future of mathematics education research. We will use an international survey (conducted before and during the pandemic) as the basis of the discussion. The survey results have been published in 2021 in ESM (https://link.springer.com/article/10.1007/s10649-021- 10049-w). We aim to organize the best ideas for the future of mathematics education research into a form that ICMI members will find appropriate. In particular, we will discuss the impact of the pandemic on the shape of mathematics education and mathematics education research, including increased attention to issues such as online assessment and pedagogical considerations for virtual teaching.

Planned Activities & Working Format & Responsible Person

21:30–21:35 **Introduction and Brief Reflection**
Looking back, and plan of the discussion group
Jinfa Cai on the basis of Inglis and Foster (2018)

21:35–21:50 **Introduction and Brief Reflection**
What do international voices say?
Arthur Bakker on the basis of an international survey that appeared in Educational Studies in Mathematics in early 2021

21:50–22:00 **Personal Discussion**
Relation of what has been discussed to the ICME survey from 2004
Anna Sfard (relating to Sfard, 2005)

22:00–22:30 **Break-out Session**
Formulation of research questions at research program level (Moderated by all team members)

22:30–22:45 **Plenary Discussion**
Sharing best ideas from the break-out session (Guangming Wang)

22:45–22:55 **Personal Discussion**
What can ICMI learn from the discussions? (Jill Adler)

22:55–23:00 **Looking into the Future**
What is the next step? (Arthur Bakker, Jinfa Cai)

DG8: Developing Teachers' Professional Competence and Improving Their Teaching Practice through Cross-cultural Programmes

July 14, 21:30–23:00 **Location: W201**

Organizers: Xingfeng Huang (Shanghai Normal University, China); Minxuan Zhang (Shanghai Normal University, China); Rongjin Huang (Middle Tennessee State University, USA); Shiqi Li (East China Normal University, China)

Description:
Since 2014, the UK government has funded the Mathematics Teacher Exchange Programme between UK-China to improve British teacher's professional development. Through this programme, nearly 1000

teachers from both countries have visited schools in counterpart schools and learned teaching and teacher professional development practice from the other country. Over the past eight years, participating teachers have benefited from the exchange activities and improved their teaching practice. However, some contradictions have occurred due to cultural differences between China (the East) and the UK (the West).

Classroom teaching and teacher learning are cultural activities. Thus, the differences in mathematics teaching and teacher learning between the East and the West are rooted in their cultural values, educational philosophies and traditions, and practical wisdom. It is crucial to identify the strengths and weaknesses of mathematics education and understand the underlying cultural differences in order to learn from each other. The contradictions regarding mathematics teaching and learning between the East and the West could be the driving force for teachers' learning, and promote their self-reflection and teaching improvement. Therefore, based on these projects and research literature, this discussion group will focus on (1) what we can learn from the exchange programme between the Eastern and Western cultures; (2) practice and research on cross-cultural teachers' collaboration and learning in the future. This discussion is aimed to deepen our understanding of the theories and practice of mathematics teaching and teacher professional learning in the East and the West and improve our own mathematics education.

Planned Activities & Working Format & Responsible Person

21:30–22:00 **Sharing the Experience in and Research Findings on the Exchange Programme between UK-China**
(Minxuan Zhang)

22:00–22:45 **Discussion:**
(1) Why it is necessary and important for teachers' collaboration cross-culturally;
(2) What can be learned from the exchange programme between the Eastern and Western cultures;
(3) Practice and research for teachers' cross- culture collaboration and learning in the future
(Rongjin Huang)

22:45–23:00 **Comments**
(Jenni Ingram)

DG

DG9: Non-university Tertiary Mathematics Education: An Emerging Field of Inquiry

July 14, 21:30–23:00 **Location: W203**

Organizers: David Tannor (Faculty of Mathematics, Kellogg Community College, USA); Laura Watkins (President-Elect, AMATYC; Faculty of Mathematics, Glendale Community College, USA); Kathryn Kozak (President, AMATYC; Faculty of Mathematics, Coconino Community College, USA)

Description:
The intent of this discussion group (DG) is to gather ICME-14 participants to engage in conversation about non-university tertiary mathematics education (NTME). Since ICME-9, it has been a tradition to dialogue about educational matters unique to this area. Over time, with both advances, challenges, and opportunities in tertiary mathematics education, as well as increasing attention, it is apparent that NTME is becoming a critical branch of inquiry in mathematics education. Yet, compared to primary, secondary, and university education, historically NTME has received insufficient attention. Consequently, this DG will provide an avenue to engage a wider group of mathematics educators, network, exchange ideas, and learn more about NTME practices around the world. The meaning of NTME as well as developing this area as a field of inquiry will be explored.

Planned Activities & Working Format & Responsible Person

21:30–22:05 **Introduction of Topic and Brief Presentation on Related Practices around the Globe**
TBA

22:05–22:45 **Break-out Sessions for Small Group Discussion**
TBA

22:40–23:00 **Summary and Report**
TBA

DG10: Teaching and Learning Linear Algebra

July 14, 21:30–23:00 **Location: W211**

Organizers: Sepideh Stewart (University of Oklahoma, USA); María Trigueros (Instituto Tecnológico Autónomo de México, MEXICO); Michelle Zandieh (Arizona State University, USA)

Description:
This discussion group will draw on the experience of three Linear Algebra researchers and curriculum designers to facilitate discussions around the past and future of Linear Algebra education. Linear Algebra is an important area of study for STEM majors. In a survey paper by Stewart, Andrews- Larson, and Zandieh (2019) the authors summarized some advances in many areas of linear algebra education (e.g., span, linear independence, eigenvectors, and eigenvalues). The survey paper also identified areas that need more research (e.g., systems of linear equations, properties of linear transformations, orthogonality, and least squares), and revealed the gaps (e.g., proof).

This working group will provide the opportunity to continue to develop and extend the field. Key questions and issues to be discussed are: What do we know from research about the teaching and learning of Linear Algebra? How can research results be used in the teaching of Linear Algebra? What innovative teaching methods have proved some success in the teaching of Linear Algebra?

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Introduction**
The organizers will give a brief overview of their research. Attendees will introduce themselves. The plan for the discussion group as well as a set of questions will be presented

21:40–22:05 **(a) Issues on First-year Linear Algebra Topics**

(b) Teaching Resources (Application, Technology)
The attendees will break up in small groups to discuss:
(a) What are some pressing issues concerning the teaching of first-year courses?
(b) What teaching resources do you use to help students to understand the concepts better?

22:05–22:30 **(c) Linear Algebra Proofs,**

(d) Second Courses in Linear Algebra
The attendees will break up in small groups to discuss:
(a) What are some issues surrounding teaching linear algebra proofs?
(b) What is the nature of second courses in your institution? The attendees will discuss the pertinence and possible contents of the second courses as a group.

22:30–22:50 Group discussion

22:50–23:00 **Closing Remarks, Supporting New Researchers, Future Work**
The organizers will close by summarizing participants' views about future research

DG11: How Do Movements Of Bodies and Artifacts Emerge in Mathematics Education?

July 14, 21:30–23:00 **Location: W303**

Organizers: Anna Shvarts (Utrecht University, The Netherlands); Dor Abrahamson (University of California, Berkeley, USA); Ricardo Nemirovsky (Manchester Metropolitan University, UK); Nathalie Sinclair (Simon Fraser University, Canada); Candace Walkington (Southern Methodist University, USA)

Description:

This discussion group is initiated by an international collective of researchers all concerned with embodied processes in mathematics teaching and learning. Operating from different perspectives that consider bodies as partaking in educational processes, we have been offering theoretical rethinkings of cognitive and affective processes in mathematical practices. This discussion group aims to consider the origins of movements performed by students, teachers, and artifacts. We invite group participants to reflect on resources initiating bodily movement and on the agents who perform or share the movement. We hope to articulate the difference between motion and movement as well as when and how movements become recognized as mathematical activity and discourse (language, diagrams, gestures). Imagine a student who draws the graph of $y=x^2$ on grid paper.

From a theory of dynamic systems that Abrahamson uses to argue for his embodied-design framework, this movement emerges as embodied adaptive coordinations in a complex dynamic system bearing agentive, environmental, and task constraints, such as figural features of the paper (Abrahamson & Sánchez–García, 2016). From a new-materialist perspective that Sinclar elaborates in the mathematics education field (de Freitas & Sinclair, 2014), an assemblage of the student with her capacities, the formula and the paper with the virtual transformation that they imply is actualised towards the graph. From a phenomenological perspective, in which Nemirovsky was engaged for many years (Nemirovsky, Kelton, & Rhodehamel, 2013), objectification of formula includes protention and retention of its usage, and the subject joins intentional horizon of the paper and retention formula usage in fulfilling her intentionality of drawing a graph by moving the hand along the paper. From an embodied cognitive science perspective that is within Walkington's expertise, movement is driven by cognitive processing of the formula that is extended beyond the scalp in a distributed system of activity that includes both explicit use of embodied resources and implicit embodied associations (Walkington et al., 2019). From a cultural-historical account, represented by Shvarts in the team (Shvarts & Abrahamson, 2019), the student's drawing is mediated by cultural artifacts—the paper and the formula—and expresses an ideal (cultural) form of action, which the student appropriated in a previous collaboration with a more knowledgeable other.

Group discussion will draw on a prepared audio-video excerpt from a mathematics teaching–learning episode featuring explicit bodily movement apparently relevant to mathematical conceptualization. Group participants will consider this excerpt to elaborate and debate theoretical perspectives as these illuminate agential sources and implications for practice. In the excerpt, there will be vivid involvement of the students, a teacher, and a technological artifact so that participants could draw their theoretical analysis on the enactment and gestures of all participants and interactive feedback from the artifact. Finally, we will discuss applications of the theoretical ideas to educational design and future research questions.

Planned Activities & Working Format & Responsible Person

21:30–22:00 **Introduction: The Vision of Agency from Different Theoretical Perspectives.**
A short introduction and five 5- minutes presentations by each of the team leaders

22:00–22:30 **Analysis of A Video Excerpt with a Movement in Technologically Enhanced Settings from Different Theoretical Perspectives.**
Five groups focus on different theories and moderated by a corresponding team leader who screen-shares the video fragment

22:30–22:45 **Exchange of Findings between the Perspectives.**
Moderated by the team leaders

22:45–23:00 **General Discussion: The Consequences of Each Theoretical Approach for Educational Design and Future Research Questions.**
Moderated by Shvarts

DG

DG12: Driving Forces behind School Mathematics Curriculum Change in Asia

July 14, 21:30–23:00 **Location: W313**

Organizers: Zahra Gooya (Shahid Beheshti University, Tehran, Iran); Soheila Gholamazad (Organization for Research and Education al Planning, Ministry of Education, Iran)

Description:
There are many different driving forces behind every mathematics curriculum change around the world including politics, values and culture. In recent time, one of the driving forces behind mathematics curriculum changes has been international assessment results. For instance, every four years, after the TIMSS results are released, many officials in various education systems tempting to take some remedial measures to improve their countries' ranking by the next TIMSS.

The scope of this proposal is to discuss the root causes of such hasty and sudden decisions. The proposers invite the audience to discuss the ways in which, school mathematics curriculum be altered and adjusted in such ways to keep the balance between local and global situations and to use research findings properly to suit different education systems.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Introducing the Aim of the DG**
Rationale for DG (Zahra Gooya)

21:40–22:00 **Open the Floor for Participants to Discuss the Controversial or Emerging Issues and/or Dilemmas They Have Faced in Mathematics Curriculum in Their Countries**
Driving forces behind mathematics curricula change/ reform in some of the Asian countries.
Soheila Gholamazad (White/ chalk board)

22:00–22:15 **Discussion among Team Members & Participants**
Major driving forces and controversial issues in math curriculum reform
Chair & Co- chair (White/ chalk board)

22:15–22:35 **Challenging Participants with the Identified Issues in the 1st Meeting**
The relation between local characteristics and math curriculum reform/ change
A volunteer from team members/ participants (Video projector)

22:35–22:50 **Examining the Development of a Framework for Studying Math Curriculum Changes in Asia**
A possible framework for studying math curriculum changes in Asia
Soheila Gholamazad (Video projector)

22:50–23:00 **Planning Next DG?**
Where to go from here?
Whole participants (Video projector)

DG

DG13: Capacity and Network Project Sustainablity and Future Directions

July 14, 21:30–23:00 **Location: W101**

Organizers: Anjum Halai (Aga Khan University Pakistan); Moustapha Sokhna & Mamadou Sangare (CANP1); Yuri Morales and Nelly Leon (CANP2); Maitree, Khamla and Vu Nhu Thu (CANP3); Alphonse Uworwabayeho and Veronica Sarungi (CANP4); Augusta, Gabriela and Maria del Carmen Bonilla Tumialan (CANP5)

Description:
This discussion group will be attractive to congress participants interested in creating networks and communities of practice in challenging and disadvantaged education contexts. Discussion will focus on the Capacity and Network Projects (CANP) of the International Commission of Mathematical Instruction (ICMI) supported by the International Mathematical Union (IMU), UNESCO and the International Council of Scientific Unions (ICSU) as well as regional governments and institutions. Five CANPs have been organised so far. While each CANP differs in its focus, approach and process the goal is to respond

to the challenges in mathematics education that have been documented among other reports in UNESCO 2011. The aims of the Discussion Group at ICME 14 include identifying, sharing and discussing common key issues in creating a critical mass to sustain the network and its activities over long term. Through sharing cross-national regional experiences, we expect to deepen and broaden the understanding of lessons learnt in the process of establishing the CANP and taking it forward.

Discussions will be guided by the following key questions:

a. What did the CANP do in 2020? How (if at) were your activities impacted by the pandemic? (focus on one or two innovations/activities).
b. What is planned for the CANP in 2021? Why?
c. What new questions arise for the mathematics education community?
d. What are the similarities and differences in the opportunities and challenges arising in the CANPs?
e. What is the impact of CANP on mathematics education in the region? how could the impact be sustained?

Planned Activities & Working Format & Responsible Person

21:30–21:45 **Short Introduction**
Introduction to the DG and its website

21:45–22:05 **Current/Proposed Curriculum Provisions**
Discussion on four or more selected national examples (Max Stephens)

22:05–22:25 **Classroom/Teaching Activities**
Presentation and discussion on selected classroom/teaching activities (Zhang Qinqiong)

22:25–22:45 **Resources to Support Teachers**
Discussion of available resources to support teaching of CT/AT (Djordje M. Kadijevich)

22:45–23:00 **Post Conference Developments**
Recommendations for continuing collaboration/discussion (Max Stephens)

DG14: Mathematics Education and Teacher Professional Development System in Jiangsu Province

July 14, 21:30–23:00 **Location: W301**

Organizers: Lianhua Ning (Nanjing Normal University, China); Ping Yu (Nanjing Normal University, China); Jingya Zhao (Nanjing Normal University, China); Xiaoyan Zhao (Nanjing Normal University, China); Shanliang Li (Institute of Teaching in Primary and Secondary Education in Jiangsu Province, China); Jiuhong Wang (Tianzheng Primary School, China); Guangming Wei (Experimental Primary School Affiliated with Jinling High School, China)

Description:
In Jiangsu Province, which has been considered as one of the provinces with highest educational development in China, a system at various administrative levels for facilitating professional development of mathematics teachers has been established. By means of setting expert mathematics teacher studio, supporting People Educators in mathematics education, strengthening the cooperation between researchers and in-service mathematics teachers etc., a great progress has been made in mathematics education at primary and secondary level in terms of mathematics teachers' capability of doing research.

In this discussion group, it will be shared with examples how these supporting systems helps to supporting mathematics teachers' professional development. More specific, various activities done in each of the three manners mentioned above will be given, with the aim of characterizing the advantages and challenges in such supporting system. Another aim of this discussion group is to gather more ideas for further improving such system in order to better help mathematics teachers' professional development.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Introductory Comments (Organizing the group discussion through the key questions)**
Whole group discussion (Ping Yu / Xiaoyan Zhao)

21:40–22:00 **System of and Strategies for Supporting Mathematics Teachers' Professional Development in Jiangsu Province**
Presentation given by Lianhua Ning, Jingya Zhao and Shanliang Li

22:00–22:25 **Suitable for Development: Purport of Mathematics Teaching Wisdom under the Condition of Large Class Size**
Presentation given by Jiuhong Wang

22:25–22:45 **Expert Mathematics Teacher Studios Driven by Research-based Teacher Professional Development Programme**
Presentation given by Guangming Wei

22:45–23:00 **Closing comments –Summarize the presentations and Discussions, and Identify Follow-up Questions to Investigate**
Whole group discussion (Organizing Committee)

DG15: Searching New Paradigms on Mathematics Teacher Education Research and Classroom Mathematics Assessment

July 14, 21:30–23:00 **Location: T105**

Organizers: Regina Ehlers Bathelt (UFSM, Brazil); João Pedro Antunes de Paulo (IFC, Brazil)

Description:
This discussion is proposal by some members of the SIGMA-t Group – an interinstitutional net of Brazilian researchers seek Mathematics Education research and development based on theoretical frame of the Model of Semantic Field (MSF) by Lins. Dr João Pedro Antunes de Paulo, Substitute Teacher of Federal Institute Catarinense. The aim of his research is understand the producing of MSF and what would be propose like a teacher education program in line with this theoretical model. Dra. Regina Ehlers Bathelt, Adjunct Teacher of Santa Maria Federal University, has seeking out "think outside the box" searching ways to read and understand theoretical-didactic models of mathematics education with implications to different curriculum production, use and evaluation of didactical materials and resources both, to mathematics teacher education' courses, and mathematics classrooms (primary and secondary schools). We intends congregate the community members of Mathematics Education who want discuss paradigms on mathematics teacher education and mathematics classroom assessment research, both "on the fly" actions of teaching and learning process. So, thinking mathematic' classrooms how do we make decisions on real didactical actions? What change in the classroom didactical actions world if we operate one or another theoretical world? During DG different theoretical worlds emerges and a reading of classroom situations produced. This "a read" highlight the difference among didactical actions supported by MSF and the counterparts presented. We hope at the end, the participants will be able to read in MSF another theoretical tool, especially productive to analyze the Mathematics classroom teaching-learning processes.

Planned Activities & Working Format & Responsible Person

21:30–21:50 **Introduction**
The organizers will introduce their selves and present the general idea of DG. The attendants will present their selves

21:50–22:10 **Different Theoretical Frames/Different Mathematics Education Worlds– RME, DST, MSF and DTT**
Regina Ehlers Bathelt Mathematics class episodes: Telling stories/ pedagogical discussion

22:10–22:25 **Curricular Proposal for Teacher Education/ Guidelines from MSF**
João Pedro Antunes de Paulo Proposal analysis

22:25–22:55 **Discussion Group**
Curriculum and differences: mathematics teacher education and evaluation on mathematics classroom.

22:55–23:00 **Closing Remarks**
Questions to further research

WS1: Beyond Financial Literacy and Financial Mathematics: Conceptualizing Financial Numeracy

July 14, 21:30–23:00 **Location: T419**

Organiser: Annie Savard (McGill University, Canada); Alexandre Cavalcante (University of Toronto, Canada); Daniela Caprioara (Ovidius Universitatea din Constanta, Romania)

Description:

This workshop aims to engage participants in an inquiry-based environment to conceptualize the role played by mathematics education in regard to financial literacy both in elementary and secondary schools. Our main goal is to introduce a conceptual framework that allows researchers and teachers to move beyond financial literacy and financial mathematics. The international efforts to incorporate financial literacy in schools have also penetrated the community of mathematics educators in several countries (Savard & Cavalcante, in press; Savard, Cavalcante, Turineck & Javaherpour, 2020; Caprioara, Savard & Cavalcante, 2019; Savard, 2018; Sawatzki, 2017; Bansilal, 2016), however the role played by mathematics in this topic has been undertheorized, leaving practitioners without proper support to integrate these concepts in mathematics classes.

The concept of financial numeracy refers to the intersection of mathematics and everyday practices in the realm of finance (Camiot & Jeanotte, 2016). In that sense, it comprises more than simple arithmetic operations in financial contexts (a role that has been proposed by scholars in the field of financial literacy). We believe that financial numeracy involves the wider scope of mathematical concepts, tools and procedures instead of referring to financial mathematics (which is a specific subfield of applied mathematics). In this workshop, participants will define their vision of the role played by mathematics educators in regard to the teaching of financial numeracy by exchanging their thoughts, categorizing tasks and by analysing some data.

Planned Activities & Working Format & Responsible Person

21:30–21:45 **Introduction + Developing a shared vision of financial numeracy**
Participants will identify some links between financial literacy and mathematics education. They will answer questions about their motivation and understandings of financial numeracy.

21:45–22:05 **Comparing and contrasting financial tasks**
Participants will be presented with financial tasks that portray money in different ways. In groups (elementary and secondary schools), they will find similarities and differences between these tasks and identify the mathematics and financial literacy.

22:05–22:20 **Moderated discussion of the findings**
The presenters will moderate a discussion on the findings from participants' group discussions.

22:20–22:35 **Presentation of a theoretical framework**
The presenters will present their conceptual framework. They will also provide some readings for participants to be familiarized with the notion of financial numeracy.

22:35–22:50 **Critical discussion on financial numeracy in schools**
Participants will have the opportunity to share their concerns, challenges, perspectives and experiences regarding financial numeracy in schools around the world.

22:50–23:00 **Conclusion**
We aim to create a community cantered around financial numeracy internationally. We will share resources and contact information for expanding these financial numeracy ideas.

WS2: International Mathematics Festival: A Fun and Collaborative Event for Students to Discover "Why" and "What If"

July 14, 21:30–23:00 **Location: T423**

Organiser: Mark Saul (Open House Education Foundation, China); Cherry Pu (Open House Education Foundation, China); Rick Sommer (Stanford University, USA)

Description:

A mathematics festival is an extra-curricular activity for K-12 students which provides them with advanced and attractive mathematics in a non-competitive situation. Rather than textbook exercises, a festival offers colorful puzzles, games, and hands-on activities to inspire students to think creatively and encourage collaborative problem-solving. Each activity comes with a wide range of problems on a given topic that students of different abilities can work on. Students can choose from among the activities freely, decide for themselves how long to work at each activity, and move to another table at their pace. The festival supports students' thought-process, helping them to discover mathematical patterns and relationships and to take joy in finding new insights. The length and depth of student engagement provides a useful evaluation of the activity.

We have originally planned to host a full-scale in-person mathematics festival at ICME-14. We have switched to an online version. At the beginning of the workshop, we will demonstrate a festival game and illustrates the progressive style of questions that students can explore. Then mathematics teachers and students will share their experiences. We will also conduct a live discussion with Rick Sommer, Hector Rosario and mathematics professionals who have extensive experience in K-12 mathematical enrichment programs.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Welcome and introduction**
Online/ Mark Saul and Cherry Pu

21:40–22:15 **Demo class of a festival game with international students joining online**
Online/ Mark Saul and festival table facilitator

22:15–22:30 **Interview with students and teachers**
Online and pre-recorded video / Mark Saul and Cherry Pu

22:30–22:45 **Panel discussion between Rick Sommer, Hector Rosario, Mark Saul and guest speakers on the K-12 mathematics enrichment program**
Online/ Mark Saul and Cherry Pu

22:45–23:00 **Q&A for conference participants**
Online/ Mark Saul and Cherry Pu

WS3: From the Power of Intuition to the Beauty of Abstraction

July 14, 21:30–23:00 **Location: T519**

Organiser: Damjan Kobal (University of Ljubljana, Slovenia)

Description:

Contrary to the fact that mathematics many ideas, beauty and inspiration are hidden within simple and intuitive patterns, which are easily noticed and 'intuitively understood', mathematics is considered very abstract. Therefore, the motivation for mathematics teaching and learning should be intuitive and the beauty of abstraction will rise from there.

The main aim of the workshop is to challenge our sensibility for the importance of the intuitive in mathematics teaching and learning. Participants will be challenged by smartly chosen hands-on (and eyes-on) problems. Like some 'graphic puzzles', which are understood in seconds, but are often harder to formulate then to solve. Through examples participants will explore how understanding, motivation and challenge often lie within intuitive comprehension and how abstraction (especially on the primary level) only follows later. For better imagination of what will be happening at the workshop, participants are invited to explore interactive applets at http://ko.fmf.uni-lj.si/ICME-14/ and at https://www.geogebra.org/m/yknjkxne.

Damjan Kobal has been a devoted teacher at high school and university level and a leading Slovenian educator for (high school) mathematics teachers. For many years he has been the leader of traditional seminars for mathematics teachers and frequent lecturer for teachers and students of all ages. He was a plenary speaker at the first international GeoGebra conference in Hagenberg, Austria, 2009 and has lectured on many international conferences and was hosted at many educational institutions from USA to India.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Introduction**
Presentation – discussion / Kobal

21:40–22:50 **Eyes-on problem solving**
Dynamic exploration / Kobal

22:50–23:00 **Sum it up and feed back**
Discussion / Kobal

WS4: Learning with Virtual Manipulatives

July 14, 21:30–23:00 **Location: T523**
Organiser: Philipp Legner (Mathigon, UK)

Description:
Manipulatives have been used in mathematics classrooms for many decades: they can transform how students engage with mathematical ideas by making abstract relationships more visual, by teaching creativity and problem-solving skills, and by allowing students to explore and discover. Similarly, virtual manipulatives have greatly increased in popularity in recent years – especially for remote learning. They can mirror the effects of their physical counterparts, and even support more complex interactions that are not possible in the physical world.

In this workshop, we will explore a wide range of manipulatives: from the popular numbers bars, fractions bars and algebra tiles to more unusual ones like prime factor circles, multiplication grids, spinners, non-transitive dice, balance scales, exploding dots, polyominoes or tangram. We will share a brief summary of existing research into virtual manipulatives, as well as many different examples and activities how manipulatives can be used in the classroom to engage students in deep mathematical thought: with topics ranging from simple arithmetic to advanced number theory. We will also show participants how they can use some of the free tools we have developed at polypad.org to conduct research studies. Most importantly, we want to hear participants' thoughts, ideas and experiences in order to aggregate a library of teaching ideas for virtual manipulatives, come up with innovative, new ideas for manipulatives to build in the future, and understand which data we are collecting would be most useful for researchers, so that we can make it openly available.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Introduction and research summary**
Lecture

21:40–22:00 **Using manipulatives: existing websites, tools, activities and resources**
Interactive lecture: participants can follow along on their own devices

22:00–22:10 **Using Polypad to conduct research studies**
Lecture

22:10–22:25 **Participants share their experience and thoughts on using/researching manipulatives**
Open discussion

22:25–22:45 **Come up with specific ideas for classroom activities, new types of manipulatives or research projects using manipulatives**
Break out into smaller groups

22:45–23:00 **Student data: what is most interesting for researchers? What data formats to use?**
Open discussion

WS5: Problem-based Learning: Enhancing Higher-order Thinking Skills in the Topic of Differentiation through STEM Approach

July 14, 21:30–23:00 **Location: T116**

Organiser: Sarveswary Velayutham (SMJK Chung Hwa Confucian, Penang, Malaysia); S.Kanageswari Suppiah Shanmugam (Universiti Utara Malaysia, Perlis, Malaysia); Tan Phei Ling (SMK(P) Methodist, Penang, Malaysia); Chia Hui Min (The Education University of Hong Kong, Hong Kong SAR, China)

Description:

STEM have attracted the attention of researchers and educators from all over the world. There is increasing effort in promoting students' learning in STEM related subjects. However, study conducted by Nadirah Mohd. Nasir and her team (2013) found that students have difficulties in applying the concepts and basic problem-solving skills on differentiation related with science and engineering subjects. Similar findings were also reported by Wright (2014) and suggested that extra cognitive task and abilities were needed in solving algebraic word problem. As such developing higher order thinking skills in the topic of differentiation warrants attention. Hence, this workshop is aimed at adopting Problem-based learning through STEM for participants to experience hands-on in applying the concept of differentiation to enhance HOTs. The activities in this workshop are designed to facilitate students' HOTs through enquiry-based learning. With the use of GeoGebra, an open source software, participants will explore on the concept of tangent, perpendicular lines, minimum and maximum value, rate of change and small changes to construct models with low cost material and solve three problems involving concept of maximum and minimum value. Appropriate use of computer software could help to enhance students' learning in topic related to calculus (Bognar et al., 2018; Cekmez, 2020). Besides, Engineering the models promotes participants visualization, relational learning and application of STEM in real life and hence meaningful learning occurs from the series of STEM integrated activities. After the workshop, participants would be more confident in facilitating their students' inquiry learning in the topic of Differentiation and spur their interest in Mathematics.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Introduction to the workshop and Pre-workshop questionnaire**
Colored sticky notes, discussion/ Chia,H. M. & Dr Sarves

21:40–22:00 **Understanding the model (interactive discussion)**
Power point/ Dr Kanages & Tan P. L

22:00–22:30 **Case study 1 – Students perspective & Case study 2 – Educators perspective**
Power point, interactive/ Tan P. L. & Dr Sarves

22:30–22:35 **Question and answer sessions**
Discussions/ Dr Kanages

22:35–22:45 **Post-workshop questionnaire & making reflection from the sticky notes from slot 1**
Colored sticky notes, discussion / Chia H. M.

WS6: The Felix Klein Project – Vignettes in Practice

July 14, 21:30–23:00 **Location: T218**

Organiser: Hans-Georg Weigand (University of Wuerzburg, Germany); Michelle Artigue (University of Paris, France); Christian Mercat (IREM de Lyon, France); Ferdinando Arzarello (University of Torino, Italy); Yuriko Baldin (Federal University of São Carlos, Brazil); Bill McCallum (University of Arizona, USA); Samuel Bengmark (University of Gothenburg, Sweden)

Description:

The Klein Project aims to present contemporary mathematics for secondary school teachers. The idea of the project is to transfer the ideas of the legendary books of Felix Klein: "Elementary Mathematics from a Higher Standpoint", written in the beginning of the 20th century, into the present. A collection of Klein Vignettes is found on the website (http://blog.kleinproject.org) in different languages. A Klein Vignette is a short article about a single mathematical topic. Vignettes are intended to give teachers a sense of

connectedness between the mathematics of the teachers' world and contemporary research and applications in the mathematical sciences.

Aims and ideas: Klein Vignettes are for teachers, but we also want to motivate them to bring ideas presented in the vignettes to the classroom. In some years of experience, we noticed that a) the ideas of the vignettes have to be supported by activities in the frame of professional development, and b) teachers had difficulties with the transfer of the Klein-ideas into the classroom, they had difficulties in creating adequate classroom materials.

This workshop pursues three aims:
a) We want to give best practice examples how the idea of the vignettes could be integrated into the professional development of secondary school teachers;
b) We want to motivate mathematicians to contribute to the Klein project with a new vignette;
c) We want to motivate especially mathematics educators to think about Bridging-Vignettes which bridge the gap between the mathematics explained in a classical vignette and its use in the classroom.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Introduction to the ideas of the Klein Project**
Presentation/ Hans-Georg Weigand.

21:40–22:00 **Creating vignettes and exploiting them with teachers and students: The case of a vignette on entrelacs**
Presentation of the vignette on Entrelacs, its story and associated resources. Practical work of design of entrelacs from some selected graphs. Michèle Artigue, Christian Mercat (France).

22:00–22:20 **Working with Klein Vignettes as teaching strategies in actual classrooms – issues and possibilities. Material for professional development and designing innovating didactical sequences**
Slide presentation / Report and interactive group discussion on given examples/ Yuriko Yamamoto Baldin (Brazil).

22:20–22:40 **From a Klein Vignette to a concrete material for the classroom: the secret message game. Contribution from a work done with Italian teachers**
Slides presentation/ using a software (PARI-GP) for illustrating the game/ short discussion with the ground / Ferdinando Arzarello (Italy).

22:40–23:00 **Klein vignettes and problem-based instruction**
We will give an example of how a Klein vignette can be adapted into materials for a workshop for teachers on problem-based instruction. Bill McCallum (USA).

WS

WS7: Developing Quality Criteria for Creating and Choosing Mathematics Learning Videos

July 14, 21:30–23:00 **Location: T316**

Organiser: Iresha Ratnayake (Technical University of Darmstadt, Germany); Eugenia Taranto (The University of Catania, Italy); Regina Bruder (Technical University of Darmstadt, Germany); Maria Flavia Mammana (The University of Catania, Italy)

Description:
In this workshop, we share the results of a joint project between two universities in Germany and Italy. The project's aim is to develop quality criteria to create or to choose mathematical learning videos. There are many mathematical learning videos freely available on the internet and daily many videos are uploading on various platforms. However, there are many important factors that need to be considered in creating and choosing a learning video. Thus, in our project, we suggest some quality criteria that are crucial to accomplish the intention expressed above. We started with a catalogue developed under the CAKE project (Feldt-Caesar & Bruder, 2018). This catalogue was a general one including quality criteria for digital learning environments. Following this, the current project was designed to develop quality criteria for learning videos from a mathematical perspective (Ratnayake et al., 2020). The result of our collaboration has generated two catalogues: (i) quality criteria for creators and (ii) quality criteria for users (teachers). In particular, our catalogues paid attention to learning situations, expected prior knowledge, accuracy of the content, learner's expectations, pedagogical consideration and design and technical consideration. During this workshop, we share the two developed catalogues to stimulate discussion with

colleagues in the mathematics education research community about ways in which they might be refined and extended and contribute to building a shared understanding of creation and the use of high-quality mathematics learning videos.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Watch learning videos and choose your favourite for your teaching intention - depending on a specific goal**
The organizers show some videos (chosen from YouTube) created to accomplish some mathematical teaching intentions. The participants choose the best one that they would like to use in their teaching while noting down the reason/s for their choice.

21:40–21:50 **Presentation and use of the catalogue "Quality Criteria for Teachers as Users"**
The organizers provide a link to the catalogue for users to the participants. The participants, individually, evaluate each video that they have watched using the catalogue which includes a 4-point Likert-style scale. They then, will share the evaluations in a Padlet and will start a discussion to choose the best one according to the results of the evaluations in small groups (depends on the number of participants).

22:50–22:05 **Group work and participants' feedback to the catalogue for users**
Based on this experience in the groups participants will then write down some suggestions in a Padlet, and/or critique, if any, about the catalogue for future use. They will write down these suggestions and will present at the discussion. Finally, the organizers conduct a discussion based on these suggestions.

22:05–22:25 **Watch learning videos from the designer's point of view**
The organizers show to the participants two videos created by teacher-students of each of the organizers' universities.

22:25–22:35 **Presentation and the use of the catalogue "Quality Criteria for Video Creators"**
The organizers provide a link to the catalogue for creators. The participants, individually, evaluate each video they watched using the catalogue which includes a 4-point Likert-style scale.

22:35–22:50 **Group work and participants' feedback to the catalogue for creators**
The organizers direct the participants to share their evaluations in a Padlet in groups. They will then discuss on participants' suggestions, and/or critique, if any, about the videos and/or the catalogue in groups in breakout rooms.Finally, the organisers will conduct a discussion on these suggestions.

WS8: Rich Math Activities for a Primary School Class

July 14, 21:30–23:00 **Location: T418**

Organiser: Vilalta, A. (Universitat Autònoma de Barcelona (UAB), Innovamat & eXplorium, Spain); Morera, L. (Universitat Autònoma de Barcelona (UAB), Innovamat & eXplorium, Spain); Solar, H. (Pontificia Universidad Católica de Chile (UC), Chile); Rojas, F. (Pontificia Universidad Católica de Chile (UC), Chile)

Description:
Innovamat is a project that develops resources to teach and learn maths at school. In 2020/21 almost 700 Primary Schools are using our program, mostly in Spain but also in France, Chile or Ecuador. According to NCTM Principles and Standards, we define 4 big maths processes: "Problem-Solving", "Reasoning and Proof", "Connections" and "Communication and Representation". Our activities always seek that children develop content and skills related to these processes, and this is why our teacher's guides focus on class conversation and materials manipulation. In addition to that, Innovamat is making big efforts to train Primary School teachers in teaching rich maths from a process point of view.

Our didactic team is led by experts from Universitat Autònoma de Barcelona (UAB) and the ideas beneath the project are based on research. Specifically, our main sources are Morera's doctoral thesis (directed by Fortuny, J. M., and Planas, N.), the Freudenthal Institute for Science and Mathematics Education, the Catalan official curriculum, USA Common Core and Mogens Niss' research. At this workshop, we are going to introduce, perform and analyse two examples of activities from our project. Therefore, this

workshop might be especially interesting for Primary School teachers and any person who wants to know about rich activities and discuss them. We are going to explain two activities, ask attendants to take part in solving every challenge like if they were students, and concurrently we are going to discuss, as teachers, the maths didactics and learning opportunities beneath all of it.

Planned Activities & Working Format & Responsible Person

21:30–21:45 **Definition of the framework: maths processes in the Innovamat project**
Computer and projector. / Exposition and group discussion. / Vilalta, A.

21:45–22:15 **Activity 1: Geometry**
Computer and projector, paper and three different coloured pencils. / Group discussion. / Vilalta, A. & Morera L.

22:15–22:45 **Activity 2: Productive thinking**
Computer and projector, paper. / Group discussion. / Rojas, F. & Solar H.

22:45–23:00 **Conclusions**
Computer and projector, paper. / Group discussion. / Vilalta, A.

WS9: Modelling Motion

July 14, 21:30–23:00 **Location: T120**

Organiser: Brian Doig (Deakin University, Australia); Susie Groves (Deakin University, Australia); John Cripps-Clark (Deakin University, Australia)

Description:

This workshop builds on the results of a research project, Modelling Motion: Developing Mathematics Concepts through STEM activities, which was funded by the Australian Association of Mathematics Teachers and the Australian Academy of Science. The activities were developed from the work of Galileo Galilei (1564-1642) who challenged the scientific wisdom of the Age that had been established by Aristotle.

In this workshop, attendees will perform activities, based upon the materials now available on the world-wide web, with a view to establishing the rôle of such activities as a part of a STEM programme that develops students' new mathematics, and not merely employs already known mathematics as a tool.

Planned Activities & Working Format & Responsible Person

21:30–22:00 **Session 1**
This session will begin with some background to the work of Galileo and the reSolve Project. As many of the activities in Modelling Motion require measurement of speed in term of time and distance, it is necessary to investigate what speed means conceptually.
A video of students investigating speed will be shown and the results discussed.
Note that the use of streamer graphs enables the mathematics to explain the physics.
Video with follow up discussion. / Brian Doig and John Cripps-Clark to lead the session.

22:00–22:30 **Session 2**
In this session we will employ Galileo's 'gravity diffuser' that allows us to measure how far a ball travels during successive time intervals. This was a crucial experiment that allowed Galileo to attack the Aristotelian precepts of motion. This activity builds on our experiences from Session One. The mathematics, again, is fundamental to explaining the physics. Finally, we will experiment with what happens to objects that are free-falling under gravity, and thus establish a mathematical relationship between distance fallen and time. Discussion will, of course, round off our activity.
Video with follow up discussion. / Brian Doig and John Cripps-Clark to lead the session.

22:30–23:00 **Session 3**
In this final session we will investigate what happens when a motion is the result of two forces. While this is a simple experiment, the mathematics is not so simple for those of us with experience with a Cartesian plane.

A video of the experiment will be followed by a discussion that will recapitulate the set of activities viewed and discussed in all three sessions and also discuss some of the other activities from the Modelling Motion research.
Video with follow up discussion. / Brian Doig and John Cripps-Clark to lead the session.

WS10: Poly-universe & Lénárt Sphere: Manipulatives from Hungary

July 14, 21:30–23:00 **Location: T124**

Organiser: Eleonóra Stettner (Hungarian University of Agriculture and Life Sciences, Hungary); Zsuzsa Dárdai (Poly-Universe Ltd, Hungary); István Lénárt (Eötvös Loránd University, Hungary); János Saxon Szász (Poly-Universe Ltd, Hungary); Réka Szász (Budapest Semesters in Mathematics Education, Hungary); Szabina Tóth (Szabó Lőrinc Bilingual Primary and Secondary School, Hungary)

Description:
Tools for Participants: In order to enhance the experience, we recommend participants to have the following tools available during the workshop (they are not required): laptop or tablet, two oranges, coloured pens or markers that can mark the oranges, rubber bands, toothpicks, bottle caps.

Hungary has a strong tradition of using games and manipulatives to develop concept building and problem solving in mathematics. The workshop presents online adaptations of two educational tools: the Lénárt Sphere developed by István Lénárt, and the Poly-Universe set developed by János Saxon Szász. Both tools are used with 6-18 year-old students and in teacher training.

The aim of the Lénárt sphere is to explore analogies and differences between the plane and the sphere, which helps students understand how relative all axioms and theorems of science are, and also develop understanding of those who are different in their cultural or social background. The workshop will demonstrate how ball geometry can be taught online or in person using simple tools such as oranges and rubber bands.

The Poly-Universe (PUSE) is an educational tool that originates from art, and connects multiple subjects and mathematical topics through scale shifting symmetry and color combinations. In the workshop participants will have the opportunity to try out and discuss the e-learning platform of the tool, which is an online application for manipulating the set and solving tasks that involve both analytic and visual thinking.

Planned Activities & Working Format & Responsible Person

21:30–21:35 **Introduction**
Lecture / Szász

21:35–22:15 **Ball Geometry Activities**
Interactive / Lénárt

22:15–22:55 **Poly-universe Activities**
Interactive / Dárdai, Saxon, Stettner, Tóth

22:55–23:00 **Wrap-up**
Discussion / Szász

WS11: Math for All: Professional Learning to Help Teachers Reach All Students in the Mathematics Classroom

July 14, 21:30–23:00 **Location:T128**

Organiser: Babette Moeller (Education Development Center, USA); Matt McLeod (Education Development Center, USA)

Description:
Persistent differences in mathematics performance between general and special education students underscore the need for improving teachers' preparation to better serve the needs of students with different strengths and needs. Math for All (MFA; Moeller et al., 2012; 2013) is an evidence-based, intensive, 50-hour professional learning program designed to help general and special education teachers

in grades K–5 make high-quality mathematics instruction accessible to ALL students, including students with disabilities. This workshop is intended for mathematics teacher educators and researchers. Our overall aims are to illustrate key professional learning strategies employed by Math for All to better equip teachers for planning cognitively demanding mathematics lessons that build on diverse students' strengths and needs, and to share research findings that demonstrate the efficacy of the program. We will demonstrate these strategies by engaging participants in the following activities in a hands-on manner: (1) learning about a neurodevelopmental framework for learning (e.g., Barringer, Pohlman & Robinson, 2010; Pohlman, 2008), (2) applying the neurodevelopmental framework in the analysis of the demands of a mathematical task and a focal student's strengths and needs using segments from a video-recorded third-grade case lesson on multiplication, and (3) reflecting on how instructional strategies for a mathematical task can be adapted to build on the strengths and needs of a focal student without undermining the rigor of the mathematical goals. We will conclude with sharing findings from multiple research studies that have demonstrated the efficacy of the Math for All approach.

Planned Activities & Working Format & Responsible Person

21:30–21:45 **Math for All overview & introduction to the neurodevelopmental framework**
Small group and large group discussions (Babette Moeller).

21:45–22:05 **Analysis of the demands of the mathematical task of a case lesson**
Viewing of video clip of the case lesson's teacher introducing the math task
Hands-on exploration of the math task
Small and large group discussion of the demands of the math task (Matt McLeod)

22:05–22:25 **Observation of a focal student from the case lesson to understand her strengths and needs**
Viewing of video clip of a focal student working on the math task
Small group and large group discussion of the focal students' strengths and needs (Babette Moeller).

22:25–22:45 **Discussion of the mathematical goals of the case lesson and instructional strategies employed by the case lesson teacher**
Large group discussion of the mathematical goals of the case lesson's math task
Small group viewing of video clips of case lesson teacher working with the focal student and other students as they engage in the math task
Large group discussion of instructional strategies and how they align with the focal students' learning profile and support the goals of the lesson (Matt McLeod).

22:45–23:00 **Discussion of research findings**
Large group discussion (Babette Moeller & Matt McLeod).

WS

WS12: Teaching Mathematics for Social Justice in TVET Colleges

July 14, 21:30–23:00 **Location: T132**

Organiser: Siphokazi Winniefred Vimbelo (Cape Peninsula University of Technology, South Africa)

Description:
The organiser is Ms Siphokazi Winniefred Vimbelo from Cape Peninsula University of Technology in South Africa. The workshop will be about teaching mathematics for social justice in TVET colleges. Mathematics is often seen as the most neutral of discipline within a given curriculum, one that is removed from the arguments and controversies of politics and social life (Yeh & Otis, 2019). However, in reality, it is like all other disciplines of learning- it sits within larger fields of social, cultural, and political beliefs and practices (Greenstein & Russo, 2019). It can serve as a powerful means for developing students' understanding of issues of social justice and the students are likely to develop an understanding of both social justice issues and mathematical concepts. One of the greatest challenges in learning to teach mathematics for social justice is a requirement for negotiation and integration of mathematical goals with social justice goals (Yeh & Otis, 2019). Teaching mathematics through social justice becomes a way to make the learning more relevant to students' real – life examples (Harrison, 2015). Hence the workshop on teaching mathematics for social justice. The workshop will consist of 4 components:

- Narratives – participants will be writing narratives about their current praxis and will shared.

- Brainstorming – PowerPoint presentation and Gutstein's book will be used but we will focus only on his projects.
- Implementation – Participants will be designing lessons based on TMfS and lesson will be presented.
- Reflexive Activity – participants will be reflecting on the workshop and lessons and write narratives.

Planned Activities & Working Format & Responsible Person

21:30–21:50 **Narratives – about current praxis**
Templates.

21:50–22:10 **Brainstorming**
Power Point slides (Gugu'story and Gutstein's book (2006) "Reading and writing the world with mathematics".

22:10–22:40 **Implementation – lesson presentations**
Gutstein's projects to be used

22:40–23:00 **Reflexive activity**
Template

WS13: Self-made Automata to Teach Mathematics in Preschool

July 14, 21:30–23:00 **Location: T222**

Organiser: Oliver Thiel (Queen Maud University College, Trondheim, Norway); Piedade Vaz Rebelo (University of Coimbra, Portugal)

Description:
The workshop disseminates findings from the European research project AutoSTEM. The aim of the project is to investigate how automata can enrich young children's play to promote a better understanding of Science, Technology, Engineering, and Mathematics (STEM). It aims to provide preschool teachers and other stakeholders of young children's education of tools and materials to build a didactic path, which is simple, replicable, and valuable in terms of

1) promotion of a motivation for STEM, especially mathematics,

2) promotion of the development of creative thinking, problem-solving, and comprehension ability, and

3) cultural awareness and transversal values such as recycling.

Automata are fascinating mechanical toys. Due to the combination of narrative and mechanical parts, automata have several possibilities for use within education. They are easy to create in the classroom, suitable for the children's age, with simple to complex designs and motions. In the project, we use a relational play-based pedagogy (Hedges & Cooper, 2018) and a dynamic learning concept (Broström, 2017).

In the workshop, we will present the 'snapping crocodile' developed by the project and discuss how they can be used to teach mathematics in the early childhood classroom (preschool and kindergarten). A major part of the workshop will be hands-on work where participants will make their own mechanical crocodile. To participate, you have to prepare: cardboard (at least A4 in size), a wooden skewer or an awl, scissors or a knife, 10 split pins (paper fasteners). Target group for the workshop are preschool teachers and educators.

Planned Activities & Working Format & Responsible Person

21:30–21:50 **Automata in early childhood mathematics education**
Short presentation of the project's findings – O. Thiel

21:50–22:40 **Making a 'snapping crocodile'**
Participants make their own crocodile from recycled materials and experience how they are related to maths concepts – O. Thiel

22:40–23:00 **Pedagogical concepts and ideas**
Participants reflect on and discuss how the presented automata can be used to teach mathematics in preschool – O. Thiel

WS14: Exploratory Lessons Using Pop-up Cards and Making of Cards

July 14, 21:30–23:00 **Location: T226**

Organiser: Kazumi Yamada (Niigata University, Japan); Takaaki Kihara (Nagaoka Institute of Design, Japan); Anri Yamada (Tama Art University, Japan)

Description:

(1) Making of cards as the teaching materials of the space figure

We have been continuing workshops on ICME11, ICME12, and ICME13 about teaching spatial figures using pop-up cards.

A static figure is used in the learning of the plane figures. In contrast, it is important to present the shapes of the spatial extent and dynamic movements when a teacher teaches a space figure. When making a card, a three-dimensional card is completed by trial and error, making a cut in a plane (card) plan, and opening and closing a card repeatedly. Especially, the popup card called "the origami architecture" is effective as the teaching material.

(2) Exploratory classes using pop-up cards

Let's create the pop-up card. You will discover that if you make the cards correctly, you can fold the cards and stack. This is a meaningful discovery that easily checks the correctness of the design drawing. While repeating the card making, various questions will arise and discover many properties. For example, they are as follows. "In the blueprint, where are the cut lines? Where are the folds? Are there any secrets to these lines?" In this workshop, we perform a class to discover these mathematical properties for searching with a participant of the part of student.

(3) Making works

Make works with Kihara. Teaching material 1 is a pop-up card that opens at 90 °, where the house appears. Teaching material 2 is a pop-up card, where the house appears when it opens at 180 °.

Planned Activities & Working Format & Responsible Person

21:30–21:50 **Discovery of exploratory mathematical properties through pop-up card creations**
Online Lecture / Kazumi Yamada.

21:50–22:20 **Exploratory class using pop-up cards**
Online Activity / Kazumi Yamada, Anri Yamada

22:20–22:50 **Making of pop-up cards**
Online Activity / Takaaki Kihara.

22:50–23:00 **Question and answer**

WS15: Challenging Ableist Perspectives on the Teaching of Mathematics: A CAPTeaM Workshop

July 14, 21:30–23:00 **Location: T230**

Organiser: Elena Nardi (University of East Anglia, UK); Irene Biza (University of East Anglia, UK); Solange Hassan Ahmad Ali Fernandez (Universidade Anhanguera de São Paulo, Brazil); Lulu Healy (King's College London, UK); Érika Silos (Universidade Federal Fluminense, Brazil); Angeliki Stylianidou (University of East Anglia, UK)

Description:

The CAPTeaM project (Challenging Ableist Perspectives on the Teaching of Mathematics) sets out from the assumption that, rather than being the consequence of internal, individual factors, disabled students' oft-reported underperformance in mathematics can result from explicit or implicit exclusion from mathematics learning. The project challenges teaching practices that contribute to such exclusion and that may emanate from ableist perspectives on mathematics. The project's aims cohere with the 2006 United Nations Convention on the Rights of People with Disabilities. The project endorses a Vygotskian historical-cultural perspective and elements of embodied cognition and its data consists of written

responses and video recorded work on two types of tasks, Type I and Type II, by pre- and in-service teachers of mathematics.

In Type I tasks, participants engage with classroom episodes that evidence mathematical contributions which are made by students with a physical disability (e.g. are visually or hearing impaired), have the potential to shift classroom mathematical discourse towards creatively unexpected turns and may bring learning benefits to all in class. Said episodes are selected from the databases of the Brazil-based (Rumo à Educação Matemática Inclusiva) and UK-based project partners. In Type II tasks, participants engage in small groups with solving a mathematical problem while at least one of them is temporarily and artificially deprived of access to a sensory field or familiar channel of communication. Work on tasks concludes with sharing reflections in plenary discussion.

This workshop will engage participants with tasks of Type I and II and will last 90 minutes.

Planned Activities & Working Format & Responsible Person

21:30–21:35 **What is CAPTeaM?**
The project lead presents a brief introduction to the CAPTeaM project. / Nardi, brief exposition

21:35–21:55 **A CAPTeaM activity (Type I)**
Participants engage with a CAPTeaM Type I activity. / Nardi, Biza; participants work in small groups

21:55–22:10 **Plenary discussion I**
Participants share the work generated in small groups with the whole group and reflect on the experience. / Nardi, Biza; whole group discussion

22:10–22:30 **A CAPTeaM activity (Type II)**
Participants engage with a CAPTeaM Type II activity. / Nardi, Biza; participants work in groups of three

22:30–22:45 **Plenary discussion II**
Participants share the work generated in the groups with the whole group and reflect on the experience. / Nardi, Biza; whole group discussion

22:45–23:00 **CAPTeaM findings: the present and the future, Q&A, reflections and evaluation**
The project lead outlines project findings so far and maps plans for the future. Participants ask questions and reflect on/evaluate the experience of participating in the workshop. / Nardi, brief exposition; then, all.

WS16: Networking Design Approaches: Around the Teaching of Mathematical Proof

July 14, 21:30–23:00 **Location: T234**

Organiser: Tatsuya Mizoguchi (Tottori University, Japan); Ignasi Florensa (Escola Universitària Salesiana de Sarrià, Spain); Koji Otaki (Hokkaido University of Education, Japan); Hiroaki Hamanaka (Hyogo University of Teacher Education, Japan)

Description:
This workshop is based on part of an ongoing research project regarding the cultural and anthropological study on the development of competencies of mathematical proof throughout of secondary school. This workshop will focus on the design of teaching, especially for mathematical proof task. For this, various designs based on different theoretical approaches will be compared and their characteristics will be considered. Therefore, the key questions of this workshop are as follows: (1) How teaching of mathematical proof can be designed with each approach; (2) What characteristics each approach has in the design process; (3) How does each approach complement the others?

In this workshop, we will consider three different approaches: Study and research paths (Q-A map) in the Anthropological Theory of the Didactic; Japanese problem-solving lesson model (so called open approach); Substantial Learning Environment. Based on the planned structure shown below, this workshop accesses the above questions by designing teaching for a common mathematical task and then comparing (networking) them. There will be cultural and theoretical differences in teaching design. In this workshop,

we will inquire the possibility of new approaches to these problems through collaboration with participants.

The workshop will be organized jointly by Japan and Spain. In addition, the workshop will be conducted in cooperation with the following prospective contributors (project members): Yoshitaka Abe (Niigata, University), Terumasa Ishii (Kyoto University), Hiroyuki Kumakura (Shizuoka University), Susumu Kunimune (Shizuoka University), Takeshi Miyakawa (Waseda University), Yusuke Shinno (Hiroshima University), Yuki Su.ginomoto (Nagasaki University).

Planned Activities & Working Format & Responsible Person

21:30–21:35 **Introduction and overview of WSG**
All participants / T. Mizoguchi.

21:35–21:50 **Introducing the common task**
All participants / H. Hamanaka

21:50–22:20 **Short keynotes: theoretical tools and the teaching-designs**
All participants / I. Florensa, T. Mizoguchi, & K. Otaki

22:20–22:50 **Discussing along with the key questions**
All participants / I. Florensa, T. Mizoguchi, K. Otaki, & H. Hamanaka

22:50–23:00 **Summarizing: reflections and further considerations**
All participants / I. Florensa, T. Mizoguchi, K. Otaki, & H. Hamanaka

WS17: Linguistic and Logical Methodological Tools to Address Language Diversity in Mathematics Education

July 14, 21:30–23:00 **Location: T302**

Organiser: Viviane Durand-Guerrier (University of Montpellier, France); Cris Edmonds-Wathen (Charles Darwin University, Australia); Faiza Chellougui (University of Carthage, Tunisia); Judith Njamgong Ngonsap (University of Yaoundé, Cameroun); Jean-Jacques Salone (CUFR of Mayotte, France)

WS

Description:
The aim of the workshop is to share with an international audience the linguistic and methodological tools we are developing in our own multilingual contexts in order to discuss the possibility of their generalisation, how to improve them for wider use and to initiate international collaborations involving a variety of languages.

The main idea underlying this proposal is that in multilingual contexts differing grammatical structures of languages might affect the process of teaching and learning mathematics, whatever the level of instruction, considering that switching from one language to another in a classroom might be both an obstacle or a resource, and that translating even the most straightforward of mathematical statements from a language to another presents challenges. We also consider the issue raised by the translation of transcripts of classroom situations for communication of our research for an international audience this being even more accurate for research on language diversity.

The workshop will comprise one session of 90 minutes, with previous asynchronous activities consisting in watching videos presenting our methodological tools, answering a short questionnaire, including a short transcript to translate in the participants own preferred language. During the session, the participants will 1/ Share questions and comments on the methodological tools shared via the videos; 2/ Small groups discussions on grammatical issues raised by the translation of the transcripts, and the relevance and the limits of the shared methodological tools; 3/ Collective synthesis of the small groups work; 4/ Perspective for possible future collaborations.

Planned Activities & Working Format & Responsible Person

21:30–21:45 **Sharing questions and comments on the methodological tools**
Collective discussion / VDG & CW

21:45–22:45 **Working and discussing on translation issues in multilingual contexts and in communication of research results**
Small groups works on issues arising while the translation / FC, VDG, CEW, JNN, JJS

Report of small groups works and collective discussion / FC, VDG, CEW, JNN, JJS

22:45–23:00 **Toward future collaborations**
Collective discussion and paths for going on working on this topic / VDG & CEW

WS18: Topological Approach to Game Theory

July 14, 21:30–23:00 **Location: T305**

Organiser: Giovanna Bimonte (University of Salerno, Italy); Francesco Saverio Tortoriello (University of Salerno, Italy); Ilaria Veronesi (University of Salerno, Italy)

Description:
We present a laboratory developed in the mathematics activities during the lessons of the research –project "Mathematical High School" at the University of Salerno.

In Italian higher education, the topic of "Game Theory" is not included in the ministerial indications

of the mathematics curriculum. Students do not have the prerequisites that allow them to understand and solve optimisation problems of several variables. We decided to use a geometric approach applied to localisation problems. Competitive Localisation Models are concerned with the fact that some structure is already in the market and the new structure will compete for market share (Hotelling1929).

We consider a continuous location optimization problem, where an optimal location is found in a continuum on a plane. We introduce the Voronoi diagram in order to solve the location problem, in which the number of players is determined exogenously. We use Delaunay triangulation to find the equilibrium point, and consider some generalizations of the of the ordinary Voronoi diagram.

The solution of the problem in the planar case with Euclidean distances and a variety of functions of attraction leads to a finite polynomial algorithm in the number of consumers. Using a dynamic geometry software we construct our case study on the Cartesian plane, we check how the results change as the starting conditions vary and we obtain the solutions without even performing the simple calculations required by the Cartesian geometry to find the equilibrium point.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **State of art**
Group activities – G. Bimonte.

21:40–21:50 **Dynamic mathematics software**
Group activities – F.S. Tortoriello.

21:50–22:00 **Topological approach to Game Theory**
Group activities – I. Veronesi

22:00–22:15 **Laboratory of positional games**
Group activities – G. Bimonte, F.S. Tortoriello, I. Veronesi.

22:15–23:00 **Laboratory on the topological approach, solutions and discussions**
Group activities – G. Bimonte, F.S. Tortoriello, I. Veronesi.

WS19: Global Math Stories: Travel the World, Explore Social Justice, and Deepen Your Understanding of Math

July 14, 21:30–23:00 **Location: T306**

Organiser: Chadd W. McGlone (Teachers2Teachers Global, United States); Hanna Haydar (City University New York - Brooklyn College, United States); Paola Castillo (Teachers2Teachers Global, Ecuador)

Description:
Mathematics class comes alive through global connections. Unfortunately, many classroom teachers lack the time and resources to require to make these connections. GlobalMathStories.com is a free resource for making global connections in the classroom. The site consists of approximately 75, one-page stories written by people from around the World. Teachers may choose to write their own lessons from the stories

or use one of the lessons already developed. Each story contains resources to further explore the culture and social justice questions behind the mathematics.

In this workshop, participants will learn about the site and how to use it in their classroom. First, they will participate in a mathematical task based on one story. In addition to completing the tasks, individuals will consider social justice questions associated with the story. Throughout, the presenters will emphasize the importance of reading an audience and telling a great story during the lesson. Next, participants will explore a second story. Working as teams, groups will propose mathematical tasks they might create based on the story. Additionally, they will propose social justice questions that arise from their exploration. Next, participants will choose a story from the site to develop. They will present the story to the audience and describe how a lesson would progress, complete with a social justice question.

Finally, everyone will discuss how connections of local and global cultures enhance student learning. They will be invited to contribute stories to the site and to share it with educators and authors in their communities.

Planned Activities & Working Format & Responsible Person

21:30–21:50 **Model lessons drawing from a Global Math Story (GMS). GMS set the reader in a culture and provide opportunities to complete mathematical tasks based on that story. The presenter will outline how a lesson might look using a GMS.**
Cooperative learning in groups. Chadd McGlone Hanna Haydar, and Paoula Castillo

21:50–22:10 **The presenter will tell another GMS and allow participants to work in groups to design a mathematical task based on that story. An emphasis will be on helping participants understand they must bring students into the story. Additionally, participants will learn how easy it is to connect stories to mathematical tasks.**
Cooperative learning in groups. Chadd McGlone Hanna Haydar, and Paoula Castillo

22:10–22:40 **Participants will choose one of 60 available stories from which to develop a lesson. They will create a mathematical task from the story and present the story to others in the workshop.**
Cooperative learning in groups. Chadd McGlone Hanna Haydar, and Paoula Castillo

WS20: Enhancing Oral Practice in Mathematics Class

July 14, 21:30–23:00 **Location: T309**

Organiser: Luca Agostino (Université d'Evry, France)

Description:

Presentation of the speaker: Luca Agostino:

Mathematics teacher in the secondary school, I work also as teacher trainer and prepare and follow the entering in the school system for young teacher. My research activity is developed in Université d'Evry and it is focused on the oral practices in the maths classes and on the international comparisons of the teacher training systems.

This workshop will allow participants to share our experience of testing out the construction of mathematical reasoning by giving the students enough time to build complex argumentative sequences. In the french high school La Plaine de Neauphle we use whiteboards to induce group work, enhance cooperative and oral skills though students debate.

Starting and ending rituals: starting and endings of a class time are often the right time to bring the students to talk: whether it is to recap the last session or sum up this one, to correct homework or to answer a few questions in order to jog one's memory about last chapter, it can be a useful time if well managed.

Running oral examinations instead of written ones will grow the students accustomed to talk in front of a crowd (or a at least a jury). The students being both speaker and listener, they will integrate the right attitude and rules of oral presentations, with the help of the teacher, who can present a first set of rules, which will be sharpened during the course of the year and the student's suggestions.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Starting and ending rituals**
Presentation, exchanges and debate

21:40–21:50 **Oral examinations**
Presentation, exchanges and debate.

21:50–22:50 **Educational walls**
Group work and roleplay

WS21: Mathematical Performance-based Learning Workshop

July 14, 21:30–23:00 **Location: T323**

Organiser: Jing Yang, Fan Zou, Shuyang Sun (Math Teacher Research Group from Yungu School, China); Xuanzhe Sun, Chuan Qu, Chengzhi Yu (Students from Hangzhou Yungu School, China)

Description:
We are a group of teachers from Hangzhou Yungu School. In this workshop, we will share how to build a mathematical performance task of real-life situation, by going through some daily practices we had in the past four years. We believe that by real-world performance-based learning, students are guided to apply mathematical knowledge and skills both inside and beyond subject learning, to help students to perceive math as sensible and worthwhile. Not only content knowledge and procedural fluence skills can be improved, but also problem solving and mathematical reasoning skills. We want to inspire students to recognize and apply connections among math and outside of math.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Warm-up:**

(1) Self-introduction

(2) Icebreaking time: a math board game created by Yungu students

(3) Clarify the major goals of the workshop
Material: Board games designed by Yungu students / Portable Tables and Chairs
Working Format: Presentation and a math game
Responsible Persons: 3 Yungu students and 3 teachers together.

21:40–22:10 **3 Presentations by Yungu students**
Material: Projector (Apple TV preferred)
Working Format: Presentations
Responsible Persons: 3 Yungu students and Jing Yang

22:10–22:50 **Daily practices of mathematical performance-based learning in Yungu School**
Material: Projector (Apple TV preferred)
Working Format: Presentations
Responsible Persons: Fan Zou/Shuyang Sun

22:50–23:00 **Summary**
Working Format: Presentation
Responsible Person: Jing Yang

WS22: Exploring the Role of Online Interactive Technology in Supporting Dialogue in Mathematics Classrooms: Lesson Study in a Chinese Primary School

July 14, 21:30–23:00 **Location: T319**

Organiser: Qian Liu[1], **Yuan Zhang[2],** Manqi Yu[2], Xianzhong Chen[2], Pan Liu[2], Taifeng Shen[2], Huayan Sun[2], Yingying Zhang[2], Yanyu Zhang[2], Guijuan Wang[2] ([1]University of Cambridge, China; [2]Hangzhou Yungu School, China)

Description:

The theory-informed and practice-based workshop is organised and presented by the mathematics research group in Hangzhou Yungu School directed by Yuan Zhang and the PhD candidate, Qian Liu. The knowledge, experience and teaching practice shared and discussed here were derived from the two-year lesson study program conducted in Hangzhou Yungu school. The lesson study inquiry was underpinned by the theoretical assumption that the pedagogically appropriate use of digital technologies could resource, expand and deepen classroom dialogue and in turn promote students' mathematical attainment, understanding and higher order thinking (e.g. Howe et al., 2019; Mercer & Sams, 2007). Based on this, ten primary mathematics teachers and the researcher explored and investigated what affordances of online interactive technology are potentially beneficial for primary mathematics dialogue and how the affordances can be effectively enacted with dialogic teaching to support productive classroom dialogue. Our workshop, bridging dialogic theory and school-based classroom practices, aims to enrich participants' understanding about the role of online interactive technology in mathematics teaching and learning from the dialogic perspective. Secondly, we would like to share our developed teaching models respectively applied in the whole-class and student-led group sessions, the corresponding pedagogical approaches and strategies exemplified by real lesson cases. More importantly, the workshop designed and organised in a dialogic manner aims to draw participants into a diverse dialogue. We will invite participants to share their comments, suggestions and questions and design together the potential pedagogical use of online interactive technologies for productive dialogue based on one provided lesson episode.

Planned Activities & Working Format & Responsible Person

21:30–21:35 **Opening and welcoming & Clarifying main objectives and structure of the workshop & Ice-breaking online interactive activity**
Introduction and online interaction (Pan Liu)

21:35–21:50 **Overview of the theoretical framework and the lesson study inquiry in Yungu school & The potentially supportive role of online interactive technology in classroom dialogue**
Presentation (Qian Liu) Discussion (Qian Liu)

21:50–22:15 **Lesson cases**
Presentation (Xianzhong Chen & Manqi Yu)

22:15–22:45 **Instructional design employing digital technology**
Group activity & Discussion (Yuan Zhang)

22:45–23:00 **Comments and additional questions & Conclusion**
Q & A (Yuan Zhang, Qian Liu)

WS23: Frame Thinking in Adaptive Learning

July 14, 21:30–23:00 **Location: T223**

Organiser: Yang Cao (Nanzhong Education, China)

Description:

Name of organizer: Yang Cao

- Former product manager of iFLYTEK ZHIXUE Adaptive Learning System
- Former assistant of iFLYTEK's Vice-President
- Sole author of series of Learn Math, This Way!, published by University of Science and Technology of China Press(2019/2020), ISBN：978-7-312-04688-9/978-7-312-05014-5

This WSG aims at how to apply frame thinking in automatic learning controlled by students themselves.

Followed the opinion described in Learn Math, This Way!, Yang Cao will give a brief introduction to Frame Thinking and some examples about alleviating the burdens of K12 student's maths learning and enhancing their abilities on mathematical modelling.

Then, other participants, including some experts in adaptive learning, will illustrate their practices in structurized maths problems solving, supported by abundant and vivid data collected from middle and primary schools.

Finally, all the staff will discuss how to improve the efficiency of maths learning empowered by innovation in mathematical thinking method and by IT product optimization.

Planned Activities & Working Format & Responsible Person

21:30–21:50 **How frame thinking makes maths easy and interesting?**
PPT, sponsored by Yang Cao

21:50–22:30 **Adaptive learning practices put into execution in chinese middle and primary schools**
PPT, sponsored by other participants

22:30–23:00 **Free discussion (innovation in mathematical thinking method or IT product optimization?)**
Not defined, responsible person: Yang Cao

WS24: Mathematics Learning and Mathematics Games

July 14, 21:30–23:00 **Location: T219**

Organiser: Hongliang Shi (No. 2 High School of East China Normal University, China); Fanglin Tian (No. 2 High School of East China Normal University, China); Zhiyu He (No. 2 High School of East China Normal University, China)

Description:
The organizers in the workshop are math teachers instructing students aged 12-18. Many of the teachers are members of a program named Mathematics Learning and Mathematics Games. Professor Shi is the leader of the organizers. He is the deputy director of Basic Education and Lifelong Education Development Department of East China Normal University, the vice principal of No.2 High School of East China Normal University, and the host of the Mathematics Base of the Fourth Phase of Shanghai Famous Principals and Educators Project and the council member of Shanghai Mathematics Society.

The aim of this workshop is to show our work on combining mathematics learning and mathematics games and to hold a mathematics festival.

In the workshop, we will share the detail of our practice, give a brief review of the results to the questionnaires and interviews, and share our experiences about the series of activities. What's more, we will hold a mathematics festival, which includes 15 games. Every participant in our workshop is allowed to play the games they are interested in and can switch to another game as they wish. Different games are played at different tables at the same time and players can discuss the answers with table leaders. In particular, we will display several traditional Chinese games such as Chinese Rings, Tangram, Magic Square and so on. Welcome game lovers and math fans from all over the world to join us.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Aims and meanings**
Lecture / Hongliang Shi

21:40–22:00 **What have we done?**
Lecture / Fanglin Tian

22:00–22:50 **Mathematics festival**
Games / Hongliang Shi, Fanglin Tian, Zhiyu He

22:50–23:00 **Conclusions**
Lecture / Zhiyu He

WS25: Mentoring Student in the Innovative Mathematics Mini Projects

July 14, 21:30–23:00 **Location: T225**

Organiser: Jieliang Wang (High School Affiliated to Fudan University, China); Xiao Enli (High School Affiliated to Fudan University, China); Yang Liting (High School Affiliated to Fudan University, China); Guo Tianxiang (Shanghai Caoyang No. 2 High School, China)

Description:

This theme has created a training model for talent education. Through this model, the educational and teaching notion of educating people have been set, and the basic principles for guiding students in the innovative mathematics mini projects have been determined. Those principles are: principle of basis, principle of self-motivation, principle of capacity, principle of innovation, principle of rigor. In order to achieve the expected goals and the basic principles, the specific practices of our team are as follows:

1. Strengthen the cultivation of thinking ability.
2. Offer 6 series of mathematics lectures.
3. Organize seminars to cultivate students' important abilities and habits.
4. Specific methods to instruct students to conduct innovative mathematics mini projects.
5. Instruct students to participate in extra-curricular activities.
6. Promotions of innovative mathematics mini projects.

We aim to enhance the academic ability of the students by implementing the research and learning model based on writing innovative mathematics essays in the high school stage. By instructing students to participate in various scientific and technological innovation activities, mathematics competition and academic exchange activities at home and abroad, we help students to dedicate to their own research in mathematics from basic mathematic problem study. We have concluded a process for guiding students to conduct innovative mathematics mini projects and have been following up with the growth of their academic abilities in the long run.

Planned Activities & Working Format & Responsible Person

21:30–21:37 **Introduction of team leader and team members, the background and expertise of the team leader**
Presentation / Jieliang Wang, Xiao Enli, Yang Liting, Guo Tianxiang

21:37–21:55 **Detailed description of the topic theme**
Presentation / Jieliang Wang, Guo Tianxiang

21:55–22:07 **Specific practices of our team**
Presentation / Jieliang Wang, Guo Tianxiang

22:07–22:25 **Specific methods to instruct students to conduct innovative mathematics mini projects**
Presentation / Jieliang Wang, Guo Tianxiang

22:25–22:50 **Instructing students to participate in extra-curricular activities and promotions of innovative mathematics mini projects**
Presentation / Jieliang Wang, Guo Tianxiang

22:50–23:00 **Interactive communication**
Jieliang Wang, Xiao Enli, Yang Liting, Guo Tianxiang

WS26: Folding for Fractional Understanding

July 14, 21:30–23:00 **Location: T313**

Organiser: Björg Jóhannsdóttir (California State University, Stanislaus); Heather Coughlin (California State University, Stanislaus)

Description:

This interactive online workshop is run by Dr. Heather Coughlin and Dr. Björg Jóhannsdóttir, veteran teacher educators and designers of professional development workshops for teachers in mathematics.

The goal of this workshop is to introduce paper strips as manipulatives to foster understanding of fractions. Attendees gain appreciation for the versatility of the paper strip to visualize concepts, link fractions to the whole numbers, and building arithmetic algorithms. By manipulating a paper strip, fraction definition emerges, and addition, subtraction, multiplication, and division of fractions actually make sense, as the operations become alive in the students' hands. Each activity presented in the workshop can be used, as exhibited, in the classroom, so attendees walk away with creative activities to build students' understanding of fractions.

Grade Level: 3-5.

Required Material: Paper Strips (approx. 2 cm), writing utensils.

Planned Activities & Working Format & Responsible Person

21:30–21:32 **Introduction**
Dr. Coughlin and Dr. Jóhannsdóttir

21:32–21:37 **Definition of fractions**
Dr. Jóhannsdóttir

21:37–21:42 **The paper strip as a number line**
Dr Coughlin

21:42–22:53 **Group work: addition, multiplication, and division of fractions with paper strips**
Dr. Coughlin and Dr. Jóhannsdóttir

22:53–23:00 **Thank you and questions**
Dr. Coughlin and Dr. Jóhannsdóttir

WS27: Simulation Games for Geometry Learning and the Development of Mathematical Language

July 14, 21:30–23:00 **Location: T202**

Organiser: Angela Piu (University of Valle d'Aosta, Italy); Cesare Fregola (University of Molise, Italy)

Description:

The aim of the workshop is to present educational interventions based on collaborative simulation games targeting geometry learning among primary school pupils. These games have been conceptualized, developed, and tested as part of a research project called Simulandia. They are designed to advance students' understanding of key geometrical concepts and to stimulate the development of related skills and competences, including the gradual appropriation of mathematical language. Their structure and characteristics foster the guided discovery of geometry concepts, eliciting internal and external representation of these concepts, the sharing and communication of related meanings, and systematic review and formalization of new learning at the end of the game.

Participants will be introduced to Cartolandia, a simulation game on isometries. They will first be familiarized with the features of the game and the underlying theoretical and methodological framework, which informed the development of all the Simulandia games. Next, they will reflect on and discuss how the teaching/learning process is related to the structure and unfolding of the game. The aim is to provide attendees with an experiential appreciation of how children can construct mathematical language starting from everyday language, and how they can abstract – both spontaneously and in response to the demands of the game – the concepts they progressively discover, representing them in different semiotic registers.

Finally, participants will debate the transferability of the simulation game technique to the settings where they teach, and discuss potential new lines of inquiry.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Introduction**
Presentation and training agreement / Piu

21:40–21:55 **Theoretical-methodological framework**
Presentation and explanation of key concepts underpinning the design of the simulation games - Fregola

21:55–22:25 **Experiential demonstration**
Observation of the teaching-learning process based on video clips / Piu - Fregola.

22:25–22:45 **Debriefing**
Analysis of observation outcomes / Piu - Fregola

22:45–22:55 **Exploration of follow-up lines of inquiry**
Free discussion / Piu

22:55–23:00 **Conclusions**
Piu - Fregola

Program Chair: Prof. Dr. Lianghuo Fan (East China Normal University, China)

Aims and Focuses: The program aims at providing early career researchers with opportunities to develop their research competencies in related fields, establish new contacts, build new networks, and work with and learn from internationally renowned scholars and experts in related fields. It will focus on research conceptualization and methods, writing research proposals and implementing research projects, and research publications.

1. Parallel Workshops: Research Conceptualization and Methodology

July 12, 8:30–12:00 (with Coffee & Tea Break at 10:00–10:30)

8:30 Location: W201

Workshop 1: Qualitative research methodology

Marcelo Borba (São Paulo State University, Brazil)
Liliane Xavier Neves (Universidade Estadual de Santa Cruz, Brazil)

8:30 Location: W215

Workshop 2: Design–based Research

Andreas Stylianides (University of Cambridge, UK)
Gabriel Stylianides (University of Oxford, UK)

8:30 Location: W301

Workshop 3: Mixed Methods

Susan Prediger (TU Dortmund University, Germany)
Kirstin Erath (TU Dortmund University, Germany)

8:30 Location: W315

Workshop 4: Video–based Research

Ida Mok (University of Hong Kong, Hong Kong SAR, China)
Wenjun Zhao (Beijing Normal University, China)

8:30 Location: W203

Workshop 5: Large–scale Assessments

Christian Bokhove (University of Southampton, UK)

8:30 Location: W211

Workshop 6: Naturalistic Paradigm and Ethnographic Methods

Judit Moschkovich (University of California, Santa Cruz, USA)

8:30 Location: W303

Workshop 7: Argumentation Analyses

Christine Knipping (University of Bremen, Germany)
Fiene Bredow (University of Bremen, Germany)

8:30 Location: W313

Workshop 8: Participatory Action Research

Julie Amador (University of Idaho, USA)

8:30 Location: W107

Workshop 9: Methods of Textbook Research

Sebastian Rezat (University of Paderborn, Germany)

2. Plenary Session: Academic Writing and Academic Publishing

July 12, 13:30–15:15 **Location: W201**

Moderator: Professor Jinfa Cai (University of Delaware, USA)
Description: Presentation of 8 major journals in mathematics education by their editors.
Presentations of Journals & Editors

13:30–13:43 **Educational Studies in Mathematics**
Arthur Bakker (Utrecht University, the Netherlands)
David Wagner (University of New Brunswick, Canada)

13:43–13:56 **Journal for Research in Mathematics Education**
Patricio Herbst (University of Michigan, USA)
Jinfa Cai (University of Delaware, USA)

13:56–14:09 **Journal of Mathematical Behavior**
Carolyn A. Maher (Rutgers University, USA)
Louise Wilkinson (Syracuse University, USA)

14:09–14:22 **Journal of Mathematics Teacher Education**
Despina Potari (National and Kapodistrian University of Athens, Greece)

14:22–14:35 **Mathematical Thinking and Learning**
Lyn English (Queensland University of Technology, Australia)
Heather Johnson (University of Colorado Denver, USA)

14:35–14:48 **Mathematics Education Research Journal**
Peter Grootenboer (Griffith University, Australia)

14:48–15:01 **Research in Mathematics Education**
Alf Coles (University of Bristol, UK),
Laura Black (University of Manchester, UK)
Jenni Ingram (University of Oxford, UK)

15:01–15:15 **ZDM – Mathematics Education**
Gabriele Kaiser (University of Hamburg, Germany)

3. Parallel Interactive Discussions

July 12, 15:45–16:30

Description: The participants will meet editors of seven major journal (in separate rooms) and have interactive discussions with them.

15:45 **Location: W201**
Educational Studies in Mathematics
Arthur Bakker (Utrecht University, the Netherlands)

15:45 **Location: W215**
Journal for Research in Mathematics Education
Jinfa Cai (University of Delaware, USA)

15:45 **Location: W301**
Journal of Mathematics Teacher Education
Despina Potari (National and Kapodistrian University of Athens, Greece)

15:45 **Location: W315**
Mathematical Thinking and Learning
Lyn English (Queensland University of Technology, Australia)

15:45 **Location: W203**
Mathematics Education Research Journal
Peter Grootenboer (Griffith University, Australia)

15:45 **Location: W211**
Research in Mathematics Education
Jenni Ingram (University of Oxford, UK)

15:45 **Location: W303**
ZDM – Mathematics Education
Gabriele Kaiser (University of Hamburg, Germany)

4. Panel Discussion

July 12, 16:30–18:00 **Location: W201**

Moderator: Prof. Lianghuo Fan (East China Normal University, China)

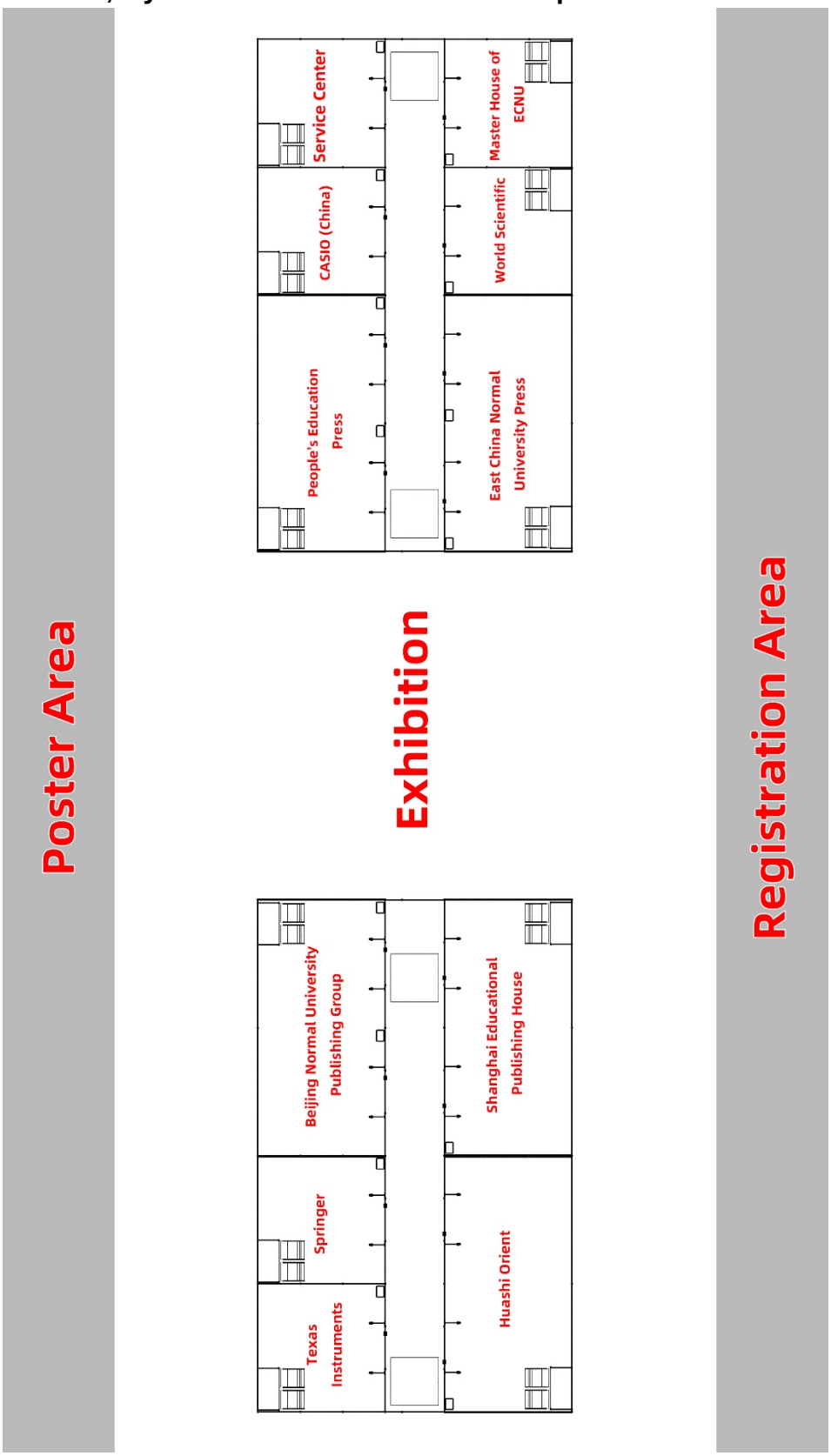
Panelists: Prof. Alan H. Schoenfeld (University of California, Berkeley, USA; 2011 Felix Klein Award)
Prof. Gert Schubring (Bielefeld University, Germany; 2019 Hans Freudenthal Award)
Prof. Anna Sfard (University of Haifa, Israel; 2007 Hans Freudenthal Award)

Description: The three world–renowned scholars in mathematics education, who are all recipients of the Felix Klein or Hans Freudenthal Awards, will share their research and publication work (results, methods, experiences, etc.) with early career researchers, have a dialogue/discussion with the participants, and answer questions specifically about their research work or generally about mathematics education research.

Acknowledgment The program organization team would like to place on record a special thanks to the ICME–14 Advisory Committee: **Lianghuo Fan** (Chair; East China Normal University, China), **Ferdinando Azarello** (University of Torino, Italy), **Jinfa Cai** (University of Delaware, USA), **Bernard Hodgson** (University of Laval, Canada), **Peng Yee Lee** (National Institute of Education, Singapore), **Frederick Leung** (University of Hong Kong, Hong Kong SAR China), and **Anna Sfard** (University of Haifa, Israel), for their recommendations, helps and supports in designing this ERCD program, especially at the early stage.

EXIHIBITION

Location: 1st Floor, Gymnasium of ECNU Putuo Campus



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► **East China Normal University Press**

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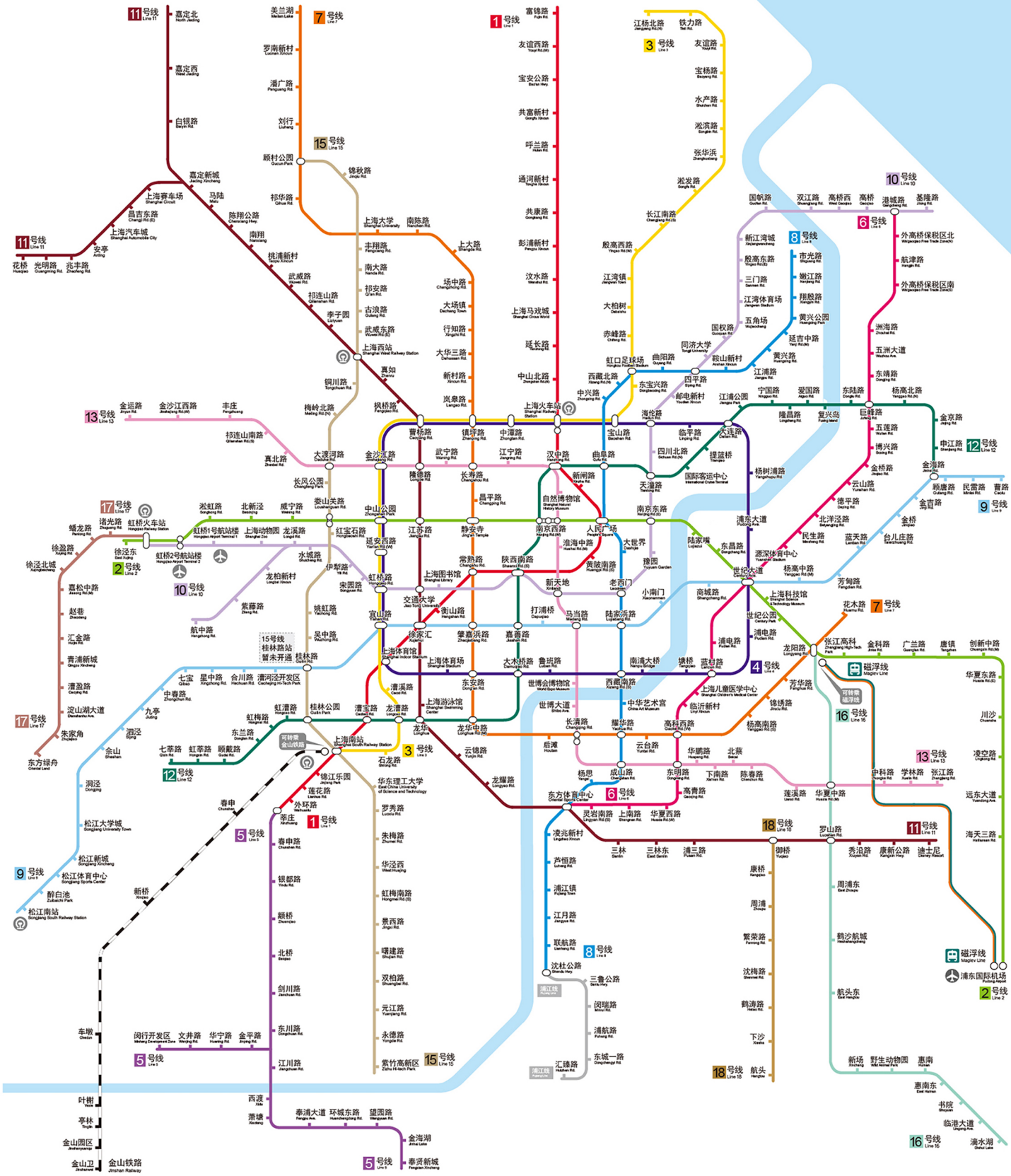

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- 上海火车站（1号线与3号线、4号线需出站换乘）
- 南京西路（2号线、12号线、13号线）
- 娄山关路（2号线、15号线）
- 长清路（7号线、13号线）

机场 Airport　火车站 Railway Station　磁浮线 Maglev Line　1 线路号 Metro Line　黄浦江 Huangpu River

单线车站 Single-line Station　换乘车站 Transfer Station　出站换乘车站 Out-of-station Transfer Station　出站转乘车站 Out-of-system Transfer Station

1号线 2号线 3号线 4号线 5号线 6号线 7号线 8号线 9号线 10号线 11号线 12号线 13号线 15号线 16号线 17号线 18号线 浦江线 磁浮线 金山铁路

上海轨道交通网络示意图

SHANGHAI METRO NETWORK MAP

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