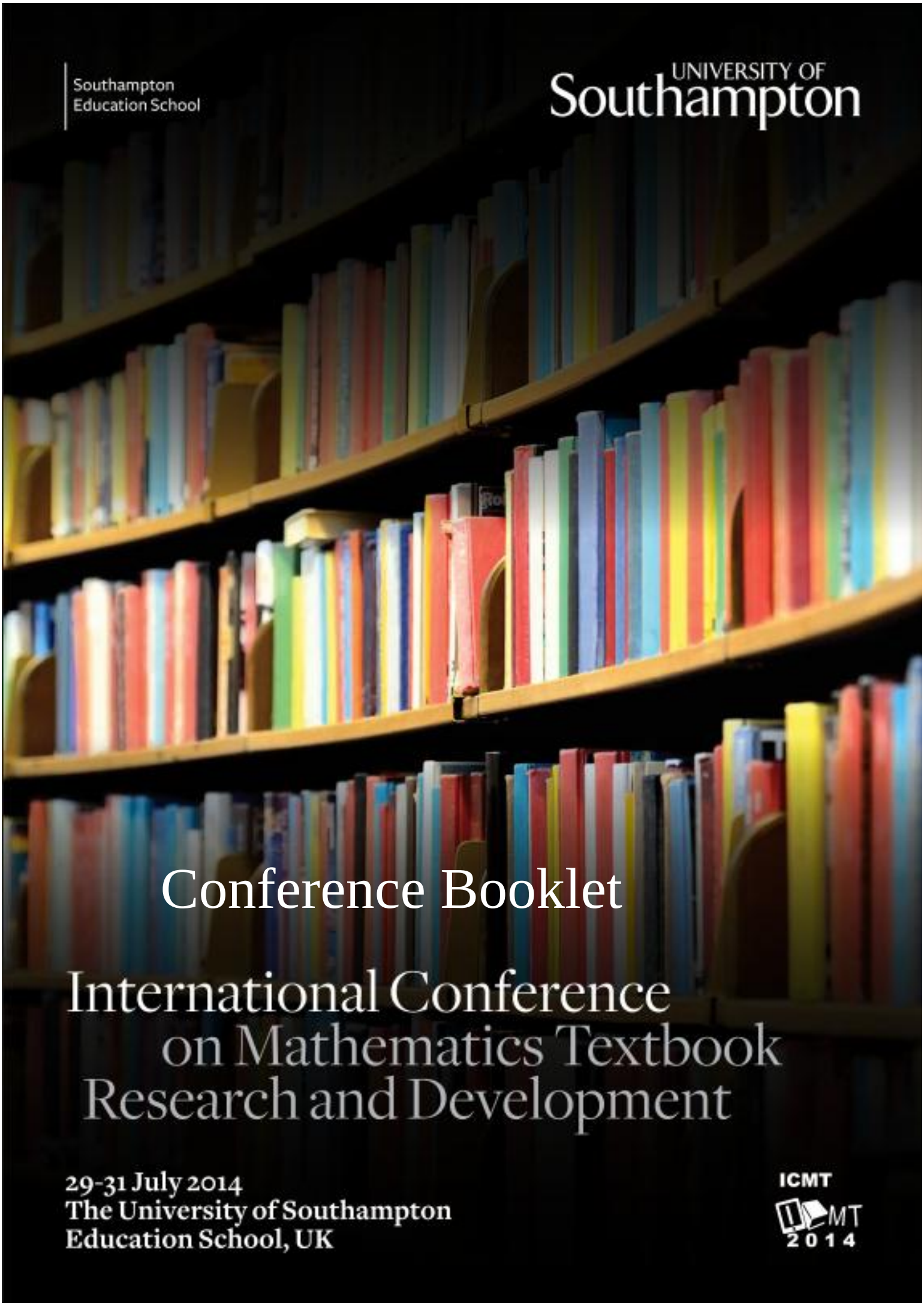

Southampton
Education School
UNIVERSITY OF
Southampton
Conference Booklet
International Conference
on Mathematics Textbook
Research and Development
29-31 July 2014
The University of Southampton
Education School, UK
ICMT
ICMT
2014

Sponsors

We are particularly grateful for the generosity of the following major sponsors, in alphabetical order, for enabling us to host this conference:

Beijing Normal University Publishing Group

East China Normal University Press

Oxford University Press

School Mathematics Project

Springer

Zhejiang Education Publishing House

We are also indebted to Prof. Sir Bryan Thwaites for donating a copy of his recent book for each conference bag:
Thwaites, B. (2012). The School Mathematics Project 1961-1970: A decade of innovation and its sequel. Cambridge: Cambridge University Press.

The support and assistance of the University of Southampton and the Southampton Education School has been invaluable.

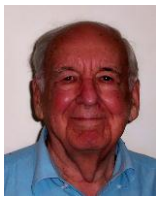
Welcome to ICMT2014

To many people, especially mathematics educators in the world, Southampton has always been historically linked to mathematics textbook reform and development through the School Mathematics Project or SMP since the early 1960s. We are happy to see today that many researchers in mathematics education and mathematics, as well, textbook reformers and developers, policy makers and practitioners from different parts of the world come to attend this conference, the International Conference on Mathematics Textbook Research and Development, or ICMT2014, from 29-31 July 2014.

The provision of well-judged, coherent mathematics courses, whether they be textbook-based, hybrid (textbooks with IT), entirely IT or teacher-based, is vital. It is our hope that this conference will not only result in improvements to what is currently available, but will also promote further research and will assist the propagation of acquired knowledge and experience to administrators, developers and teachers.

We wish to extend a warm welcome to everyone attending this conference. We hope that your stay in Southampton will prove both valuable and enjoyable.

Geoffrey Howson
Honorary Chair, International Programme Committee
Emeritus Professor, University of Southampton, UK



Lianghuo Fan
Chair, International Programme Committee
Professor in Education, University of Southampton, UK

Keith Jones
Chair, Local Organization Committee
Senior Lecturer, University of Southampton, UK

International programme committee

Prof. Geoffrey Howson (Hon Chair, UK)
Prof. Lianghuo Fan (IPC Chair, UK)
Prof. Marcelo C. Borba (Brazil)
Prof. Barbro Grevholm (Norway)
Assoc. Prof. Keith Jones (LOC Chair, UK)
Prof. Gabriele Kaiser (Germany)
Prof. Anthony Kelly (UK)
Prof. Jeremy Kilpatrick (USA)
Prof. Frederick Leung (Hong Kong)
Prof. Eizo Nagasaki (Japan)
Prof. Graham Niblo (UK)
Prof. Birgit Pepin (Norway)
Prof. Kenneth Ruthven (UK)
Prof. Zalman Usiskin (USA)
Prof. Jianpan Wang (China)

Local organising committee

Keith Jones (Chair)
Marcus Grace (Co-Chair)
Christian Bokhove (Co-Chair)
Jenny Byrne
Ian Campton
Andri Christodoulou
Julie-Ann Edwards
Lianghuo Fan
Caro Garrett
Rosalyn Hyde
Charis Voutsina

All Local Organising Committee members are from the Mathematics and Science Education Research Centre (MaSE) in the Southampton Education School at the University of Southampton.

Our website is at http://mase.soton.ac.uk

Our Twitter account is @MASEsoton (hashtag #ictmt2014)

Conference website

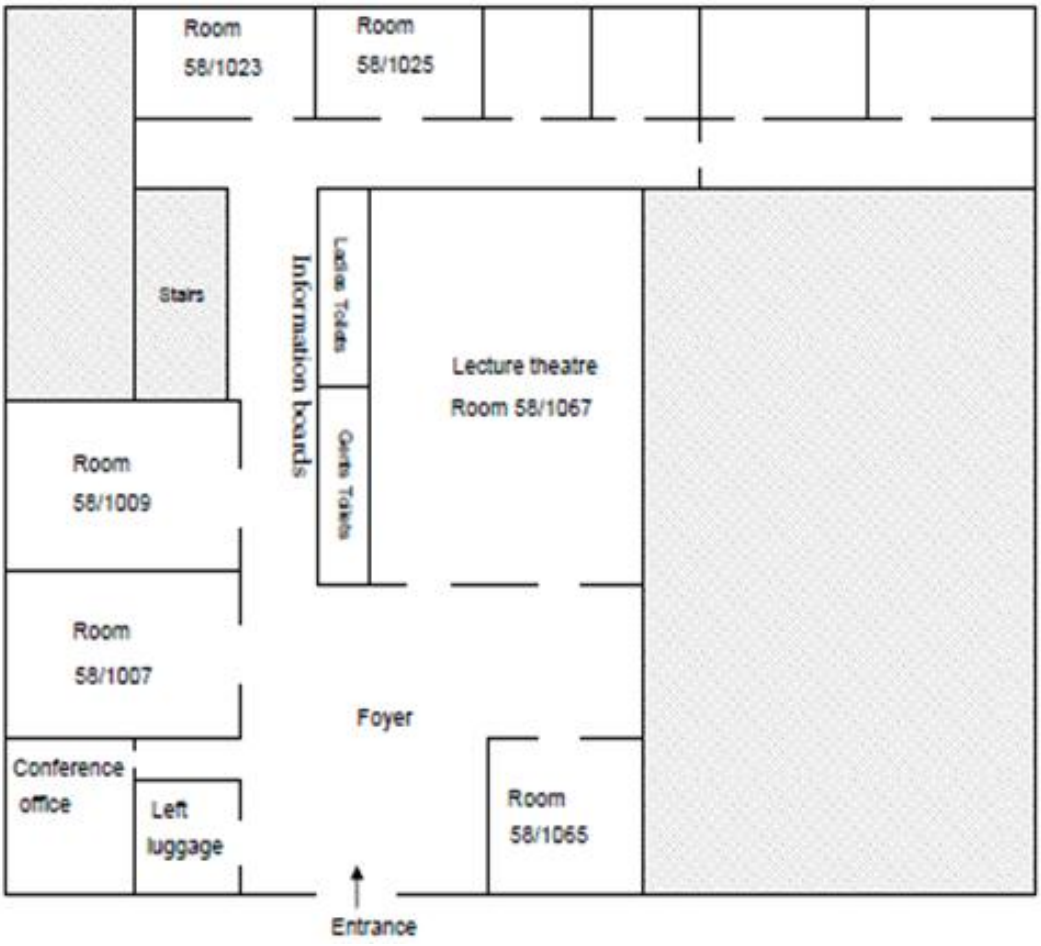
The conference website is at http://icmt2014.soton.ac.uk

Conference site

The International Conference on Mathematics Textbooks Research and Development 2014 is hosted on the Highfield campus of the University of Southampton. A campus map is provided in your conference bag.

All plenary sessions and conference presentations will take place on the ground floor of Building 58, the Murray Building. Building 58 is located adjacent to the Southampton Common, an historic green space dating back to 1228 where local townspeople tended their sheep and cattle in the 16th and 17th centuries but which is now open parkland and woodland collectively owned by the residents of Southampton City.

Building 58, Murray Building



Left luggage

There is a left luggage room in 58/1001, Lecture room A.

Conference office

The conference office is located in room 58/1003, Lecture room B.

Disabled access

All conference rooms, including the Garden Court are accessible by wheelchair. Please ask a conference helper for assistance, if necessary.

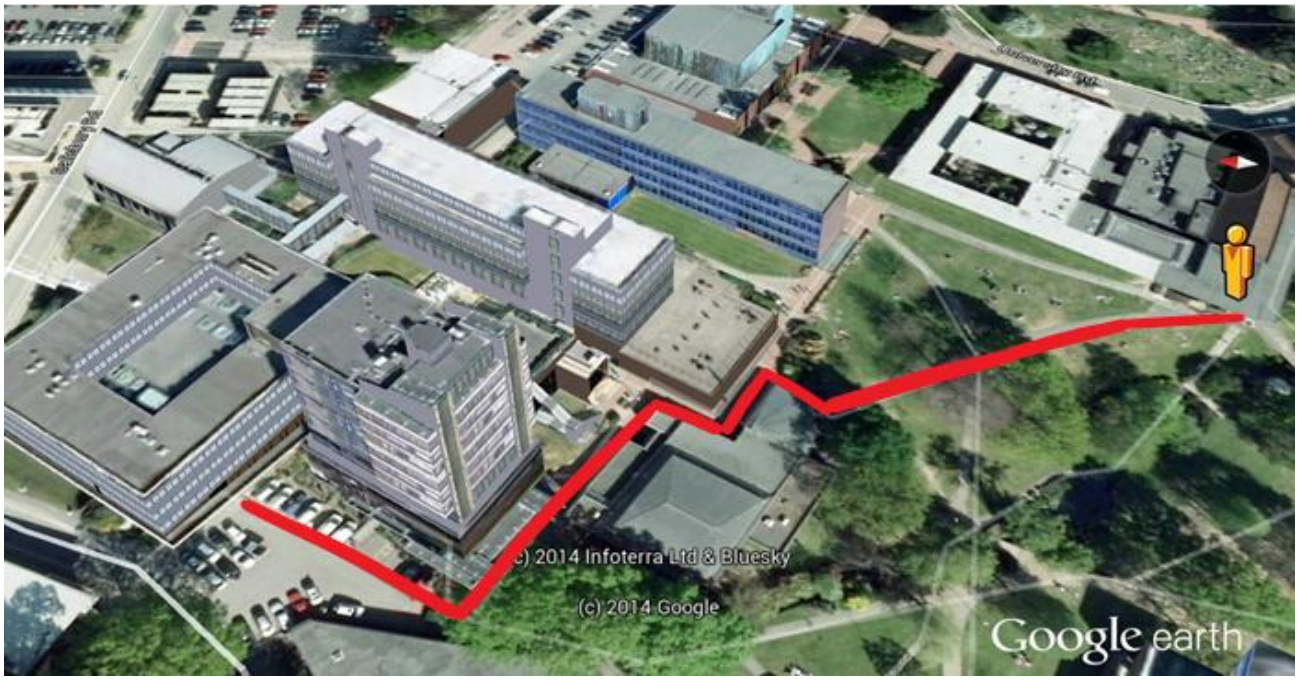
Lunch and refreshments

Lunch will be served each day in the Garden Court (Building 40) a short walk from the conference site (see map below).

On Tuesday, a hot lunch will be served with choices from Palak chicken with spinach or Kashmiri vegetables with banana and pineapple (vegetarian), served with pilau rice, poppadums, Naan bread and chutney for the main course and Gulab jamun with passionfruit crème fraîche or Fresh fruit salad for dessert. On Wednesday, a self-service buffet lunch will be provided with a wide range of finger food.

On Thursday, a hot lunch will be served with choices from Beef Hongroise (beef strips cooked in paprika cream) or Butternut squash, spinach and mushroom stroganoff (vegetarian), served with a selection of vegetables and rice for the main course and Tiramisu trifle or Fresh fruit salad for dessert. Fairtrade tea and coffee accompany all meals.

The Garden Court will also be the venue for tea and coffee breaks and the Happy Hour. A light self-service buffet will be provided during Happy Hour. For those who have pre-paid for the conference dinner, this is will also take place in the Garden Court on Wednesday evening.



Evening meals

Conference participants should make their own arrangements for evening meals for the duration of the conference, unless you have pre-registered for the conference dinner on Wednesday evening. One of the information boards displays a map of Southampton city indicating restaurants representing a range of cuisines.

Conference dinner

If you have pre-registered for the conference dinner, you will find a ticket behind your conference badge. Please ensure you have this with you when you go to dinner.

Conference help

Local organising committee members are identifiable by a yellow conference badge. The organisational manager for the duration of the conference is Dr. Julie-Ann Edwards. All conference administrators and conference helpers can be identified by a yellow T-shirt with the conference logo. Please seek their advice, so they can help you directly or pass on your query further.

Conference administrators

Manahel Alafeq
Mandy Lo
Mailizar Mailizar
Zhenzhen Miao
Linda Wang
Joanna Williamson

Conference helpers

Li Hao
Liyuan Liu
Ping Lu
Jinyu Yang
Michael Zhai
Bo Zhang

Notice boards

The main source for information about any necessary changes to the programme or alerts to other events relevant to the conference will be the **plasma screen** visible as you enter Building 58.

Notice boards are located in the corridor beyond the foyer in B58 (see diagram on page 5) which will also provide information on:
changes to the programme
floor plan for B58, Murray building
personal messages for conference participants
changes to lunch menus
bus/taxi/restaurant information
conference site information

Car parking

If you are travelling to the conference by car, a small number of day parking permits are reserved for conference participants. Please enquire about these prior to attending the conference or at the conference office on the day.

Photocopying

We regret that we are unable to provide a photocopying service during the conference. Please organise any copying you wish to do in advance of arriving at the conference. In an emergency, however, please contact one of the conference administrators.

Residents in Glen Eyre complex South Hills accommodation

The Glen Eyre complex is located approximately a ½ mile from the main Highfield Campus.

When you arrive at the Glen Eyre complex, you will need to go to the 24-hour Reception (indicated on the map) to collect your room key, access code and Welcome Pack. Check in time is usually from 15.00 (unless special arrangements have been made). Check out time is 09.30 am.

GLEN EYRE COMPLEX

The South Hill accommodation is on the other side of the Glen Eyre complex from the Reception area, across Glen Eyre Road. **It is strongly advised, if you arrive by taxi, that you ask the taxi driver to wait with your luggage while you collect your key and then drive you to your accomodation location in South Hills**.

If you are arriving by car, a car parking permit will be available for you at Registration. Please note that this must be displayed in your car at all times to avoid a penalty fine.

For further information, please see the website at
http://www.southampton.ac.uk/accommodation/halls/gleneyrehallscomplex.html

The following map of the walking route to the conference site offers two options. The first (and most direct) route allows you to briefly take advantage of Southampton Common. This route is marked in red from the South Hills accommodation (S) to the conference venue (C). The additional route (in thick green) follows the footpath and is accessible by wheelchair.

Breakfast

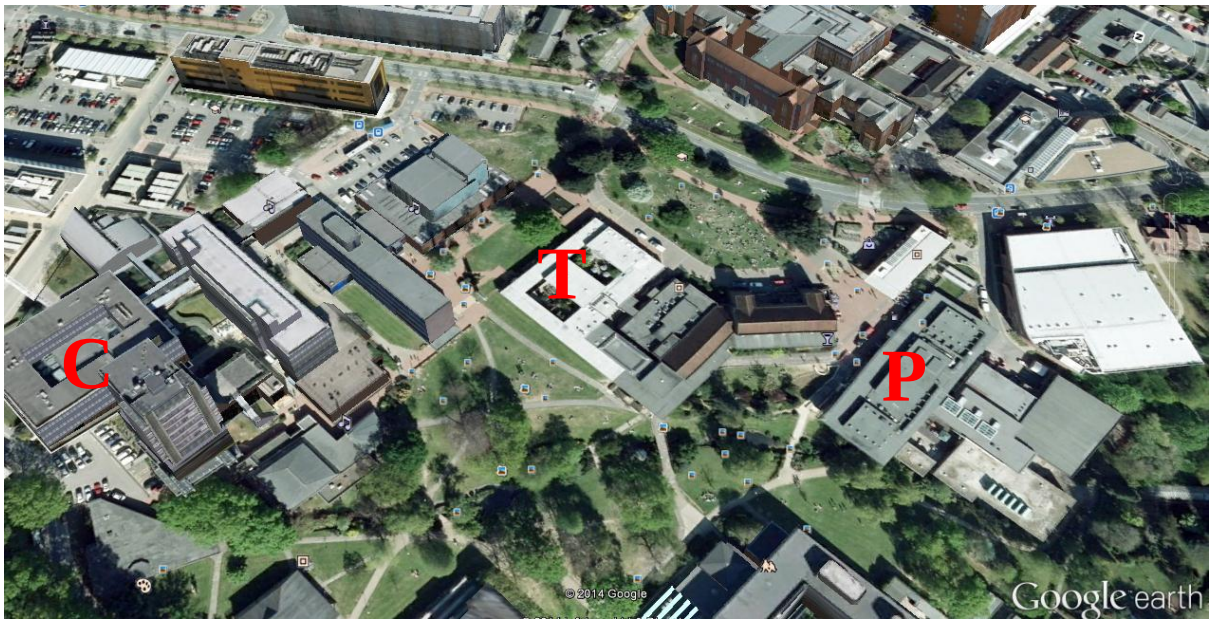
For residents in the South Hills accommodation, breakfast is provided in restaurants on the Highfield campus. For those arriving on Sunday evening, vouchers will be provided at registration on the Glen Eyre site for breakfast on Monday morning in the Terrace Restaurant (labelled T on the map) from 08.00-08.30. The Terrace restaurant is situated in the Staff Club between the two outdoor seating areas.

For those arriving on Monday, vouchers will be provided at registration on the Glen Eyre site for breakfast on Tuesday morning in the Piazza Restaurant (labelled P on the map) from 08.30-09.00.

On Wednesday morning and Thursday morning, breakfast will be served in the Piazza restaurant (labelled P on the map) from 08.00-08.45. You will need your conference badge for identification as conference participants.

For those staying on for Thursday evening, , vouchers will be provided at registration on the Glen Eyre site for breakfast on Monday morning in the Terrace Restaurant (labelled T on the map) from 08.00-08.30. The Terrace restaurant is situated in the Staff Club between the two outdoor seating areas.

Both these venues can be reached by continuing the thin green route (wheelchair accessible) along University Road on the map on the previous page.



Tourist information

Tourist information is provided in the conference bag. The City of Southampton tourist information website is at http://www.discoversouthampton.co.uk/visit. We recommend the Sea City experience, incorporating the Titanic exhibition. There are also historic walks around the city of Southampton, which include visits to 15th and 16th century buildings in the city.

General Information

Tap water throughout the UK is safe to drink (unless labelled otherwise). Within Southampton city, tap water is minimally fluoridated to promote healthy teeth.

Currency

Currency in England is the Great British Pound (£), though Scottish (£) currency is also legal in England. Currency transactions, both through a bank and through electronic cash point facilities are available to the north of Building 58 in the arcade of shops on Burgess Road.

WiFi access

Conference participants will be provided with access to WiFi while on site at the University. Each conference participant is provided with **a unique password** which will be attached to the back of your conference badge. Please note that University regulations require us to record your name for use of the unique password given to you, so you should keep this secure.

Eduroam is also available, if you prefer this. Please check that access is organised at your institution before arriving in Southampton.

Local transport

The city of Southampton is well-served by public transport options.

Bus

The Uni-link bus service departs from the University with destinations to the city, the train station and the airport at a moderate cost. A single journey costs £2, payable to the driver when you board the bus, but we recommend you purchase the £3.50 'Day Rover' from the driver which allows you to travel on any Uni-link bus during the day the ticket is purchased, allowing a return journey for cheaper than two single tickets.

A Uni-link timetable with a map which opens out at the back is provided in your conference bag.

Taxi

Taxis are readily available to transport you to the city centre and return. Taxis can arrive at the University or Glen Eyre complex within 15 minutes of booking. Our recommended taxi service is Radio taxis at 02380666666; however, other taxi services are at 02380222222 (ATS taxis) or 02380999999 (West Quay cars).

The average cost of a journey between the University and the city centre is about £8.00, though this will vary depending on the time of day.

Train

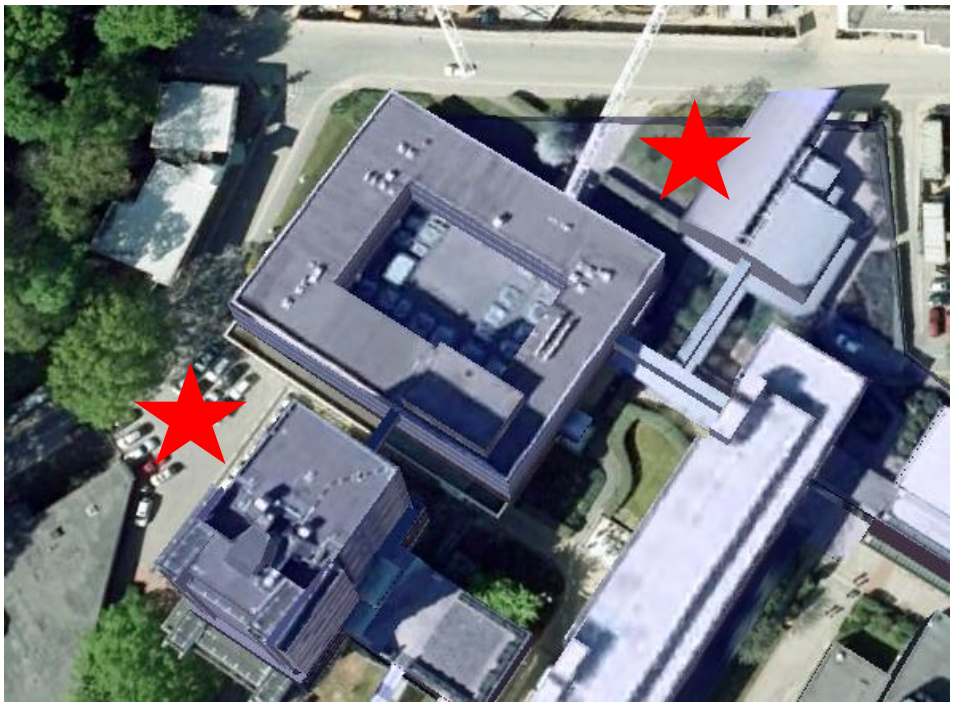
Information for transport by train is available at a national website: http://www.nationalrail.co.uk Please ask a conference helper if you need help to use this website.

Please ask conference administrators for advice about planning journeys by air.

Safety

The University of Southampton is unable to accept liability for any accident happening to participants. You are strongly advised to take out travel insurance for the duration of the conference.

There is no fire alarm practice timetabled during the conference, so any fire alarm should be taken seriously. Fire assembly points are indicated on the map below. The closest fire assembly point for most participants is in the car park facing the entrance to Building 58. For those in the upper section of the lecture theatre (58/1067) the upper fire assembly point is nearest (top right of the picture).



Health

If there is a need for you to access health advice, the University has trained first aid members of staff available in Building 58 for your immediate needs. There are medically trained doctors available at the University Health Service should you need further care. Please ask a conference helper if you need this support.

A pharmacy is located on University Road, south of the main campus (3 minutes walk), for advice about minor ailments. A walk-in dental service is also available, if necessary. Please ask a conference helper for information.

For general out-of-hours medical advice, there is a National Health Service (NHS) helpline available at 111 or at http://www.nhs24.com/ContactUs

The number for the emergency services is 999.

Scientific programme

The official language of the conference is English.

The scientific programme includes the following activities:
Plenary lectures and a Plenary panel
Paper presentations
Symposia
Workshops
Posters

Conference themes

Category	Themes
A	Textbook research
B	Textbook analysis
C	Textbook comparison or history
D	Textbook use
E	Textbook development
F	e-Textbooks and technology
G	Other disciplines in mathematics textbooks

Review committee

Lianghuo Fan (Chair), Keith Jones, Geoffrey Howson, Christian Bokhove, Manahel Alafaleq, Jenny Byrne, Ian Campton, Andri Christodoulou, Julie-Ann Edwards, Ruth Edwards, Taro Fujita (University of Exeter), Marcus Grace, Rosalyn Hyde, Mailizar Mailizar, Zhenzhen Miao, Ida Ah Chee Mok (University of Hong Kong), Charis Voutsina, Yuqian Wang (Durham University)

Conference programme outline

The conference programme outline is on the back cover of this conference booklet.

Plenary sessions

Plenary session 1

Speaker: Prof. Jeremy Kilpatrick, University of Georgia, USA

From Clay Tablet to Computer Tablet: The Evolution of school mathematics textbooks

Over the centuries and around the world, school mathematics textbooks have differed in many ways, including variations in form, function, content, and approach. In this idiosyncratic survey, I attempt to portray, across time and space, what researchers have learned about those textbooks: what they are, what they appear to be, how they are related, and how they have been used. In general, school mathematics textbooks have differed much more in form and approach than in function or content. Their principal function has been to serve as repositories of authorized knowledge, although at times they have been enlisted as resources for creative problem solving or as material for self-instruction. The earliest textbooks in the Babylonian scribal schools, for example, were collections of arithmetic tables or of problems, most of which involved finding a number that satisfied given conditions. The problem collections varied in approach: Sometimes the solution was given, and sometimes the text outlined the procedure to be followed in reaching that solution. They were clearly intended to be used in schools, and presumably a teacher was

expected to explain the procedure and set the assignment. Today's textbooks vary in a similar fashion but along many more dimensions. It appears that textbooks are being written as much or more for the teacher as they are for the learner. As textbooks took different forms and appeared in different media—clay tablet, papyrus, parchment, bamboo, paper—they also began to take on a wider span of mathematical content and to vary extensively in pedagogical approach: from providing no suggestions at all to including detailed scripts specifying what the teacher should say and do. Research on textbooks has examined many of their characteristics, looking at how they have changed over time and, less often, how they differ across communities. Today, school mathematics textbooks seem more similar in mathematical content than they are in appearance, pedagogical outlook, or assistance for the teacher. There does seem to be something of a virtual school mathematics curriculum worldwide, whereas there is little agreement on what features the textbooks enshrining that curriculum should have. Tomorrow, computing technology seems likely not only to yield tailor-made textbooks but also to allow authors and publishers to revise the text swiftly in light of how the learner responds.

Plenary session 2

Speaker: Prof. Michal Yerushalmy, University of Haifa, Israel

Challenging the Authoritarian Role of Textbooks

A textbook is a special type of book that is part of institutionalized schooling, usually used in a particular way. Kuhn (1962) considers textbooks to present accumulation of knowledge rather than promoting shifts of paradigms. Digital books offer new kinds of flexibility, participation, and personalization – properties that are in contrast to the traditionally authoritative structure of the textbook and the passiveness of the reader (the teacher or the student). Current proposed pedagogical changes, especially those directly touching upon inquiry teaching and learning from open educational resources that advocate community writing—and that seem to be the appropriate ones to support constructivist pedagogies—challenge the accepted and still dominant functions of the textbook and textbook culture. To study the implications of the proposed affordances of interactive textbooks, we will review the accepted norms of textbook authority in mathematics classrooms and address the challenges interactive e-Textbook post to the foundational ideas of textbooks: authority and stability. Two concerns that should be part of any involvement with e-Textbooks will be in focus; one is the non-sequential manner of evolving digital collections and the second is the effect of interactive multimodality on the restructure of teaching resources. It is commonly believed that digital books enable changes of sequence and flexibility, but at the same time such flexibility may cause lack of clarity. For a collection of semi-ordered materials and multimodal digital "pages," which to a certain extent stand on their own, to be considered a textbook, the deep structure of the concepts and the inter-relations between them must be simple and visible. Teaching in which a principal challenge is conceptual navigation demand a new kind of professional responsibilities. The challenge in constructing a task is to design opportunities for action. Interactive elements can be designed to support the systematic generation of examples in linked multiple representations, to accommodate various entry points, and to provide non-judgmental mirror feedback that should be interpreted subjectively. In this situation the main challenge is to rethink the sets of concepts and images used to guide us in thinking about the design of activity and to consider the consequences of design and structure to respond to subjective needs and to personalization by the user – primarily the teacher. Considering possible consequences of the above mentioned changes, an interesting question remains whether the textbook will undergo a significant innovation to the point where the idea of a single document representing external authority will no longer be considered a foundational idea in teaching and learning.

Plenary session 3 (plenary panel)
Speakers: Prof. Kenneth Ruthven (Panel Chair; University of Cambridge, UK)
Prof. Jere Confrey (North Carolina State University, USA)
Mr. John Ling (Former School Mathematics Project, UK)
Prof. Binyan Xu (East China Normal University, China)

Back to the Future of Textbooks in Mathematics Teaching

The textbook is dead; long live the textbook

(Ken Ruthven)

This conference takes place during a period of considerable change in the form of textbooks and challenge to their place in mathematics teaching. This situation has many aspects, including shifts in the types of educational materials used in schools; the emergence of new and multiple modalities for representing mathematics and mediating learning; criticism of the pedagogically malign influence of narrowly examination-oriented textbooks; the rise of re-sourcing and a trend away from use of a single textbook towards combining varied resources; and renewed ideas about the use and functioning of textbooks. These are discussed with particular reference to mathematics teaching in English secondary schools.

Building digital curriculum for Middle School using challenges, projects and tools

(Jere Confrey)

In this talk, I will discuss the activity of designing digital curriculum for middle grades mathematics. The implications of placing students into a mathematical workspace that supports collaboration, presenting, sharing, and working on dynamic tools will be the starting point. From this, I will discuss two kinds of mathematical work: engaging in mathematical projects and using challenges to spur productive struggle. For mathematical projects, I will illustrate how to use media, context, tools and presentations. For productive struggle, I will illustrate how to sequence and design challenges built around learning trajectories for major topics. In each kind of mathematical work, I will focus on what features are made possible by digital affordances of the tablet.

The School Mathematics Project: mapping its changes of direction

(John Ling)

This presentation focuses on aspects of the work of the School Mathematics Project (SMP), one of a number of initiatives originally set up in the 1960s to modernise the secondary mathematics curriculum and foster in students a deeper understanding of the subject. By the mid-1970s, pedagogical thinking had embraced mixed-ability classes and the SMP responded with a new set of materials designed to facilitate this in the first two secondary years. The model of individualised learning was adopted, with a pedagogy heavily influenced by research that was largely Piagetian in approach. Mathematical content was presented through concrete situations in profusely illustrated and informally written booklets. Over time the weaknesses of individualised learning became apparent and the title of the SMP's next, and current, initiative – SMP Interact – indicates a recognition of the important element missing from the individualised approach. Two external developments had serious repercussions on this project. First, the introduction of the National Curriculum curtailed the freedom the SMP had hitherto enjoyed to decide on curriculum content. Second, examination boards began publishing their own textbooks matched to the modules of their assessment schemes. This practice has grown and makes it increasingly difficult for independent organisations to compete in the market.

Competence-oriented development of mathematics textbooks in the twenty-first century in China

(Binyan Xu)

In the twenty-first century the development of mathematics textbooks in China emphasized the cultivation of mathematical capabilities. The core capabilities, originally including

operations, logical reasoning, and spatial imagination, have been extended. It highlights basic capabilities, including the sense of numbers and symbols, spatial concepts, geometric intuition, consciousness of data analysis, abilities of calculation and reasoning, and the idea of modeling. While carrying out the national project "cross-national comparison of senior high school mathematics textbooks", we developed an analytic index framework to investigate the organization and representation of inquiry content in mathematics textbooks. The preliminary findings indicated that Chinese textbooks used in Shanghai as well as used in other provinces paid attention to designing open-ended questions and representing problems with interrogative sentences. The more concrete findings will be reported in this panel session. The new development of mathematics textbooks in China attaches importance to the different roles of mathematics textbooks in relation to teaching and learning. From reviewing the literature and doing our own interviews with teachers, we found that teachers changed their understanding of the roles of mathematics textbooks and made efforts to put the understanding into practices. In this panel session we will discuss with you about the successes and failures in dealing with textbooks in China.

Plenary session 4

Speaker: Prof. Frederick Leung, University of Hong Kong, Hong Kong

Messages Conveyed in Textbooks: A study of mathematics textbooks during the cultural revolution in China

Textbooks are an important source of potential learning (Mesa, 2004), but the potential differs among countries according to the different cultures and practices of the countries concerned. So it is essential for textbook studies to be situated within the cultural contexts in which the textbooks are produced and utilized, since "mathematics textbooks ..... (are) historically developed, culturally formed, produced for certain ends and used with particular intentions"(Rezat, 2006, 482). No textbooks have illustrated Rezat's claim more vividly than the textbooks produced during the time of the Cultural Revolution in China. The Great Proletarian Cultural Revolution, commonly known as the Cultural Revolution, was a social-political movement that took place in China roughly between 1966 and 1976. It was a time of great political and social turmoil, and its espoused goal was to remove capitalist as well as traditional cultural elements from the country in order to achieve an idealistic form of communism. As such it was explicit in articulating communist values and criticizing the capitalist and traditional Chinese cultural elements and values. One important arena for this revolution is education, and this arena provides an excellent opportunity for studying the interplay between the cultural context and educational goals, through examining the messages conveyed in the textbooks. In this presentation, selected topics in the mathematics textbooks from the Cultural Revolution period in China are analysed and compared to the textbooks published in Hong Kong roughly at the same time. Messages about the nature of mathematics, the nature and goal of education, as well as the political ideology of the time are delineated. A comparison is also made with contemporary mathematics textbooks, where the ideological values are not as explicitly propounded as those during the Cultural Revolution. Yet, it is argued, even these contemporary mathematics textbooks not produced at a time of political upheaval are still conveying the values of the dominant authorities, albeit in a more implicit manner. This testifies to the intricate relation between the mathematics textbook and the underlying values of the education systems concerned, and corroborates the assertion that the mathematics textbooks can be regarded as a cultural artefact. Implications of the analysis for curriculum developers and classroom teachers will be discussed.

Conference programme

Day 1 Tuesday 29 July 2014

08.00– 10.00	**Registration** Foyer, Level 1, Building 58 (Murray Building) (Day Chair: **Marcus Grace**)

10.00-10.30	**Opening Session** Lecture Theatre, 58/1067 (Chair: Dr. **Jenny Byrne**)

10.30-11.30	**Plenary Session 1** Lecture Theatre, 58/1067 Speaker: Prof. **Jeremy Kilpatrick**, University of Georgia, USA ***From Clay Tablet to Computer Tablet: The Evolution of School Mathematics Textbooks*** (Chair: Assoc. Prof. **Keith Jones**)

11.30-12.00	**Tea/Coffee Break** (Building 40, Garden Court)

12.00-13.00
Parallel session 1.1 Room 58/1007 Chair: **K. Ruthven**
A87. The Nordic network for research on mathematics textbooks, eight years of experience **Barbro Grevholm** Univ. of Agder, Norway The Nordic Graduate School in Mathematics Education organised a workshop in 2006 on research on mathematics textbooks. The researchers present created an informal network, which functioned as a supporting and inspiring group for the members. Among other things the network arranged a Discussion group on research on mathematics textbooks in PME 30 in Prague, 2006. Another event that members initiated and took part in was a Symposium on Mathematics textbooks, mathematical tasks and pupils' identity: An international perspective in ECER in 2008, which took place in Gothenburg. A number of master and doctoral students were supported on a voluntary basis by researchers in the network and could get advice and reading suggestions. Joint papers were prepared, intended for a book. Since 2011 and for three years NordForsk is financing the network (see http://textbookstudy.wordpress.com). Opportunities were thus opened for more regular meetings and activities like seminars and workshops, and deeper collaboration among members could be developed. In the presentation I will give examples of scientific work done by members in the network and elaborate on some of the publications produced over the eight years the network existed. Presented work is created at all levels, master, doctoral, postgraduate and senior researcher level.
A16. Textbook use in England: mining OFSTED reports for views on mathematics textbooks **Christian Bokhove** and **Keith Jones** Univ. of Southampton, UK Textbook use in mathematics classrooms in England is, according to TIMSS data, "lower than that in the highest-attaining countries" (see Askew et al, 2010, p.34). In England there is an important role for OFSTED, the official body for inspecting schools, when it comes to inspection of the quality of teaching. It has been suggested that OFSTED holds particular views on textbook use in that it opposes an 'over-reliance' on textbooks. This paper reports on a text analysis of almost 10,000 publicly-available OFSTED secondary school inspection reports and mathematics-specific commentaries from the year 2000 until

now. The analysis focuses on what OFSTED has said over this period about textbook use in general and about the use of mathematics textbooks in particular. The analysis is complemented by examining whether there are differences across different chief inspectors of OFSTED. The analysis was conducted by first 'scraping' the reports from the OFSTED website and then utilising basic text mining and analysis methods to extract information on these documents. While the results of the analyses show that the role of textbooks for OFSTED appeared to be relatively minor under different inspection regimes, interpreting these findings from text mining alone was not straightforward. A further qualitative analysis found mention of 'over-reliance' on textbooks, confirming that 'over-reliance' on textbook use might still be seen in a negative way.

Parallel session 1.2 Room 58/1009 Chair: **A. Takahashi**

B12. Providing textbook supports for teaching mathematics through problem solving: An analysis of recent Japanese mathematics textbooks for elementary grades

Akihiko Takahashi, Tokyo Gakugei Univ., Japan

Problem solving has been a major theme in Japanese mathematics curricula for nearly 50 years. Numerous teacher reference books and lesson plans using problem solving have been published since the 1960s. Government-authorized mathematics textbooks for elementary grades, published by six private companies, have had more and more problem solving over the years. As a result, almost every chapter in Japanese mathematics textbooks for elementary grades begins with problem solving as a way to introduce students to new concepts and to introduce new procedures. There has been a long tradition of teaching mathematics through problem solving in Japan, however; a large wave of teacher retirement in recent years has left newly hired teachers without the collegial support they need to develop the expertise to teach through problem solving. In order to overcome this challenge, the latest edition of a major mathematics textbook series in Japan includes more resources to help teachers teach through problem solving and to help students learn through problem solving. The book contains more alternative approaches to a problem, provides diagrams meant to help students solve problems independently, and includes pages that teach students how to take notes effectively. By comparing the latest two editions of this textbook series, the author will highlight how the text has increased its support of problem solving, and will relate the changes to recent trends of Japanese mathematics textbook designs.

B20. Contemporary study of 5th grade textbooks – tasks on whole numbers and their compliance with mathematics Olympiad content

Ingrida Veilande, Latvian Maritime Academy, Latvia Relevant characteristic of mathematics education quality is students' achievements on Mathematics Olympiads. The challenge is that Olympiad content differs from ordinary tasks offered in school. This reflects on the young grade students' relatively low performance in the Olympiads. The presented paper reports on comparative study of presentation of problems on whole numbers in Olympiad problem sets and in mathematics textbooks of 5th grade. The following research questions are stated:

1) What types of problems about whole numbers are included in Olympiad problems? What mathematics knowledge is necessary at the solutions of these problems?

2) How mathematics textbooks for 5th grade support the knowledge necessary for participation at mathematics Olympiads?

Parallel session 1.3 Room 58/1023 Chair: **J. Novotna**

D6. Impact of changes in teaching strategies on how teachers work with a textbook

Jarmila Novotná, Charles Univ., Czech Republic; **Petr Eisenmann**, Jan Evangelista Purkyně Univ., Czech Republic

Textbooks are one of the basic teachers' instruments in planning and conducting their lessons. This is why textbooks have been in the centre of attention of teachers, educators and researchers for a long time (see e.g. Triantafillou, Spiliotopoulou, Potari, 2013). Most of this research, however, focuses on specific mathematical content and its presentation. This paper focuses on teachers' change of use of textbooks as a result of change in their teaching strategy. The paper presents one of the findings of a longitudinal research focusing on improving culture of problem solving by pupils through use of various heuristic solving strategies (Břehovský et al., 2013). It combines two aspects:

1. It classifies how teachers work with textbooks in mathematics lessons (ignoring the case when the textbook is used for pupils' self-study). The classification is based on the following: The teacher:
- uses the textbook only when planning the lesson,
- supplements its content with his/her own material or modifies it,
- works exclusively from the textbook.

2. Textbook analysis with respect to inclusion of problems suitable for different types of heuristic solving strategies.

Based on experiments conducted within the frame of this research, the paper shows changes in

participating teachers' approaches to use of mathematics textbooks in the classroom. The findings are based on in-depth interviews with participating teachers. The survey shows there is a shift towards creativity in the way teachers use their textbook. This change is not instantaneous, it is a longer process which has considerable impact also on pupils' attitudes to mathematics and problems solving. The findings are important both for pre-service and in-service teacher training.

F83. How do textbooks incorporate graphing calculators?
Carlos Carvalho, Escola Secundária Lima de Freitas/UIED FCT UNL; **José Matos**, New Univ. of Lisbon, Portugal
Textbooks are still the main support and mediator in the educational process, for teachers, students and parents alike. The use of technology based on microprocessors such as computers, graphing calculators and, recently, other interactive devices, have enabled a new approach for the study of mathematics. This new approach offers multiple perspectives. The invention of the graphing calculator in 1985 by Casio has introduced a dimension that was lacking in the scientific calculator, the graphing one. Its portability, capability, sophistication, and eventually its relatively low price when compared to a computer, have fostered the use of technology. The purpose of this paper is to present a analysis of the complexity of activities proposed to students in the trigonometry chapters of 11th grade textbooks as they incorporate graphing calculators in the intended students' actions. More specifically we intend to:
a) Characterize how textbooks in the 11th form integrate graphing calculators in the study of trigonometry;
b) Analyze the use of the calculator in the textbooks and the use of the calculator as suggested by the syllabus and see if they convergent;
c) Analyze research activities and problem solving with the use of the graphing calculator in textbooks.
An apparatus was created for data collection discriminating between two dimensions: the Level of Intended Use of the calculator in the presentation of mathematical topics, and the Level of Proposed Use of the calculator as specific tasks are proposed to students. This work is financed by national funds through FCT - Foundation for Science and Technology in the context of the project "Promoting Success in Mathematics"(PTDC/CPE-CED/121774/2010).

Workshop 1 Room 58/1065 Chair: **Z. Miao**

C65. A comparative study of illustrations in the old and new middle school mathematics textbooks
Xiaomei Liu, Capital Normal Univ.; **Chunxia Qi**, Beijing Normal Univ., China
As a media of knowledge learning, textbook illustration has become an integral part of textbooks, especially for mathematics. On the one hand, symbolic-graphic combination is the basic characteristics of mathematics as well as an important kind of mathematics thinking method; on the other hand, mathematics is an abstract and formal subject, so illustrations are an essential part in order to facilitate students' comprehension of abstract numbers, symbols and language. After implication of new curriculum reform in 2001, great changes have taken place in mathematics textbooks of junior high school, change of illustrations included. Therefore, for the purpose of provide theory basis for selection and arrangement of illustrations, this paper analysis differences of main textbook in China, the edition of PEP, with the method of comparative analysis in order to study changes of illustrations. In this research, textbooks for grade 7 to grade 9 are focused on. Two conclusions can be caught from the research. Firstly, the number of illustrations changes greatly; secondly, with functions of decoration, characterization, organization and explanation, the illustrations introduced in new textbooks facilitate students' learning process.

Parallel session 1.4 Room 58/1067 Chair: **I. Campton**

D103. The improvement of teachers' interpretation of mathematics textbook
Pi-Jen Lin, **Wen-Huan Tsai**, National Hsinchu Univ. of Education, Taiwan
This study is designed to examine how teachers improved their understanding of the textbook to be used through case discussion. Fix fifth-grade teachers and a facilitator in a same school is desire to enhance their expertise of interpreting the textbooks in a meaningful way. Pre- and post- interviews were conducted to document the impact of the use of case discussion. Results show that the teachers improved their interpretation on problems and structures of texts of textbook, from unawareness, awareness move toward understanding and applying to other situations.

D99. Teacher guides as instruments for teaching mathematics – A case study
Sebastian Rezat, Univ. of Paderborn, Germany
In Germany, teacher guides to secondary mathematics textbooks were merely solution manuals for the past 20 years. A new textbooks series for secondary school now offers a teacher guide, with a comprehensive didactical and methodological commentary to each page of the mathematics textbook. The teacher guide is structured in terms of blocks with different functions. In order to understand how teachers

use these teacher guides to prepare mathematics lessons a case study with two teachers (cases) was conducted. The instrumental genesis (Rabardel) of these two cases was analysed. The study shows that among different kinds of resources the teacher guides are the most important and are heavily used for preparing mathematics lessons. However, the analysis of utilization schemes shows that both teachers show different instrumentations of the teacher guides. Whereas one teacher is clearly instrumented by the block structure of the teacher guide the other is not. Furthermore, the results indicate possible factors that are likely to be responsible for teachers' following or deviating from the textbook and the intended implementation of it.

13.00-14.00 **Break/Lunch** (Building 40, Garden Court)

14.00-15.00

Parallel session 2.1 Room 58/1007 Chair: **T. Fujita**

B50. Open approach in Japanese textbooks: Case of the teaching of geometry in lower secondary schools.
Taro Fujita, Univ. of Exeter, UK; **Yutaka Kondo**, Nara Univ. of Educ., Japan; **Susumu Kunimune**, Shizuoka Univ., Japan; **Keith Jones**, Univ. of Southampton, UK
From the early 1970s Japanese mathematics teaching has put particular emphasis on designing and implementing lessons in which students can explore different approaches and ways to solve given problems. This is generally known as the open-ended approach because the tasks tackled by students are 'open' to different solution strategies and approaches. The purpose of this paper is to report on the extent to which such an open approach is realised in current mathematics textbooks in Japan. Our focus is geometrical reasoning in lower secondary school, as this is one of the important topics in mathematics. In analysing the topic of angles in polygons, we found that open problems were utilised by Japanese textbook authors as worthy approaches which all teachers could take in everyday lessons on this topic. We further found that while each of the seven textbook series had undergone the same official authorisation process, the textbooks showed different approaches for the same geometry topic. This illustrates the variety of ways in which the open-ended approach can be enacted in the teaching of mathematics.

B23. Mathematics textbook analysis: Supporting the implementation of a new mathematics curriculum
Lisa O'Keeffe, Univ. of Bedfordshire, UK
Following the 2005 National Council for Curriculum and Assessment (NCCA) review in Ireland a new mathematics curriculum was developed. This new curriculum was part of a strategic plan intended to improve mathematics teaching and learning in Ireland and it led to the development of new mathematics textbooks and the updating of already well-established mathematics textbooks. At the time there was significant national debate centered on the new curriculum. This national debate kept the spotlight firmly on the national roll out of the curriculum in late 2010 and no doubt mounted pressure on the relevant Government bodies. Hence in 2011, for the first time in Irish education history, the NCCA made the decision to intervene in the development and redevelopment of the new mathematics textbooks. One of their interventions was to commission the author, as part of the National centre of Excellence in Mathematics and Science Teaching and Learning (NCE-MSTL), to conduct a review of the available mathematics textbooks in light of the Project Mathematics curriculum documents. This paper presents a brief outline of this textbook review, discussing the methodology and the main findings while also intending to highlight the role of textbook analysis in supporting the implementation of a new curriculum.

Parallel session 2.2 Room 58/1009 Chair: **T. Miyakawa**

C19. Functions of proof: A comparative analysis of French and Japanese national curricula and textbooks
Takeshi Miyakawa, Joetsu Univ. of Education, Japan
The aim of this paper is to identify, through a comparative analysis of French and Japanese national curricula and textbooks, different functions attributed to and/or played by proof in geometry, and clarify the relations between the identified functions and the nature of related objects (e.g., theory, statement, diagram). As a result, it is made clear that proofs in two countries play some functions in different ways, and two countries take distinct positions on the choice of a raison d'être of proof (reason why proof is necessary in mathematics) around justification function: justification without perception in France and justification of general case in Japan. The analysis also shows that the functions identified in curricula and textbooks affect and/or are affected by the nature of related objects. For example, justification without perception is closely related to the theoretical geometry as an object to be taught, and provokes the use of "incorrect" diagrams in French textbooks.

C28. A cross-cultural analysis of the voice of curriculum materials
Janine Remillard, Univ. of Pennsylvania, USA; **Hendrik Van Steenbrugge**, Mälardalen Univ., Sweden; **Tomas Bergqvist**, Umeå Univ., Sweden
This paper presents a cross-cultural analysis of how authors of elementary mathematics curriculum materials communicate with teachers and what they communicate about, focusing on six teacher's guides from three distinct school systems, Flanders, U.S. and Sweden. Findings revealed distinct differences between approaches common to each cultural context that relate to different educational traditions. These findings point to differing assumptions about the knowledge needed by teachers to enact instruction. Further research is needed to explore these patterns qualitatively and consider teachers' use of these materials when planning and enacting instruction.

Symposium 1 Room 58/1023 Chair: **R. Even**

E98. Teachers editing textbooks: Transforming conventional connections among teachers, curriculum developers, mathematicians, and researchers
Ruhama Even, **Michal Ayalon**, **Shai Olsher**, **Edriss Titi**,Weizmann Institute of Science, Israel, **Charalambos Charalambous**, University of Cyprus, Cyprus
The relationships between teachers and textbooks are generally associated with curriculum enactment and teachers' use of curriculum materials. The proposed symposium examines what might be gained and what is entailed in providing teachers with the opportunity to edit the textbooks they use in class, using the M-TET (Mathematics Teachers Edit Textbooks) project, now in its fourth year, as the focus of investigation and illustration.
Ruhama Even will present the rationale and structure of the M-TET project, which invites teachers to collaborate in editing the textbooks they use in their classes, and to produce, as group products, wiki-based revised textbooks. This activity serves as a means to transform the conventional connections among teachers, curriculum developers, mathematicians, and researchers in mathematics education into multi-directional and more productive ones.
Michal Ayalon and Edriss Titi will illustrate: (1) the nature of the interactions between the participating teachers, and the textbook authors and mathematician that were made available to them for consultation, and (2) the contribution of these interactions to shaping the teachers' editing processes.
Shai Olsher will present findings from a study that examined the changes that the first year participants in the project suggested to make in the 7th grade textbook they were using in class. Four types of changes were identified: (1) Creating organizers to improve teacher work and accessibility to parents, (2) Organizing textbook presentation to better suit student learning, (3) Adding materials for low achieving students, and (4) Integrating technological tools for improving teaching and learning.
Charalambos Charalambous will serve as reactor to the above presentations.

Parallel session 2.3 Room 58/1065 Chair: **C. Morgan**

E15. The creation of mathematics in school textbooks: Palestine and England as example
Jehad Alshwaikh, Birzeit Univ., Palestine; **Candia Morgan**, Institute of Education, Univ. of London, UK The language of mathematics textbooks, including symbols and diagrams, constructs particular views of the nature of mathematics and expectations about students' participation in mathematical activity. In a collaborative project between the Institute of Education and Birzeit University, we developed an analytic framework for examining the nature of mathematics and mathematical activity in textbooks. This framework, based on those developed by Tang, Morgan, & Sfard (2012) for the verbal mode and by Alshwaikh (2011) for the visual, enabled us to take account of the multimodal nature of mathematical texts. We applied the framework to analyse a sample of topics from the textbooks used in Palestinian schools and to a smaller sample of topics from textbooks commonly used in England. The research showed that, for younger students in both countries, mathematics is construed as involving practical activities. For students in Palestine, however, abstract mathematical reasoning is also prioritised from a much earlier age. This raises questions about how textbooks in the two countries may support students to move towards abstract mathematical reasoning.

E5. Development of curriculum units as basic course for calculus
Yuang-Tswong Lue, Taipei Chengshih Univ. of Science and Technology, Taiwan
This study was to design, develop, and investigate instructional units for freshmen to learn before they study calculus. Because the concepts, skills, and theories of function are fundamental for the calculus course but the below average students were not familiar with the basic knowledge and ability in function when they studied in the high schools and it will affect their learning calculus, the investigator in this study has analyzed the calculus course to find out the relevant functional concepts, skills, and theories and taken some actual research studies as references to deliberately design, compile, and write an instructional unit on function. Then the teaching material was tried out in the classroom. During trying out the unit, the

investigator found that students were also unfamiliar with the concepts and operations of numbers and sets. Therefore, the investigator thought that it is indispensable to integrate the content of numbers and sets into the course. Finally the curriculum units including numbers, sets, and functions have been completed to be a basic course for calculus. After preparing the curriculum units, the teaching materials were sent to experts to ask for reviewing and giving feedback for revising the content. Then the curriculum will be tried out again in the beginning of the calculus course to test the degree of appropriateness and find where should be revised again. During the next year, a formal instruction will be carried out. Finally, it is to complete a set of curriculum units on number systems, sets, and functions for freshmen to take as basic content for calculus course.

Mathematics in the Science Curriculum Symposium Room 58/1067 Chair: **A. Christodoulou**

G110. Mathematics within bioscience undergraduate and postgraduate UK higher education

Jenny Koenig, Univ. of Cambridge, UK

At a time when bioscience is becoming more and more quantitative, undergraduate bioscience courses are facing problems of new students being underprepared. There are gaps in knowledge and understanding and issues surrounding attitudes to mathematics. This presentation will look at the transition issues and identify where many of the gaps are and explain how HE courses are seeking to overcome these problems through the use of context, authenticity and closer integration of mathematics in biology. The implications of recent government initiatives for the school curriculum will also be discussed, including GCSE reform and the proposed post-16 "Core Mathematics".

15.00-16.00

Parallel session 3.1 Room 58/1007 Chair: **F. Leung**

B62. Concept of probability: discursive analysis of Japanese secondary school textbooks

Koji Otaki, Hiroshima Univ., Japan

I report here a part of findings on my curriculum research about probability. The purpose of this paper is to clarify some differences between lower secondary school natures of the concept of probability and upper ones in Japan. For this, Japanese secondary school textbooks are analysed from the discursive framework in the commognitive theory. The results of analysis show two differences, which are not simple like the simple distinction of 'frequentistic vs. classical,' but more complex. The first difference exists between general natures of the concept of probability in the lower secondary textbook and in the upper one: the lower level nature is a hybridity of frequentistic and classical nature, while the upper level nature is a purity of classical nature. The second difference exists between their classical natures in the lower secondary textbook and in the upper one: a lower secondary school classical probability is different from an upper one in terms of their roles and realizations. These findings suggest that the number of natures of the concept of probability 'to be taught' around the world is more than what we have considered so far.

B74. Reading geometrically: The negotiation of expected meaning of diagrams in mathematics textbooks.

Leslie Dietiker, Boston Univ., USA; **Aaron Brakoniecki**, Michigan State Univ., USA

This paper applies reading theory to examine the challenges present in the interpretation of geometric diagrams in mathematics textbooks and identifies the different expectations of elementary and high school students when it comes to interpreting diagrams. We motivate this analysis by exploring how a task with a geometric diagram can appear in both elementary and secondary mathematics textbooks in the same form and still have substantively different mathematical answers. Thus, it starts to address the questions: (a) What strategies of reading diagrams are younger and older students expected to have? (b) What implications might this have for student reasoning with diagrams and its development? We demonstrate, through the contrast of diagrammatic positioning in tasks found in textbooks at different grade levels, how students are expected to develop sophisticated ways to interpret diagrams using context and convention. Based on a survey of elementary and high school U.S. textbooks, eight dimensions of reading geometric diagrams are identified, illustrated, and discussed. The textbooks used in this analysis were selected to reflect a variety of pedagogical and philosophical commitments in case these commitments altered the relationship between diagram and text. Also, to understand the role of cultural context, we included a grade 6 textbook from Turkey in the analysis. As a result of this analysis, we introduce multiple dimensions of diagram negotiation that are expected in textbooks as represented by their tasks and answers. Using these dimensions, we propose a definition of "reading geometrically," a notion inspired by Pimm (1995), and offer a reading heuristic to support student geometric reading.

Parallel session 3.2 Room 58/1009 Chair: **R. Rabelo**

C32. Dewey and mathematics textbooks

Rafaela Silva Rabelo, Univ. de São Paulo, Brazil

The following work is focused on a discussion about the contributions of John Dewey to mathematics education. It is based on the articulation of Dewey's ideas in different mathematics books/textbooks, between the end of the 19th century and the early 20th century. The purpose is to characterize the referred books and the differences among them, and to identify how Dewey's ideas – in special the notion of experience – are mobilized. More specifically, the present study is part of a doctoral research project that investigates the appropriations of John Dewey's and Edward Thorndike's ideas in the mathematics education field in Brazil between the 1930s and the 1960s. The discussion held in the present paper is based on the work of such authors as Roger Chartier and Michel de Certeau, regarding the social places of texts production, and concepts as appropriation and strategy. Some of the sources adopted were Dewey's books, such as The Psychology of Number (McLellan & Dewey, 1895); the series of arithmetic books written by James A. McLellan and Albert F. Ames, published between the 1890s and the 1900s; and the series of Georgia Alexander, published in the 1920s (both series had the involvement of Dewey). Based on this study it is possible to highlight the changes in mathematics teaching approaches in the analysed books as it relates to the changes in Dewey's own ideas. It is also possible to chart the evolution of Dewey's thinking from the general concepts conveyed in The Psychology of Number to a more focused attention on examples of daily life and references to cultural aspects regarding American context or other countries in Georgia Alexander's series.

C29. A comparative analysis of national curricula relating to fractions in England and Taiwan

Hui-Chuan Li, Univ. of Cambridge; **Yan-Shing Chang**, King's College, London, UK

The importance of a working knowledge of fractions in mathematics learning, coupled with the difficulties that students have with learning fractions, have prompted researchers to focus on this area of mathematics teaching. Research has reported that Taiwanese students show greater fluency in operations with fractions than their British peers. In view of the impact of the mathematics curriculum on a student's opportunity to learn mathematics, this paper explores and presents findings on what can be learned from an analysis of respective curricula in England and Taiwan. Specifically, fractions-related content as presented in the national curricula in England from 1999 to 2013 is compared with that of the "Grade 1-9 curriculum" in Taiwan as published in 2003 and implemented from 2005 to the present. The analysis of the 1999 and 2007 national curricula in England, and of the "Grade 1-9 curriculum" in Taiwan with respect to fractions shows that Taiwanese students begin to learn fractions addition at the age of nine, and learn the other three operations on fractions by age twelve (the end of primary education), while all four operations with fractions are not introduced to British students until age twelve. Taiwan's curriculum also emphasises proficiency in computing with fractions by the end of primary education. The new 2013 curriculum in England highlights some important changes in teaching fractions. For example, pupils will start to learn fractions addition from age seven. The implications of these and other changes in England's 2013 curriculum relating to fractions are discussed.

Symposium 1 Room 58/1023 Chair: **R. Even**

E100. Teachers editing textbooks: Changes suggested by teachers to the mathematics textbook they use in class

Shai Olsher, **Ruhama Even**, Weizmann Institute of Science, Israel

This study focuses on the changes teachers suggest making in mathematics textbooks. The study addresses this issue by investigating the changes the first year participants in the M-TET project suggested to make in the mathematics textbook they used in class, adopting Activity Theory as a theoretical framework. The participants, nine 7th-grade teachers, worked in an online environment combined with monthly face-to face group meetings and on-going consultation. Four types of teachers' changes to the textbook were identified: (1) Creating organizers to improve teacher work and accessibility to parents, (2) Integrating technological tools for improving mathematics teaching and learning, (3) Re-structuring textbook content presentation to better suit student learning, and (4) Adding materials for students with low achievements. This study contributes to gaining insights into teachers' needs, desires and aspirations about textbooks and the mathematics curriculum, and also revealing areas that require professional development.

Parallel session 3.3 Room 58/1065 Chair: **P. Teixeira**

F38. Building new teaching tools in mathematics: teacher and technology resources

Paula Teixeira, Mária Almeida, António Domingos, José Matos, New Univ. of Lisbon, Portugal

Using the paradigm of activity theory, the central problem is the characterization of the processes through which teachers replicate, adapt, and improvise tasks of textbooks with use of technological resources (CD-ROMs and web portals), in other words, we seek to identify teachers' use of schemes in actions mediated

by these technological elements. Two of us accompanied Portuguese secondary mathematics teachers in the assessment of learning tasks involving the use of new technological resources and the analysis of feedback of teaching performance after implementation in the classroom. This feedback was obtained from their peers, trainers and teachers' reflection on the actions in classes and occurred during the sessions of the training activities. The study[1] shows that teachers plan coordinated tasks that integrate technology resources and apply them in classes adjusting them to the technological environment of their schools. However, some difficulties in interpreting the returns are revealed.

F51. Modern Descriptive Geometry Supported by 3D Computer Modelling
Petra Surynkova, Charles Univ., Czech. Republic
In my research, I investigate innovative methods of explaining complex concepts in descriptive geometry. These novel methods will be employed in my upcoming textbook on descriptive geometry for undergraduate students. The innovation in explanation and didactic methods will include 3D computer modelling and interactive software visualization. In this paper, I will present my recent advances in teaching aspects of several descriptive geometry topics – parallel and central projections, especially linear perspective or the geometry of curves and the geometry of surfaces in technical practice. For selected topics, I will provide examples of usage of 3D computer modelling. My aim is to stimulate students' interest in the study of geometry, motivate them, improve their understanding of geometry, innovate the methods of teaching geometry, achieve better results in examinations and put emphasis on practical use of geometry. I would like to attract students to the traditional topics of descriptive geometry by using modern methods. At the same time, since I would like to motivate students to think about concepts in descriptive geometry, the suggested teaching aids should not suppress independent thinking. In other words, these aids should not be designed so as to solve all questions for my students – some should be left for the students to address. Surfaces used in technical practice are very suitable for presentation by means of 3D printing. Therefore, I plan to model these surfaces in the 3D modelling computer software in cooperation with my students so that these computer models can subsequently be printed on a 3D printer to foster spatial imagination.

Mathematics in the Science Curriculum Symposium Room 58/1067 Chair: **A. Christodoulou**

G111. Mathematics: the language of physics and engineering
Peter Main, Institute of Physics, UK
Physics is the most mathematical of the natural sciences. However, over time and for a number of reasons, the curriculum and assessment of physics at GCSE and A-level have become progressively less mathematical. Using data from published reports, I shall demonstrate the mismatch between what physicists and engineers in HE require of entrants in terms of their mathematical capabilities and the actuality. In addition, I shall discuss how physics often becomes much harder to understand when the mathematical content is minimised. Finally, I shall offer some ideas on how the linkage between physics and mathematics might be improved and also provide some early indications from the Institute of Physics' new Curriculum Committee which has started its work by considering A-level Physics.

16.00-16.30 **Tea/Coffee Break** (Building 40, Garden Court)

16.30-17.30

Symposium 2 Room 58/1007 Chair: **Z. Usiskin**

C53. Lessons learned from three decades of textbook research
Denisse Thompson, Univ. of South Florida**; Sharon Senk**, Michigan State Univ., USA
The University of Chicago School Mathematics Project (UCSMP) is a K-12 curriculum development and research project that has generated materials for U.S. classes consistent with national recommendations. As part of the curriculum development for grades 6-12, the Secondary Component has conducted research on the effectiveness of its textbooks. Research studies typically involve a combination of formative and summative elements conducted simultaneously. Formative elements inform author teams about content, sequence, and other aspects of the materials that need revision prior to commercial publication. Summative aspects investigate the effectiveness of the materials in typical classroom settings in comparison to textbooks already in place in schools. In research over three decades, numerous issues have

arisen and lessons have been learned about dealing with these issues. This paper shares six lessons we have learned in conducting textbook research that we believe transcend national contexts and may be of benefit to international scholars.

Parallel session 4.1 Room 58/1009 Chair: **D. Yang**

C31. A comparison of function in middle school textbooks among Finland, Singapore and Taiwan
Der-Ching Yang, **Yung-Chi Lin**, National Chiayi Univ., Taiwan
The purpose of this study is to examine the differences on the topic of functions among Finnish, Singapore, and Taiwanese middle grade mathematics textbooks. This study adopted a content analysis method to analyze how the textbooks introduced functions and the problem types presented in the middle grade textbooks. Results show that the three textbooks use different ways to introduce the concept of functions. Finnish textbooks use function machines with input and output tables to introduce the concept of function. Textbooks in Taiwan use verbal and visual (table) representations to introduce the concept of function. However, the Singaporean textbooks use verbal representation. Regarding representation forms in problems, the majority of problems in all three countries are provided in the purely mathematical form. However, the distribution of the representation forms in the Finnish textbooks is more balanced. The Finnish textbooks included a fair number of visual form and verbal form problems whereas the Taiwanese and Singaporean textbooks inclined to use purely mathematical form problems. About 98% of function problems in the middle grade textbooks in Taiwan and Finland and 84% in Singapore are close-ended problems. The Singaporean textbook has more open-ended problems than Finnish and Taiwanese textbooks. Comparing to the two Asian countries, the Finnish textbooks have more problems but these problems are more straightforward in terms of complexity than the Asian countries. The function machine has been recognized as a better way to introduce functions (Tall et al., 2000) and visual presentations benefit students' problem solving performance (Cai, 1995). In addition, various types of problems presented in a more balanced way may help students learn a concept more coherently (Zhu & Fan, 2006). From above discussion, we suggest that the Taiwanese and Singaporean textbooks should consider to more visual or verbal representation in their textbooks. On the other hand, the Finnish textbooks may increase the complexity of their problems.

B30. Assessing a new Indonesian secondary mathematics textbook: How does it promote authentic learning?
Mailizar Mailizar, Syiah Kuala Univ., Indonesia**,** and Univ. of Southampton, UK; **Lianghuo Fan**, Univ. of Southampton, UK
The new national curriculum has been implemented in Indonesia since 2013. One of the new curriculum's aims is to fulfill the three main components of education aims – knowledge, skill, and attitude – through authentic learning. In order to implement this new curriculum, the Indonesian Ministry of Education published the textbooks for all subjects, including mathematics. This study is intended to examine how the new national mathematics textbooks reflect one goal of the national curriculum, that is, to promote authentic learning. We think it is both timely and important to assess the new mathematics textbooks on how they are aligned with the new curriculum. This is particularly so in countries like Indonesia with a highly centralized education system, since the national textbooks are used in all public schools in Indonesia as the main teaching and learning resource in implementing the new curriculum, and they have great influence on classroom teaching and learning. The study focuses on to what extent authentic tasks are presented in the new mathematics textbooks. For this purpose, we established a framework for analyzing the mathematics tasks presented in the new textbooks. The year 7 mathematics textbook was selected, as it is the only new secondary school textbook currently available following the new curriculum. The analysis was carried out through two layers. First, all the mathematics tasks were classified into two categories: authentic task and non-authentic task. Second, the authentic tasks were categorized into two different levels of authenticity, which are real authentic and semi-authentic. In addition, the analysis also goes further to the comparisons of authenticity between topics of mathematics. The initial findings show that only about twelve percent of the tasks were authentic, and most of the authentic tasks were semi authentic ones. Moreover, only two percent of the tasks were real authentic tasks. This indicates to a large degree that the new textbook does not fully reflect the new curriculum in promoting authentic learning. Implications and further directions in research in this area will be discussed in the paper.

Parallel session 4.2 Room 58/1065 Chair: **B. Pepin**

B35. Choosing textbooks without looking at the textbooks – the role of the other's interpretations
Rúbia Barcelos Amaral, São Paulo State Univ., Brazil, & Univ. of Algarve , Portugal; **C. Miguel Ribeiro**, **Juliana Samora Godoy**, São Paulo State Univ., Brazil
This is part of a broader research project aimed at obtaining a deeper understanding on how Geometry and Technology intertwine in the textbooks and what kind (nature and goals) of proposals are made. Amongst

ten sets of textbooks that have been evaluated and approved by the Brazilian Government, to be distributed in schools (freely), only three of them have "digital learning objects" (DLO). Mayer (2009) presents a cognitive theory of multimedia learning considering how people learn from words and pictures. The technology evolution prompted new efforts to understand the potential of multimedia as a means of promoting human understanding – a potential that Mayer (2009) called the promise of multimedia learning. The need for intertwine research on textbooks and the DLO included on them is also justified by the fact that such DLO expand Valverde et al. (2002) comments that textbooks are the print resources most consistently used by teachers and students in the course of their joint work. The project considers a qualitative research with an interpretative approach and here we will discuss some aspects of the DLO included in one of the three collections approved by the Government - such DLO include, amongst others, videos, animations, simulators and games. Preliminary results show that the DLO included in the collection consider Mayer's (2009, p. 10) defines has "Three Views of Multimedia": Delivery media, Presentation mode, and Sensory modality. Although such views are considered, a deeper analysis reveals that the required level of interaction with pupils is very low and it can be considered only has a detractor for students, and a domestication of media (Borba & Gadanidis, 2008). Deeper analysis is needed in order to understand what is really the role of DLO in textbooks and possibly, to steer some possibilities for improving its conceptualization in and for facilitate the multimedia learning.

A73. Reflections on trends in mathematics education in Brazil set in the context of textbooks for teaching mathematics **Maria Margarete Do Rosário Farias**, State Santa Cruz Univ., **Andriceli Richit**, State Sao Paulo Univ., **Rejane Waiandt Schuwartz Faria**, Intitution Bradesco Foundation, Brazil
In this article we bring some reflections related to trends in mathematics education and their possible interrelationships with textbooks of the Mathematics teaching into secondary education. To analyze the data we used content analysis by form themselves into a research methodology used to describe and interpret the contents of all kinds of documents and texts. In this analysis, we seek to describe qualitatively the data which helped us to reinterpret the messages as well as to achieve an understanding of their meanings at a level that goes beyond a common reading. Having the works listed, we put them according to the Trends highlighted by D'Ambrosio and Borba (2010) - Mathematical Modelling, Use of Technology in Mathematics Education, Ethnomathematics, Philosophical Aspects, Historical and Political Perspectives of Mathematics Education.Those trends, in our understanding may be presented as supporting mathematical discipline working as a strategy in which students and teachers can foster discussions about the theories and practices.

Parallel session 4.3 Room 58/1023 Chair: **I. Mok**

F2. How technology use is being reflected in junior secondary mathematics textbooks in Hong Kong?
Ida Ah Chee Mok, Univ. of Hong Kong, Hong Kong
The use of digital technologies has been proposed as one of the five basic principles of curriculum design in the curriculum document for the secondary mathematics curriculum (CDI, 1998). Since then, the Hong Kong curriculum has undergone continual reforms of different scales and the use of digital technologies in mathematics teaching has been promoted. Textbook is the medium for informing what should be taught in the curriculum and often recognized as the potentially implemented curriculum. To what extent has the technology been used and reflected in the junior mathematic textbooks under the promotion of top-down curriculum reforms? A popular textbook series was analyzed. The use of technology was categorized into the use of calculators; the use of internet and the use of software, internet and CD-ROM; and other supplementary materials provided by the publishers. The use of technology varies according to the topics in the different strands, namely, algebra, geometry and data handling. Finally, Hong Kong as an example in an Asian context to the use of IT in mathematics teaching is argued to be at a very preliminary stage and some future directions are proposed.

F80**.** In-service teachers education and e-textbook development: an integrated approach
Victor Giraldo, **Letícia Rangel**, Univ. Federal do Rio de Janeiro, **Cydara Ripoll**, Univ. Federal do Rio Grande do Sul; **Francisco Mattos**, Univ. do Estado do Rio de Janeiro, Brazil
The Brazilian Mathematical Society (SBM) has been conducting the research project MatDigital, for the design and production of digital materials (e-textbooks) for the teaching of mathematics at elementary school (grades 6 to 9, corresponding to ages 11 to 14). MatDigital is under the broader Klein Project for the 21st Century, internationally conducted by International Commission for Mathematical Instruction (ICMI) and International Mathematical Union (IMU). The development methodology is based on the collaborative work of a large team, including school teachers and researchers on mathematics and on mathematics education, from different regions of the country. The need to integrate the design of digital materials with in-service teachers' education initiatives was clear for the team. These initiatives had several goals: (1) to train teachers on the use the digital materials, from both the perspectives of technical knowledge of

software, and devices and of the preparation for potential changes in the classroom dynamics brought into play by the emergence of digital instructional tools; (2) to create and consolidate an environment, involving school teachers, teachers educators and policy makers, for long- term joint discussion, integration the reflection on mathematical subject matter, classroom practices and use of instructional materials; (3) to enrol teachers in the development process of the digital materials, as a means to turn passive use to authorship, and to reverse the traditional top-to-bottom paradigm on instruction development; (4) to use the feedback from workshops and testing in actual classroom situations to develop successively improved versions of the digital materials. Therefore, MatDigital has evolved to a project with two-fold, integrated and equally important objectives: design of digital textbooks and in-service teachers' education. In this paper, we report results of pilot stage of MatDigital project, in which early versions of the materials were tested in public schools. We focus the analysis in two dimensions: students' learning and teachers' practices. The results suggest that the involvement of the teachers with the collective discussion about the materials conception and methodology, together with some special features of the materials themselves, may be associated with a profound shift in the classroom dynamics.

Mathematics in the Science Curriculum Symposium Room 58/1067 Chair: **A. Christodoulou**

G112. Chemistry and Mathematics: A symbiotic relationship?
David Read, Univ. of Southampton, UK
This presentation will explore the role of mathematics in chemistry, and the importance of mathematical skills in ensuring that students can fulfil their potential in studying the discipline. This will include discussion of the impact of prior attainment in mathematics on performance at degree level, and will outline the support provided to students at Southampton in the form of 'Mathematics for Chemists' workshops and accompanying resources.

17.30-19.00 **Happy Hour** (Building 40, Garden Court)

Day 2 Wednesday 30 July 2014

08.00– 09.00 **Registration** Foyer, Level 1, Building 58 (Murray Building)
(Day Chair: **Keith Jones**)

09.00-10.00 **Plenary Session 2** (Lecture Theatre, 58/1067)

Speaker: Prof. **Michal Yerushalmy**, University of Haifa, Israel
Challenging the Authoritarian Role of Textbooks

(Chair: Dr. **Christian Bokhove**)

10.00-10.30 **Tea/Coffee Break** (Building 40, Garden Court)

10.30-11.30

Parallel session 5.1 Room 58/1007 Chair: **B. O'Sullivan**

A84. Change comes slowly: Using textbook tasks to measure curriculum implementation in Ireland
Brendan O'Sullivan, St. Patrick's College, Ireland
Textbooks are an important resource in Irish mathematics classrooms, which can have both a positive and negative impact on teaching and learning.The mathematics curriculum at post-primary level in Ireland was reviewed in 2005. The Project Maths initiative was introduced to reform the curriculum, bringing about changes to what students learn in mathematics, how they learn it and how they are assessed. Publishers have produced new texts in response to the expectations of the revised curriculum and the changed needs of the classroom. This paper presents a framework to consider how tasks found in mathematics textbooks are meeting the objectives of this new curriculum. Sections of textbooks currently being used in Irish classrooms at second level have been analysed using this framework and the results indicate that, while all textbooks incorporate a significant number of these objectives to some extent, key aspects are being neglected.

A95. What official documents tell us about textbook use in times of curricular change: The case of the "new mathematics movement" in Portugal
Cristolinda Costa, Univ. do Algarve/UIED; **José Matos**, Univ. Nova de Lisboa/UIED
This paper discusses the influence of the use of textbooks in elementary teachers' practices when a new structure was created in the Portuguese educational system in 1968. Mathematics syllabus incorporated the ideas from the New Mathematics Movement and teachers were faced with a novel situation requiring teaching new contents and the adoption of new teaching methods. Official documents report teachers difficulties and misunderstandings that may be traced to the use of textbooks

Parallel session 5.2 Room 58/1009 Chair: **G. Kim**

B60. Textbook analysis: examining how Korean secondary mathematics textbooks support students' mathematical thinking and learning
Gooyeon Kim, Sogang Univ., South Korea
This study aimed to examine how Korean secondary mathematics textbooks support students' mathematical thinking and learning. For the purpose, we analyzed mathematical tasks in selected textbooks for secondary students (grades 7-10) in terms of the levels of cognitive demand by using the task analysis framework suggested by Stein & Smith (1998). For the analysis, we first identified tasks in all the selected textbooks and coded each task as memorization (M), procedures without connections (PNC), procedures with connections (PWC), and doing mathematics (DM). The findings from the analysis revealed that 94 percent of the tasks from the secondary mathematics textbooks were at the low level of cognitive demand, that is, M and PNC tasks. In particular, the low level tasks mostly focused on PNC tasks that have no connections to concepts or meaning underlying the procedures, by requiring no explanations. Also, the findings suggested that the tasks in the textbooks hardly provide students with opportunities to use procedures for developing understanding of mathematical concepts and to explore mathematical relationships.

B85. Model Method in Singapore primary mathematics textbooks
Tek Hong Kho, **Shu Mei Yeo**, Ministry of Education, Singapore; **Lianghuo Fan**, Univ. of Southampton, UK
The Concrete-Pictorial-Abstract (CPA) approach in particular the model drawing method, or simply the model method, has been widely recognised as a signature pedagogy of Singapore mathematics. It was introduced in the 1980s and became a distinguishing feature of Singapore Primary Mathematics textbooks in the 1980s and 1990s. These textbooks and their adapted versions have been used in schools in many countries because of Singapore's high performance in mathematics in both TIMSS and PISA. In this paper, we will focus on the design and development of the model method in the textbooks, and discuss the how and why of the model method as a pedagogy for primary mathematics, and its impact on teaching and learning in Singapore mathematics classrooms. As there has been an increasing interest in the model method in mathematics education worldwide and this has attracted researchers' attention, a brief account of schema theory and brain research will be included. The paper will also make connections between the model method and the algebraic method, given the general background that in Singapore, students learn the algebraic method of using a linear equation in one variable to solve word problems formally only in secondary school, and many of them have difficulty in formulating algebraic equations to represent the quantities and relationships given in the word problems. Furthermore, the paper will highlight how

Singapore current secondary mathematics textbooks integrate the two methods to help students develop their confidence and competence in using the algebraic method, which is a fundamental skill in higher mathematics. The paper will end with a discussion on how the model method can be incorporated into the mathematics curriculum, and its strengths and weaknesses.

Parallel session 5.3 Room 58/1023 Chair: **J. Edwards**

D118. Pedagogical and curricular decision-making as personalised textbook development
Julie-Ann Edwards, Ian Campton, Univ. of Southampton, UK
The increase in expectations of teachers in England and Wales to differentiate mathematics learning for students and to personalise mathematics progression trajectories for students, either through the Teachers' Standards (DfE 2011), the inspection regime in England and Wales (Ofsted 2012) or recent initiatives from the Department for Education such as the 'Pupil Premium' (IFS 2010), can result in teachers in both primary and secondary schools utilising a range of resources to develop a 'personalised mathematics curriculum' for students in schools in England and Wales. Drawing on evidence from Remillard's (2005) study on the use of curriculum materials in differing contexts in the US and Clements' and Samara's (2004) theoretical examination of learning trajectories in mathematics education, we examine evidence from two experienced teachers who utilise established banks of mathematics resources for teaching the mathematics curriculum, present a conceptualisation of the curriculum as a 'personalised learning trajectory' for students and suggest this as an increasing trend in mathematics teaching in both primary and secondary schools in England and Wales. In presenting this evidence, we argue that this type of use of established curriculum materials by experienced teachers, in which there are successive implementations of the curriculum with individual students or groups of students, results in refining of the 'personalised textbook'.

D10. If not textbooks, then what? English mathematics teachers' use of alternative curricular resources
Helen Siedel, **Andreas Stylianides**, Univ. of Cambridge, UK
Although in several countries, such as Japan and the United States, mathematics teachers tend to use textbooks rather heavily in planning and delivering their lessons, in England the situation seems to be different. This situation deserves attention especially in light of the body of research showing or elaborating on the important role that (well-designed) textbooks can play in supporting classroom work and in promoting teachers' understanding alongside student learning. In this paper, we will report findings from an interview study with thirty secondary mathematics teachers, from six schools in two counties in England, designed to determine what specific curricular resources individual teachers use, with the term "curricular resources" used broadly, including but not limited to textbooks and other print material, digital resources, video, tools, and people. None of the schools had a policy about the use of textbooks; teachers were largely free to decide whether and how much to use textbooks and any supplementary or substitute resources. The study confirmed the perception that English teachers tend to make quite limited use of textbooks even when textbooks are available, and revealed a range of alternative curricular resources that seem to influence English teachers' work. Teachers' personal collections of preferred resources, which may or may not include textbooks, develop for a variety of reasons. Use of even the most frequently reported or most familiar resources is varied. In the paper, we will elaborate on these findings and discuss a couple of the issues that emerge from English teachers' use of alternative curricular resources.

Parallel session 5.4 Room 58/1065 Chair: **Y.Wang**

C47. Understanding of linear function: A comparison of selected mathematics textbooks from England and Shanghai
Yuqian Wang, **Patrick Barmby**, **David Bolden**, Durham Univ., UK
This study describes a comparison of English and Shanghai textbooks in terms of understanding the concept of linear function. Selected textbooks from both countries were analysed in a number of different ways. First, the extent of coverage was compared as well as the background context of this topic. Second, the examples and exercises for pure mathematics knowledge used in each country were analysed with regards to the extent of understanding required. 'Understanding' was defined by employing a combination of the most prominent theories from the existing literature and this included 'understanding' as both pure mathematics knowledge and application in real world. Particularly for application, how selected textbooks presented questions and their solutions were compared. Findings suggested that this topic was equally important in selected textbooks for both countries from coverage perspective. In general, Shanghai textbook requires more abstract understanding levels than English textbooks. However, the English textbooks tended to introduce linear function examples with an emphasis on a graphical approach while the Shanghai textbook had more of a focus on a symbolic/algebraic approach. In terms of applying the concept of linear function into real life situation, the English textbooks emphasized algebraic solutions

while the Shanghai textbook emphasized both algebraic and graphical solutions. These findings are discussed in terms of how the two countries under different cultural contexts view the teaching and learning of linear function. The discussion explores possible influences of those textbooks on students' performance and what could be learned from each other in teaching and learning this topic.

E55. Mathematics textbook research and development for the promotion of independent learning and inquiry learning
Fei Zhang, **Xiujuan Zhu**, Jiangsu Second Normal Univ., China
As the most important resource of students' learning, textbook should not only show the knowledge of the subject, but also show the occurrence and development process of the knowledge, and embody the learning process of the students. As the main carrier of students' learning, textbook should be kept some space for the students to operate directly in it, such as record and list systematically. Inquiry learning activities should be designed in textbooks, and important results of the activities should be showed appropriately to facilitate the students' learning after class. But the results should not be arranged immediately after the inquiry activities. We need to make innovation of the style of textbook and show the results of inquiry learning by means of learning links and so on. In order that the students can find out their own learning situations, we suggest the addition of learning objective and learning assessment. In order to improve the students' independent learning ability, we suggest showing moderately and summarizing the learning structure of the related knowledge; showing the guidance process of the learning methods, such as reflection after solving problems; and providing moderate help by means of prompt and so on at the place where we estimate the students have difficulties. Considering the difference of students' ability, help should include several levels, such as first showing the general help and then the more specific one. Thus all students with different learning ability can obtain help and necessary inquiry space from the textbooks.

Symposium 3 Room 58/1067 Chair: **G. Howson**

B71. US mathematics textbooks in the common core era
William H Schmidt, **Richard T Houang**, Michigan State Univ., USA
Since 2010, 45 states and the District of Columbia in the US have initiated the implementation of the Common Core State Standards for Mathematics (CCM). Two key implementation issues for mathematics were examined: teacher coverage and the coverage in available textbooks. Popular textbook series were analysed following the textbook analysis procedures developed in TIMSS. During 2011, participating K-8 teachers recorded their daily coverage of the different CCM standards. In addition, a group of experts - mathematicians, mathematics educators and practitioners – were asked to assign instructional time to the standards according to their complexities and relative importance for that grade's instructional content. The results indicated that US textbooks generally did not cover all of the on grade CCM standards. On average, 70% of the CCM standards were covered at each grade. In terms of content coverage, only an average of 43% of the book covered the on grade standards. Time spent by teachers was more aligned with the textbook suggested coverage than with the experts. The policy implications of these results on the implementation of CCM standards are also presented.

11.30-14.00 **Exhibition** (Garden Court)	**11.30-14.00** **Poster Session** (Garden Court)	**13.00-14.00** **Break/Lunch** (Garden Court)

Contributions accepted for the poster session:
Please see abstracts at the end of the conference programme.
F7. The use of technology in textbooks: A grade-7 example from Hong Kong. **Ida Ah Chee Mok, King-Woon Yau**, The Univ. of Hong Kong
C9. The study of geometric content in the middle grade mathematics textbooks in Singapore, Taiwan,and USA. **Der-Ching Yang**, Nat'l Chiayi Univ., Taiwan
A25. Situational authenticities in lower secondary school mathematics problems: Reasons for calculation and origin of quantitative information. **Lisa O'Keeffe**, Univ. of Bedfordshire, UK; **Josip Slisko**, Benemérita Univ. Autonoma de Puebla, Mexico
B26. Analysis of integral and differential calculus textbooks and mathematical modelling activities in the light of the didactic transposition theory. **Lourdes Maria Werle De Almeida**, Univ. Estadual de Londrina; **Kassiana Surjus**, PUC, Brazil

B41. The characteristics of new mathematics textbooks for junior secondary school in China: A case study. **Fu Ma**, Nanjing Normal Univ.; **Chunxia Qi**, Beijing Normal Univ.; **Xiaomei Liu**, Beijing Capital Normal Univ., China

E58. An introduction to mathematics textbooks policies in China. **Huiying Zhang**, Shijiazhuang Research Institute of Education Science, China

D61. Korean students' use of mathematics textbook. **Na Young Kwon**, Inha Univ.; **Gooyeon Kim**, Sogang Univ., South Korea

C82. The broken-tree problem: formulations in Mexican middle-school mathematics textbooks and students constructions of the related situation model. **Josip Slisko**, **José Antonio Juárez López**, Benemérita Univ. Autónoma de Puebla, Mexico

D92. Mathematics knowledge and skills higher educ. programs expect of high school graduates. **Cengiz Alacaci**, Istanbul Medeniyet Univ.; **Gulumser Ozalp**, Gaziantep C. Foundation Private Sch; **Mehmet Basaran**, SANKO Private Sch; **İlker Kalender**, Ihsan Dogramaci Bilkent U., Turkey

B93. Forewarned is forearmed: A mathematics textbook. **Peter McWilliam**, The College of The Bahamas, Bahamas

G94. Differential and integral calculus in textbooks: An analysis from the point of view of digital technologies. **Andriceli Richit**, State Sao Paulo Univ.; **Adriana Richit**, Federal Univ. of Fronteira Sul; **Maria Margarete Do Rosário Farias**, State Santa Cruz Univ., Brazil

D102. Enhancing a teacher's fundamental interaction with the textbook through a school-based mathematics teacher research group activity in Shanghai. **Liping Ding, Svein Arne Sikko**, Sør-Trøndelag University College, Norway

F119. The potential of handwriting recognition for interactive mathematics textbooks. **Mandy Lo**, University of Southampton, UK.

14.00-15.00

Parallel session 6.1 Room 58/1007 Chair: **C. Ripoll**

C54. An international comparison of mathematical textbooks

Cydara Cavedon Ripoll, Univ. Federal do Rio Grande do Sul, Brazil

As Howson (2013, p. 657) comments, mathematical textbooks "have played and will continue to play a vital role in mathematics education objectives, and not merely examination success." Therefore, attention should be paid on the importance of the coherence of textbooks, as a criterion to assess if they are suitably designed to support students on attaining a full range of mathematical abilities. In this paper, we report partial results of a research project that aims to compare textbooks from Brazil, France, Germany, Italy and Japan. Our analysis is based on the attributes of textbooks ranked by Howson (2013, p. 653-654), including: mathematical coherence; clarity and accuracy of explanations; clarity in the presentation of kernels. We add to these criteria, two particularly important analysis dimensions: (i) Do the textbooks allow students the opportunity to experience abstract mathematical thinking? (ii) Do they develop different strategies of arguing, as a means to construct a view of Mathematics as a science based on deduction? We also present and discuss excerpts from the textbooks as instances of approaches that may lead to misconceptions, misinterpretations, contradictions, or give student an unclear idea of mathematical deduction. The focus of our analysis is grounded upon the premise that the goals of mathematical instruction include not only to equip students with a clear idea of the applications of Mathematics in everyday life, but also with a view of: What is Mathematics as a science? What is an acceptable mathematical argument? How should one argue in order to establish an assertion as a mathematical truth?

C56. A comparative study of statistics in junior high schools based on mathematics textbooks of China, US and Australia

Jianbo Wang, **Yiming Cao**, Beijing Normal Univ., China

The content of statistics in current mathematics textbooks used in junior high schools of China, the United States and Australia, are chosen as the objects in this study. The paper conducts a comparative study in light of content, content proportion, presentation, and content width and depth. The study analyzes characteristics of the content of statistics in the textbooks of these three countries and provides enlightenment for the statistical content in China's textbooks.

Parallel session 6.2 Room 58/1009 Chair: **M. Almeida**

C37. Mathematics textbooks, in Portugal: The unique textbook

Mária Almeida, **Paula Teixeira**, Ag. Escolas dos Casquilhos–UIED, **António Domingos, José Matos**, Faculdade de Ciências e Tecnologia da UNL–UIED, Portugal

Textbooks are some of the most relevant elements of the material culture of any discipline. Textbooks are sensitive to national contexts and can be seen as probes of the state and structure of mathematical education, its goals and its organization. In Portugal, by 1948, an educational reform established that a disciplines' textbook for each grade of secondary schooling would be the same for all of the schools (Liceus). This new system relied on textbooks put to a tender for the approval of the unique mandatory textbook that would be used by teachers and students the following five years. The tender was issued by the Ministry of Education and encompassed a review of all the textbooks that were submitted to it. Regarding to mathematics textbooks, there was an approved textbook for each topic studied within a school year – Arithmetic, Algebra, Geometry and Trigonometry. The emergence of a unique mandatory textbook was not peaceful; some teachers published their arguments against this system in teachers' bulletins, as well as, in the press. This paper will present and discuss the tenders for the approval of the unique mandatory textbook, in the period 1948 and 1974.The main historical sources were composed from the Education Ministry's General-Secretariat Historical Archives, the Lisbon´s Newspaper Library and the National Library.

E69. Mathematics textbook development and learning under difficult circumstances in schools in Nigeria

R Abiodun Ogunkunle, Univ. Of Port Harcourt, Nigeria

The 9-year Basic Education Curriculum in Nigeria has paved way for recent innovations in the educational sector. This has included but not limited to revision and new inclusions of curriculum resources to make sure learners benefit and develop their potentials maximally from the free, universal, basic and compulsory education system for all children of school going age. Textbook development a crucial aspect of the process, has witnessed proliferation in the country. This study examined how students learning under difficult circumstances are considered in textbook development especially in the learning of mathematics in schools in Nigeria. A survey research involving stratified random sampling technique comprising of 3600 students was carried out in the six (6) geo-political zones of the country. Each strata was made up of 50 students from 4 different schools in the most volatile villages in 3 states of each geo-political zone in the country. Quantitative and qualitative analysis of results revealed that the needs and interests of students learning under difficult circumstances were inadequately considered in mathematics textbook development. The paper concludes by encouraging a shift in paradigm for textbook developers from the ideal classroom environment to incorporate extreme learning situations. Pedagogical implications as regards students learning of mathematics were put forth. The paper also suggested that contemporary national issues should serve as context for solving mathematics problems while developing textbooks in general.

Parallel session 6.3 Room 58/1023 Chair: **B. Grevholm**

B63. Possible misconceptions from Japanese mathematics textbooks with particular reference to the function concept.

Yusuke Uegatani, Hiroshima Univ., Japan

The purpose of this paper is to partially answer the following general research questions: (a) Do mathematics textbooks have an influence on students' misconceptions? (b) What should the textbook writers pay attention to? In this paper, we particularly focus on the treatment of the function concept in Japanese mathematics textbooks, and point out that a potential for misconceptions is inherent in the way of presenting the examples of functions or the questions about functions in the textbooks. We took both of the constructivist and sociocultural perspectives, and carried out one of the constructivist way of discussing what conception can arise, that is, the conceptual analysis. As a result of the analysis, we found two potential misconceptions in Japanese representative textbooks. One conception seemed to come from the encapsulation of the process of formularizing a single algebraic rules for the given relationships between the variables x and y. Another conception seemed to come from the encapsulation of the process of fixing x and calculating y in the given formulas. In addition, there was no chance around the presentation of the definition of a function in the textbooks to unify and generalize these two conceptions. As an explanation why the students may have difficulties to unify and generalize them, the idea of subjective randomness was introduced. As a possible direction of the future textbook development, to improve the insufficiency of subjective randomness, an example based on geometric construction was proposed.

B75. Integrated education at the primary school in Lithuania.
Saulius Žukas, Baltos Lankos Publishing House; **Ričardas Kudžma**, Vilnius University, Lithuania
In this article we present a concept covering the full cycle of primary education and its realisation in a set of primary-school textbooks called "Vaiva" (the original Lithuanian title is "Vaivorykštė") that connects the following disciplines: introduction to the world, native language (Lithuanian), mathematics, arts and crafts, music and dance, and ethics. The Paris school of semiotics was used as the methodological background for this concept. The material for each year is divided into abstract topics over nine months. Students have one book containing all the topics for each month. Each month's topic is divided into three or four specific subtopics. This means that over four years of primary education about 130 topics are covered. One specific subtopic – timing – is considered here in more detail. Benefits of integrated teaching are also discussed.

Workshop 2 Room 1065 Chair: **P. Charlton**

F18. Authoring your own creative, electronic book for mathematics
Christian Bokhove, **Keith Jones**, Univ. of Southampton, UK; **Patricia Charlton**, **Manolis Mavrikis**, **Eirini Geraniou**, London Institute of Education, UK
The European 'MC-squared' project aims to start several so-called 'Communities of Interest' (CoI) in a number of European countries (Fischer, 2001) that work on digital, interactive, creative, mathematics textbooks, called cBooks. The cBooks are authored in the Digital Mathematics Environment in which authors can construct books with various interactive 'widgets'. In this 120 minutes workshop you will:
* Be given a short overview of the MC-squared project and the architecture of the Digital Mathematics Environment;
* Be shown two examples of cBooks on building blocks, number and fractions, as well as a myriad of widgets that could be integrated in the cBooks;
* Learn how to make your own, simple, interactive cBook;
* Be shown how these books can be used with students by sharing the book you've made with other workshop attendees;
After the workshop it will be possible to look at further possibilities to work with the UK CoI.

Symposium 4 Room 58/1067 Chair: **M. Grace**

F3.Transition to college mathematics and statistics: a problem-based, technology-rich capstone course for non-stem students
Christian Hirsch, Western Michigan Univ., USA
This paper describes a four-year project, funded by the National Science Foundation, to design, develop, and evaluate Transition to College Mathematics and Statistics (TCMS), an innovative senior-level course to help meet the diverse quantitative needs of students whose intended undergraduate programs do not require calculus (e.g., business; management; economics; the information, life, health, and social sciences; and many teacher preparation programs). For students intending to enrol in non-STEM undergraduate programs, many schools in the U.S. have little to offer as a transition to college-level mathematics and statistics, other than Precalculus or a narrow Advanced Placement course. Consequently, many students opt out of mathematics their senior year or study mathematics that is inappropriate for their career aspirations. However, research shows that such students are much more likely to be placed in a non-credit bearing course upon admission to college. TCMS emphasizes mathematical modelling, informatics, decision-making under constraints, data analysis and inference, and important mathematical habits of mind. TCMS is accompanied by concurrently-developed, curriculum-embedded TCMS-Tools, a suite of Java-based software tools, including a spreadsheet, a CAS, dynamic geometry, data analysis, simulation, and discrete mathematics tools together with specialized apps, such as a randomization test for significance testing, tools for investigating "what-if" questions related to growth of annuities and amortization of loans, and two- and three-dimensional geometric linear programming. This session focuses on the TCMS content, pedagogical design, illustrative applied problems, affordances of TCMS-Tools, and evaluation results from classroom trials of TCMS use as a capstone course in diverse settings.

15.00-16.00

Parallel session 7.1 Room 58/1007 Chair: **L. Melo**

A24. Scientific mathematics and school mathematics: knowledge, conceptions and beliefs of teachers and mathematicians during the development of an E-Textbook.
Lucas Melo, **Victor Giraldo, Letícia Rangel**, Universidade Federal do Rio de Janeiro, Brazil
The aim of this work is to investigate the process of sharing and negotiation of knowledge, conceptions and beliefs, on Scientific Mathematics and School Mathematics, among the participants of team involved in the development of a set of e-textbooks for the elementary school (MatDigital Project, Brazilian Mathematical Society). The set of e-textbooks includes four volumes in digital interactive format, integrating a range of multimedia resources. The Project is run by a team with diverse academic and professional backgrounds, which gathers elementary school teachers and university mathematics and mathematics education lecturers. We review the research literature on pedagogical content knowledge (Shulman, 1986), beliefs and conceptions (Thompson, 1984; Ponte, 1992) and reflection-in-action / reflection-on-action (Schon, 1992) to form a framework that allows us to investigate and describe how the negotiation process to produce a consensual result for the content of the e-textbook may (or may not) have an effect on the participants' ideas towards mathematics and teaching of mathematics. The research methodology is based on observant participation (Wacquant, 2002), including semi-structured individual and collective interviews. On this paper, we present some results of this research, including a map of the meanings associated with Scientific Mathematics and School Mathematics by the participants, and their possible relationships with the work in the MatDigital Project.

A4. Pre-service and in-service teachers' preference when selecting mathematics textbooks
Hana Moraova, Charles Univ., Czech Republic
The paper presents results of a research survey carried out within the frame of a larger research project, in which the author make inquiry into the process creation, choice and use of textbooks of mathematics. In this paper, the author argues that teachers' active participation in production of new culture (as Giroux (1983) claims to be the case at schools) is possible in mathematics only if teachers realize they are working with cultural values in their classrooms. That is why the author constructed a questionnaire to name the criteria in-service and pre-service teachers pay attention to when selecting a textbook. Are cultural values (e.g. gender correctness) of any interest? The questionnaire was administered to 28 pre-service and in-service teachers. The analysis of the questionnaire among other shows that teachers prefer teaching from textbooks of their own choice and that priorities in selecting textbooks are much more connected to mathematics than cultural contents.

Parallel session 7.2 Room 58/1009 Chair: **K. Hemmi** (15.00-15.30)

C34. Crossing the boundaries: Swedish teachers' interplay with Finnish curriculum materials
Kirsti Hemmi, **Heidi Krzywacki**, Mälardalen Univ., Sweden
Crossing the cultural boundaries provides a fruitful setting for investigating the dynamic interplay between teachers and the applied curriculum materials. In this paper, we report on the initial analysis of interviews and meetings with eight Swedish primary teachers regarding using translated Finnish curriculum materials, i.e. a textbook and teacher guide, for the first year. All teachers had chosen to use the materials voluntarily. Our analysis shows that despite some consistent experiences concerning using the materials, their ways of designing lessons vary greatly in terms of selecting ideas from the materials to be realized in the classroom. Most of the teachers seem to rely on the Finnish teacher guides more than the Swedish ones. We elaborate on both similarities and differences in relation to the teachers' experiences and the specific features of the current school context.

Symposium 5 Room 58/1023 Chair: **Y. Wang**

E120. The New Century Primary Mathematics Textbook Series: Textbooks with specific consideration to characteristics of children's thinking. **Huinu Wei**, **Fengbo He**, Editorial Board of New Century Primary Mathematics Textbooks, Beijing Normal University Press, China
The process of children's mathematics learning is supposed to be lively, active and full of individual characteristics. An ideal series of textbooks should offer learning recourses with which students and teachers may work together. Therefore, while developing the New Century Textbook Series, characteristics of children's thinking were fully respected and considered, and lists of challenging and inviting tasks were designed. In doing so, a diverse and cumulative learning process was ensured. To promote understanding of core concepts in mathematics, it is designed in such a way that students are given sufficient time and space for exploration and discussion, thus contributing to all-rounded

development of students in the domains of knowledge and skills, mathematics thinking, problem solving, and affection and attitudes. In this presentation, we will share our examples, experiences and reflections in developing such a primary mathematics textbook series.

Workshop 2 Room 1065 Chair: **P. Charlton**

See programme information for 14.00-15.00

Parallel session 7.3 Room 1065 Chair: **T. Rowland**

B22. Modes of reasoning in Israeli 7th grade mathematics textbook explanations **Boaz Silverman**, **Ruhama Even**, Weizmann Institute of Science, Israel

The goal of this study is to characterize the justifications and explanations offered in 7th grade Israeli textbooks for mathematical statements. Eight mathematics textbooks were analysed: six intended for the general student population, and two for students with low achievements. The justifications and explanations offered in the textbooks for eight selected mathematical statements were classified using the modes of reasoning framework (Stacey & Vincent, 2009). Our findings suggest that 7th grade Israeli textbooks provide justifications for all of the analysed statements (but one statement in one textbook), commonly using several modes of reasoning in explanations for each statement. Most of the explanations are included in the explanatory texts; few in tasks intended for student individual or small-group work. Almost every justification is deductive or empirical, yet different modes of reasoning are used for geometric and algebraic statements. Also, empirical justifications are more prevalent in textbooks intended for students with low achievements, whereas deductive justifications are typically offered in textbooks intended for the general student population.

C45. A comparison of two grade 7 mathematics textbooks.

Jaguthsing Dindyal, National Institute of Education, Singapore

This study involved the comparison of two grade 7 mathematics textbooks. The first book is The School Mathematics Project Book 1 (SMP), which was first published in the UK in 1965, following the New Mathematics Reform of the 1960s. The second book is the New Express Mathematics 1 book, which was first published in 2007 by Multimedia Communications in Singapore and approved by the Ministry of Education for use in Singapore schools. The two books were selected precisely because they come from two different curricular contexts and cultural traditions. Also, these two books were published more than 40 years apart and the analysis will help to shed light on what were valued in the two textbooks and, to some extent, about the teaching and learning of mathematics in general, at about the time of publication. The textbooks were compared using a set of six criteria based on a framework developed by the Virginia Council of Teachers of Mathematics in 1980. The following six criteria were used: (1) Readability, (2) Organisation of Student Textbook, (3) Physical Characteristics, (4) Content, (5) Auxiliary Materials, and (6) Special Considerations. A composite score, based on a five-point scale, was calculated for each book: 3.305 for the SMP book and 3.969 for the New Express book. The scores basically informed the comparison of the textbooks in a general sense and are supplemented by a more detailed view of the six criteria over the two textbooks.

16.00-16.30 **Tea/Coffee Break** (Building 40, Garden Court)

16.30-18.00 **Plenary Session 3 (Panel Discussion)** **(**Lecture Theatre, 58/1067)

Speakers: Prof. Kenneth Ruthven (Panel Chair; University of Cambridge, UK)
Prof. Jere Confrey (North Carolina State University, USA)
Mr. John Ling (Former School Mathematics Project, UK)
Prof. Binyan Xu (East China Normal University, China)

Back to the Future of Textbooks in Mathematics Teaching

(Chair: Dr. **Charis Voutsina**)

18.30-20.30	**Conference Dinner** (Building 40, Garden Court) Note: the conference dinner is optional and must be pre-registered.

Day 3 Thursday 31st July 2014

08.00– 09.00	**Registration** Foyer, Level 1, Building 58 (Murray Building) (Day Chair: **Christian Bokhove**)

09.00-10.00

Parallel session 8.1 Room 58/1007 Chair: **A. Domingos**

F39. Technological resources that come with mathematics textbooks: Potentials and constraints
António Domingos, **José Manuel Matos**, Faculdade de Ciências e Tecnologia da UNL – UIED; **Mária Almeida**, Ag. Escolas dos Casquilhos – UIED; Paula Teixeira Ag. Escolas João de Barros – UIED, Brazil
Current textbooks come with technological resources (CD-ROMs and web portals) containing materials addressed to teachers and students. Some of these materials are independent of a specific textbook and can support a planned sequence of instruction designed by the teacher. They are currently available in web sites where the teacher, on his or her virtual workspace, can create and store lesson plans that incorporate these resources. These CD-ROMs and web portals are essentially composed of videos, applets, quizzes, texts and audio texts. This paper aims to discuss the role that technological resources, which come with textbooks, play in teaching. Based on the activity theory we aim to describe how these resources, as mediating artefacts, promote students learning. Empirical data were collected in classes of secondary school students focusing on topics related to functions and geometry. The results point to the occurrence of significant learning despite some technological constraints related both, to schools and to the proposals designed within the technological resources environments.

F79. The design of and interaction with e-textbooks: a collective teacher engagement
Gueudet Ghislaine, CREAD**,** Univ. of Brest, France**; Birgit Pepin**, Sør-Trøndelag Univ. College, Norway; **Hussein Sabra**, Univ. of Reims, France; **Luc Trouche**, French Institute of Education, École Normale Supérieure de Lyon, France
This presentation reports on an investigation of the design/re-design processes of a French grade 10 e-textbook (including its associated resources), Sésamath, designed by the French Sésamath teacher association. The object of the study is the interactive design process by the members of the Sésamath association. Using Cultural-Historical Activity Theory (CHAT), the Sésamath association's work with/on the e-textbook (as an activity system) has been investigated with respect to its rules, division of labour, objects etc. The data analysed are successive versions of the e-textbook, and traces of online discussions between authors during the years 2009 to 2013. The developments of the e-textbook during 'use', evaluation and 'redesign-in-use' has led to a project negotiation and reconfiguration of the different members' roles in the Sésamath community, and the division of labour has been closely linked to the design processes: particular roles have emerged in the process of designing different online/digital resources (e.g. designer; coordinator of online debates; reviewer), and each of these roles provided opportunities for particular professional development. The results of the study acknowledge the immense influence of digital resources/textbooks on collective design processes, and suggest that CHAT is a suitable theoretical and methodological tool to study these. Moreover, we articulate CHAT with the 'documentational approach' to understand the development opportunities for these teachers, in their roles as participants and partners in the design, evaluation and redesign processes.

Symposium 6 Room 58/1009 Chair: **L. Fan**

E101. Reform of Chinese school mathematics curriculum and textbooks (1999-2014): Experiences and reflections

Jian Liu, Beijing Normal University/Ministry of Education, China

Having worked in the Ministry of Education of China and been mainly responsible for the mathematics curriculum and textbook reform at the national level since 1999, in this session I will share my personal experience and reflection about the mainland China mathematics curriculum reform and the underlying social, political, economic, technological and cultural contexts for the past 15 years (1999-2014). Tracing back to the "21st century China mathematical education prospective" project, I will discuss the possible impacts of the research carried out by the project team on the new century mathematical curriculum and textbook reform in China. The influence of the theories and ideas from international research (e.g., Goodlad's work on curriculum development model) will also be mentioned in the presentation. The session will also introduce the basic structure of the mathematical textbooks of China and its diversifications, the general features of different mathematical textbooks and the important role that these diversified textbooks have played in pushing forward the mathematical education reform in China. In addition, using the data collected from interview with a number of chief editors of the reformed textbooks specially for this presentation, I will discuss and analyze Chinese textbook developers' views and reflections with a focus on the issue of mathematical textbook diversification and further development in mainland China.

Parallel session 8.2 Room 58/1023 Chair: **M. Leshota**

D21. The analysis of teachers' mobilisation of the textbook

Moneoang Leshota, **Jill Adler**, Univ. of the Witwatersrand, South Africa

In this paper, which forms part of a wider study investigating the relationship between the affordances of a textbook, and teachers' pedagogical design capacity (PDC) (Brown, 2002) in the mediation of the object of learning; we report on the analysis of teachers' mobilisation of the textbook. In the wider study, we have established the mathematics content, and the approach to the teaching and learning of the content as the major potential affordances (Gibson, 1977) of the textbook to the teacher's practice. In this paper, we focus on the mobilisation with respect to the content; and demonstrate that teachers' appropriation of the content of the textbook is more a function of insertions to, and omissions from the textbook, than it is of their offloading, adapting or improvising of the content of the textbook.

D88. Pre-service teachers' use of textbooks in England

Julie-Ann Edwards, **Rosalyn Hyde**, **Keith Jones**, Univ. of Southampton, UK

The use of mathematics textbooks by pre-service teachers in English schools is an under-researched area. While systematic research exists in other countries (see, for example, Nicol and Crespo 2006), there is only anecdotal evidence, albeit significant, to suggest that the use of mathematics textbooks in English secondary schools is underpinned by a complex set of rationales. A purposive sample of 40 pre-service teachers on a one-year secondary mathematics postgraduate course in southern England, some on a 70% school-based route to teaching and others on a 90% school-based route to teaching was surveyed using a questionnaire with both closed and open-ended questions about their use of textbooks while on school-based teaching placements. Responses confirm the limited use of textbooks by these pre-service teachers with a range of reasons for choosing, or not, specific textbook examples. Arguing that use of textbooks is an outcome of cultural and political activity (Apple 1992, Pepin, Gueudet and Trouche 2013), this data is examined in the light of the English context in which mathematics textbooks are written in a commercially competitive environment, the cultural context of personalised and differentiated curricula, the demands of the inspection regime of teachers in England, and the rapidly changing governmental expectations of teachers of mathematics. We present the survey findings about the more detailed rationale for decision-making in relation to this limited use of the mathematics textbooks available to pre-service teachers.

Workshop 3 Room 58/1065 Chair: **Y. Wang**

E42. Reflections on inquiry activities design in junior high school mathematics textbooks

Ji-ling Gu, Nanjing Normal University, China

Inquiry learning is not essentially a new way of learning, but it is in line with the discussion of three-dimensional mathematics curriculum standard. It's basic features are concerning about problem, reflecting initiative and highlighting the process. Its value is that it helps students to gain a deep understanding of knowledge, learn to research questions and form a good understanding of mathematics.We should note the following three areas: establish accurate objectives to prevent the bias phenomenon, select the right content to prevent the generalization phenomenon and present the comprehensive type to prevent the loss phenomenon.

Parallel session 8.3 Room 58/1067 Chair: **L. Dietiker**

A68. Telling new stories, reconceptualizing textbook reform in mathematics
Leslie Dietiker, Boston Univ., USA
This paper examines the content of geometry textbooks to begin to address the questions: When the narrative forms of contemporary textbooks are compared with those that are historical, how have the mathematical stories changed? And what implications may those changes have for teachers and students? This exploratory analysis interprets written geometry textbooks as mathematical stories in order to understand the content design curriculum as a mathematical genre. Three distinct sequences of content found in recent U.S. geometry textbooks are highlighted and compared with that of Euclid's Elements due to its large influence on geometry curriculum (Sinclair, 2008). This study employs a framework theorized in Dietiker (2013), which metaphorically positions mathematical objects as characters, procedures as actions, and representations as settings. Thus, the mathematical content in textbooks is interpreted as an art form, defining the changes of mathematical content in a sequence as mathematical events and the rhythm of raising and answering questions as its mathematical plot. Curricular reform, then, is recast as changes to previous stories, which involve changes in emphasis, form, characters, and plot. This analysis raises new questions about the sequential structure of content within geometry curricula and identifies potential reasons reformed curricula are resisted or misunderstood by teachers.

C90. An analysis of the presentation of the equals sign in grade 1 Greek textbooks
Chronoula Voutsina, Univ. of Southampton, UK
Young children often develop a partial, operational understanding of the equals sign that refers to completing an action, such as getting the answer to an addition or multiplication question, and fail to develop a relational understanding of the equals sign as a symbol that denotes equivalence. A partial view of the equals sign as an operator can be the result of primary-age pupils' overexposure to canonical equations such as a+b=c. This paper presents a preliminary analysis of the different syntaxes and formats used to present equality statements in the Grade 1 textbooks in Greece. The quantitative analysis reveals an overemphasis on presenting the equals sign within canonical equations. However, qualitative analysis reveals that the equals sign is first introduced in a context that conveys the idea of equivalence relation and is presented within an interesting mix of symbolic and non-symbolic contexts which may minimise the tendency to interpret the equals sign exclusively as an operator.

10.00-10.30 **Tea/Coffee Break** (Building 40, Garden Court)

10.30-11.30

Parallel session 9.1 Room 58/1007 Chair: **B. Xu**

A70. What can textbook research tell us about national mathematics education? Experiences from Croatia **Dubravka Glasnovic Gracin**, Univ. of Zagreb, Croatia
Analysis of textbook content may help in the identification and better understanding of the requirements of national mathematics education. This paper concerns the role of textbooks in mathematics education in Croatia. The study included a review of educational traditions in Croatia and of foreign research on mathematics textbooks, conducting a survey, interviews and classroom observations on the role of mathematics textbooks as well as analysis of textbook content of grades 6 to 8. The results show a traditional picture of mathematics education in Croatia. There is an emphasis on algorithms, closed answer form and simpler connections. These studies helped to determine the characteristics of mathematics education and generated new research questions on ways of improving the teaching of mathematics. This could be applied not only to Croatia but also to other countries with limited experience in research in mathematics education. In such environments the textbook may be an appropriate first step for research because it is a tangible artefact with text, it is part of the curriculum and it reflects national or regional traditions.

A44. Task potential for class argumentative activity: Teachers' attentiveness.
Michal Ayalon, **Rina Hershkowitz**, Weizmann Institute of Science, Israel
This study investigates mathematics teachers' attentiveness regarding the argumentative potential of textbook-tasks. Seventeen secondary school teachers were individually asked to choose three tasks that they see as encouraging argumentative activity in the classroom, and to explain their choice. The tasks were chosen from a beginning algebra 7th grade textbook-unit (comprised of 5 lessons). Bottom-up analysis of the teachers' responses yielded categories that fall into two dimensions: (D1) attention to the mathematics in which the argumentative activity is embedded, and (D2) attention to socio-cultural features related to the argumentative activity. Upon further analysis we found that teachers focused on three aspects of dimension D1: (D1a) the mathematics inherent in the task; (D1b) the mathematics related to the teaching sequence which the task is a part of; (D1c) global/meta-level principles of mathematics that transcend the particular task. Four attention-profiles of teachers were found: Teachers who attended to both dimensions were attentive to the three aspects of the Mathematics Dimension in the task (D1a+D1b+D1c+D2); teachers who were not attentive to the Socio-Cultural Dimension were attentive only to the mathematics inherent in the task (D1a). Some were attentive only to the socio-cultural dimension (D2), and some were attentive to neither of the dimensions. The bottom-up dimensions which emerged from the teachers' responses highlighted the importance of the social dimension, which is not commonly included in frameworks used to analyse textbook-tasks' potential for argumentation.

Parallel session 9.2 Room 58/1009 Chair: **J. Burke**

B67. "A foundation for understanding the world…" School mathematics and its utility
J**eremy Burke**, King's College London, UK
As one aspect of a broader sociological study, I am interested in the way mathematics education is so often constituted as being for something else (its myths of participation – Dowling:1998), particularly in relation to the GCSE examination: a national test sat by pupils at around the age of 16 years in England. The study takes the widely used Pearson/Edexcel GCSE mathematics text books (Pledger et al. 2010) and subjects these to an interrogation that draws on and seeks to develop Dowling's (2009, 2013) Social Activity Method (SAM). The result is a social-semiotic analysis of emergent strategies of alliance and opposition in the two textbooks concerned. The analysis looks at the composition of esoteric domain GCSE mathematics and the ways in which the public domain is recruited and recontextualised in order to develop marketing of and, potentially, induction into the content. The argument is put forward that, at both foundation and higher tiers, non-discursive resources (eg visual exemplars and instrumentation) are privileged over the discursive. Further, relatively little use is made of analogy; that is, there is little reference to non-mathematics practices for the purposes of explanation. Nevertheless, myths of participation are established strongly throughout both texts. There is then a marketing claim that school mathematics makes for optimal involvement in everyday life; but little content that could lead to its being so operationalised.

B27. Social and mathematical practices associated with the development of mathematical models of population growth approached in textbooks.
Lourdes Maria Werle De Almeida, **Camila Fogaça De Oliveira**, State Univ. of Londrina, Brazil
The relationship of social practices with the development of mathematics has been a subject of research in the area of mathematics education. In this article we investigate which practices (mathematical and social) can be identified with regard to population growth. We start with the analysis of the historical and cultural context in which they were developed two classical models for the study of population growth: the model of Malthus and the Verhulst model. Whereas the study of the dynamics of population growth conquers space in the school environment in disciplines of ordinary differential equations, we direct our focus for the analysis of textbooks of this discipline. This analysis allows us to conclude that, from the epistemological point of view, the authors present the models already structured and with mathematical language and notation as currently agreed. Mathematical practices are reduced to applications that differential equations can generate in relation to growth of populations of different species.We can't observe therefore modelling processes, but the application of models already developed. Thus, the books seem to reduce the population dynamics approach to the applications of ordinary differential equations, giving little attention to social and mathematical practices associated with this dynamic. What seems to set up is that the problem of the population variance analysis is overshadowed by the problem of solving differential equations. In other words, the emphasis of mathematical practice is more on solving method of EDO than in its formulation and its relationship with the phenomenon of the growth of the population.

Symposium 7 Room 58/1023 Chair: **J. Kilpatrick**

C33**.** Reflections from the past - A contemporary Dutch primary school mathematics textbook in a historical perspective

Marc van Zanten, SLO and Utrecht Univ.; **Marja van den Heuvel-Panhuizen**, Utrecht Univ., Netherlands

In the Netherlands, most of the currently used mathematics textbook series for primary school are influenced by the so-called 'Realistic Mathematics Education' (RME) reform movement that started around 1970. This reform, which aimed to give children a better basis for understanding mathematics, was a reaction to the then prevailing mechanistic approach in Dutch mathematics textbooks. In this study, we investigated the historic roots of RME by carrying out a textbook analysis in which we compared 'De wereld in getallen' (The world in numbers), one of the currently most used textbook series, with two mathematics textbook series dating from the 1950s and 1960s. In our analysis we addressed three perspectives and their interrelationships. First, we looked at the goals and didactical intentions that are explicitly stated in the teacher guidelines. Second, we analyzed content and performance expectations incorporated in the student books. Third, we investigated the didactical approaches as reflected in both the student books and in the teacher guidelines. As the mathematical focus of our analysis we chose decimal fractions. Our study revealed how content and didactics are laid down in Dutch mathematics textbook series over a period of six decades and made clear that onsets to the RME reform can be found in textbooks of the 1950s and 1960s. For example, regarding content, the current emphasis on mental arithmetic and estimation was already present. Similarities were also found for didactical approaches such as the use of models.

Workshop 4 Room 58/1065 Chair: **B. Grevholm**

B106. Analysing mathematical textbooks with parts of Greimas' semiotic theory

Ričardas Kudžma, Vilnius Univ.; **Saulius Žukas,** Lankos Publishing House; **Barbro Grevholm**, Univ. of Agder, Norway

In the workshop participants will use Greimas' semiotics theory in order to analyse short texts from a narrative perspective. Examples from textbooks for year 5 on negative numbers will be provided and after a common introduction into the theory analyses will be carried out in smaller groups. In the introduction, we will consider the four phases of the narrative level of the theory: manipulation, competence, performance and sanction. Greimas, who lived 1917 to 1992, was the mâitre of Paris school of semiotics. He investigated what produces meaning in a text. He developed a quite general theory, mainly semiotic square, narrative grammar, which allows the analysis of texts of any genre. Kudžma has applied Greimas' theory for analysis of mathematical texts since 2005.

Parallel session 9.3 Room 58/1067 Chair: **R. Hyde**

C14. The transformation since 1960 of the development of geometric transformations in commercial high school geometry texts in the USA

Zalman Usiskin, Univ. of Chicago, USA

Euclidean geometry in the United States has been traditionally taught in a single year in high school. In 1960, no geometry text in the United States mentioned geometric transformations (reflections, rotations, dilatations, etc.). By 1975 a handful of texts discussed transformations, but with the exception of my own text, all isolated the discussion of transformations. Over the years since, slowly the percent of texts mentioning transformations has increased but the treatment has still almost always been isolated. Yet, the Common Core State Standards for Mathematics (CCSSM, 2010) that have been approved by well over 80% of the states have called for congruence and similarity to be understood in terms of transformations, and for the traditional criteria for two triangles to be congruent or similar to be developed through transformations. This presentation reports a study of the treatment of transformations (if they appear at all) in over 50 commercial geometry texts published since 1960 in the United States. The study has not been completed at the time of this proposal, but we expect (1) that the percent of books discussing transformations, as well as the numbers of pages devoted to this content, has increased over time, but (2) that few of the treatments come close to the CCSSM guidelines. This will explain why so many teachers of geometry in the United States have little or no idea of the relevance of geometric transformations to the geometry they are required to teach.

F48. RME as a Teaching Approach – A case study of elementary geometry in Serbia innovative 4th-grade textbook.

Olivera Djokic, University of Belgrade, Serbia

The aim of our research paper is to present the results of an experimental research on the effects of learning geometry with an innovative model of 4th-grade textbook as our practical implementation supporting the constructivist approach to teaching RME (Realistic Mathematics Education). We have

examined the ways in which the innovative elementary textbook influences students' achievements (according to the levels of knowledge) and reasoning. Results confirm the general hypothesis that introducing an innovative textbook positively influences 4th-grade students' achievements in geometry and in this way we confirm the effect of this teaching approach to RME. We give an overview of the statistical analysis of the knowledge tests results. Comparing the experimental (N= 73) and control (N=75) groups with respect to the achievement in the two tests, we found the expected increase in the mean values of student achievement in the experimental group. This difference indicates the presence of a positive effect of the innovative textbook on students' achievement in elementary geometry. The results of variance analysis for repeated measures (ANOVA) showed that there was interaction between the pre-test–retest groups when we look at the overall test achievement ($F(1,123) = 36.42$, $p < 0.05$). The difference between the pre-test and retest for both control and experimental groups was statistically significant. Appropriate structuring of a textbook can yield the effect of activating students' potential for learning geometry. Diversity applied in the textbook elicits students' opinion, encourages the development of students' geometry skills and helps students reach higher levels of knowledge and forms of geometry reasoning.

11.30-12.30

Parallel session 10.1 Room 58/1007 Chair: **M. Alafaleq**

G81. The Eiffel Tower as a context of word problems in textbooks for school mathematics and physics: Why authors have a licentia poetica and what are possible consequences for students learning and beliefs? **Josip Slisko**, Benemerita Univ. Autonoma de Puebla, Mexico

The Eiffel Tower is a popular context for word problems in school mathematics and physics textbooks. A detailed analysis of a few formulations of those problems, carried out within the framework of Palm's theory of authentic tasks (2009), shows they are examples of invented events which can rarely or never happen in real world. In addition, the mathematical model of the Eiffel Tower used for calculations implies it only has one dimension (the height). One is obliged to ask two important questions: Why do textbook authors have such a *licentia poetica* for inventing artificial contexts as examples of mathematics and physics applications in real world? What are possible consequences of artificial contextualization for students' learning and beliefs? The answer to the first question is related to different aspects of the "teaching culture", from historic examples of contextualized problems formulated by Fibonacci to the absence of rigorous quality control mechanisms for textbook production. The base for answering the second question is the idea that the students behave as sense-seekers in their authentic real-world activities. In school setting, when they are exposed systematically to non-authentic learning practices, the students are prone to conclude that school mathematics and physics deal with problems that are senseless from the point of view of normal human beings. In this way, known "suspension of sense-making" syndrome might be an understandable (although highly negative!) consequence of artificial problems contextualization.

A46. Problem solving heuristics in middle school mathematics textbooks in Saudi Arabia
Manahel Alafaleq, **Lianghuo Fan,** Univ. of Southampton, UK

It is well known that solving mathematics problems is one of the most difficult parts for students of any stage and how to become a successful mathematics problem solver requires complex cognitive skills. Like many other countries, in Saudi Arabia teaching solving problems is a main goal of teaching mathematics and it is a central concern of mathematics educators and mathematics curriculum developers (Ministry of Education, 2007). As textbooks are fundamental resources in Saudi classrooms, this study aims to examine to what extent Saudi textbooks reflect the mathematics curriculum goal in developing students' abilities in mathematical problem solving (Ministry of Education, 2007). Most specifically, the study investigates how the national middle school mathematics textbooks in Saudi Arabia represent problem solving heuristics. The study basically adopted Schoenfeld's definition about heuristics, that is, a heuristic is "a general suggestion or strategy, independent of any particular topic or subject matter, that helps problem solvers approach and understand a problem and efficiently marshall their resources to solve it" (Schoenfeld, 1987). We established a framework for coding heuristics into different categories such as "guess and check", "look for pattern", "draw a diagram", etc. The data were collected from three textbooks, which are used in Grades 7, 8 and 9, through analyzing all examples problems in the textbooks, and then coded the result

following the framework. The initial findings show that all the textbooks represent a good number of problems and there are fourteen heuristics presented in the textbooks, though most of which are found in Grades 7 and 8. It is hoped that the findings of the study will shed light on the potential challenges facing textbooks developers in terms of mathematical problem solving.

Parallel session 10.2 Room 58/1009 Chair: **C. Sangwin**

C11. Rules of indices in United Kingdom textbooks, 1800-2000

Christopher Sangwin, Loughborough Univ., UK

This papers reports results from a textbook analysis which examined how the shift from integer to rational exponents in the rules of indices is discussed in mathematics textbooks. Rules of indices are centrally important to algebra, both theoretically and as a computational tool. The topic occurs at a number of levels in school and university curricula. The data set is a selection of historic textbooks published in the United Kingdom during the period 1800-2000. Historic textbooks potentially avoid the problem of high-stakes examinations driving textbook design, and they deal with algebra as a separate and self-contained subject. These books were in print for many year, were popular in terms of numbers of books sold and used, and were influential. The majority of books in the corpus were in print for more that 25 years, with some continuously in print for more than 80. The analysis seeks to understand the justification given by textbook authors for the shift from integer to rational exponents in the rules of indices. It also seeks to understand how this topic is presented in relation to other algebraic topics, such as "roots", "surds", multiple solutions to quadratic equations, and complex numbers. A coding scheme is developed to group justifications into categories including "given by authority", "formal proof", "analogy", "deduction from a model". It is intriguing that this topic is justified in so many different ways. Some of the epistemological and didactic implications of this analysis will be discussed.

F36. Textbook and technology: An analysis of multimedia learning in brazil

Rúbia Barcelos Amaral, São Paulo State Univ., Brazil

This is part of a broader research project aimed at obtaining a deeper understanding on how Geometry and Technology intertwine in the textbooks and what kind (nature and goals) of proposals are made. Amongst ten sets of textbooks that have been evaluated and approved by the Brazilian Government, to be distributed in schools (freely), only three of them have "digital learning objects" (DLO). Mayer (2009) presents a cognitive theory of multimedia learning considering how people learn from words and pictures. The technology evolution prompted new efforts to understand the potential of multimedia as a means of promoting human understanding – a potential that Mayer (2009) called the promise of multimedia learning. The need for intertwine research on textbooks and the DLO included on them is also justified by the fact that such DLO expand Valverde et al. (2002) comments that textbooks are the print resources most consistently used by teachers and students in the course of their joint work. The project considers a qualitative research with an interpretative approach and here we will discuss some aspects of the DLO. Preliminary results show that the required level of interaction with pupils is very low and it can be considered only has a detractor for students, and a domestication of media (Borba & Gadanidis, 2008). Deeper analysis is needed in order to understand what is really the role of DLO in textbooks and possibly, to steer some possibilities for improving its conceptualization in and for facilitate the multimedia learning.

Symposium 8 Room 58/1023 Chair: **K. Jones**

D40. Research on textbooks used in teaching transformation for secondary school – From the perspective of teachers' role

Chunxia Qi, **Xinyan Zhang**, **Danting Huang**, Beijing Normal University, China

Transformation is a new content in the Chinese standard-based curriculum and it is also one of the key issues in both textbooks and mathematics teaching for junior secondary school. Firstly, this study tries to find the characteristics and issues of transformation by examining the Xinshijie vision of the mathematics textbook. Secondly, based on the framework of three different ways of textbook use: use as following, use as interpretation, and use as participation, this study analyses the current situation of mathematics teachers' adoption of textbooks through interviews and six Chinese teachers' videotapes and tries to find the characteristics of transformation teaching in classrooms. To this end, this article will find the extent to which transformation teaching in classrooms is in line with the treatments of transformation in textbooks.

Workshop 4 Room 58/1065 Chair: **B. Grevholm**

See programme for 10.30-11.30

Parallel session 10.3 Room 58/1067 Chair: **D. Jones**

F8. The role of technology for learning stochastics in U.S. textbooks for prospective teachers
Dustin Jones, Sam Houston State Univ., USA
Professional organizations have emphasized the use of technology in teaching and learning topics in stochastics (i.e., probability and statistics). Prospective elementary teachers need experiences with various types of technology in order to develop their technological pedagogical content knowledge. In the United States, such experiences may occur within a mathematics content course. Six textbooks commonly used for mathematics content courses for prospective teachers in the U.S. comprised the sample for this study. For each textbook in the sample, references to technology in the stochastics chapters were classified according to location (main text, auxiliary text, or activity) and also by type of technology. References located within activities and exercises were also coded according to whether technology was required or optional. The textbooks within this sample displayed considerable variation along the coded dimensions. A profile describing the use of technology for learning stochastics was developed for each textbook in the sample.

F17. Co-designing electronic books: Boundary objects for social creativity.
Christian Bokhove, **Keith Jones**, Univ. of Southampton; **Manolis Mavrikis**, **Eirini Geraniou**, **Patricia Charlton**, Institute of Educ., UK
The European 'MC-squared' project has a number of 'Communities of Interest' (CoI) (Fischer, 2001) in European countries that work on digital, interactive, creative, mathematics textbooks, called cBooks. A community of interest consists of several stakeholders from various 'Communities of Practice' (Wenger, 1998). In this paper we outline the creation of an English CoI describing the development of a cBook on numbers and equivalence. We use a design-based research methodology approach for teachers, designers, researchers, teacher-educators jointly working on cBooks as 'boundary objects' (Akkerman & Bakker, 2011) to facilitate thinking about creative mathematical thinking and social creativity. We illustrate our design-based approach through the example artefacts created during the different stages of development of the cBooks. The details of our approach provide a blueprint for the formation of CoI's by working on digital, interactive, creative, mathematics textbooks.

12.30-13.30 **Break/Lunch** (Building 40, Garden Court)

13.30-14.30 **Plenary Session 4** (Lecture Theatre, 58/1067)

Speaker: Prof. Frederick Leung, University of Hong Kong, Hong Kong
Messages Conveyed in Textbooks: A Study of Mathematics Textbooks during the Cultural Revolution in China

(Chair: Prof. **Marcus Grace**)

14.30-15.00 **Closing Session** (Lecture Theatre, 58/1067)
(Chair: Dr. **Julie-Ann Edwards**)

15.00-15.30 **Tea/Coffee/Farewell** (Foyer, Level 1, Building 58 - Murray Building)

Poster abstracts

F7 . The use of technology in textbooks: A grade-7 example from Hong Kong.
Ida Ah Chee Mok, King-Woon Yau, The Univ. of Hong Kong
Information technology for interactive learning is one of the four key tasks recommending in the curriculum reform in Hong Kong (Curriculum Development Council, 2000). According to Fan (2011), the use of technology in textbooks can be reflected in the categories of calculator, computer, Internet, software. A set of Grade 7 mathematics textbooks from a popular series in Hong Kong was analyzed. The exercises or activities using the technological tools in the textbooks were identified and the tools were categorized. Their mathematical contents were classified according to the three mathematics strands (Number & Algebra; Measures, Shape & Space and Data Handling) in the curriculum. Findings show that the use of technological tools in the textbooks included Internet, software and a CD-ROM produced by the publisher. The publisher provided an "E-tutor"-website for a direct guidance for selected questions in the revision exercises in the textbooks and a drilling program in the CD-ROM. There was one project for carrying out a statistical study of the Hong Kong population. The steps for generating of statistical graphs with Excel were demonstrated with illustrations. IT exploratory using Excel and GeoGebra were found.

C9 The study of geometric content in the middle grade mathematics textbooks in Singapore, Taiwan, and USA.
Der-Ching Yang, Nat'l Chiayi Univ., Taiwan **Der-Ching Yang**
The purpose of this study was to compare the differences of geometric contents in the middle grade mathematics textbooks among the KH (Kang Hsuan) in Taiwan, the CMP (Connected Mathematics Program) in U.S.A., and the MSN (New Syllabus Mathematics) in Singapore. The quantitative and qualitative methods were used to examine the differences on: (1) the total geometric problems, (2) the types of open- ended vs closed-ended problems and representations of geometric problems, (3) the characteristics of geometric problems. The result of Chi-square test showed that there is a significant difference on the total numbers of geometric problems among the three textbooks. Data also showed that KH and MSN textbooks included over 90% of closed-ended problems. The CMP included about two-thirds of close-ended problems. The three textbooks all included about 70% to 80% of "Problems in a Combined Form" and "Problems in a Verbal Form". In addition, the CMP included the lowest percentages on the problems in a purely mathematical form. However, KH and NSM include about a half and one–fifth of problems in a purely mathematical form, respectively. The content designs of KH and NSM put more emphasis on symbolic representations and provide clear procedures of computations. The NSM also emphasizes proficiency on written computation and provides students with diverse problem solving strategies. However, the CMP emphasizes daily-life problems to enhance students' learning motivation and highlight the understanding and application of mathematics concepts. Implications for possible curriculum revision and future research studies are discussed.

A25 Situational authenticities in lower secondary school mathematics problems: Reasons for calculation and origin of quantitative information.
Lisa O'Keeffe, Univ. of Bedfordshire, UK; **Josip Slisko**, Benemérita Univ. Autonoma de Puebla, Mexico
This pilot documental research proposes to analyse a number of trigonometry and geometry problems from lower secondary school Irish mathematics textbooks, in order to evaluate their situational autenthicities. Situational authenthicity is a key area of concern, particularly in the context of the new national curriculum in Ireland which sees a a move towards an emphasis on mathematical understanding and real life applications and problems. In this poster we present the findings from an initial analysis of a random sample of 24 geometry and trigonomety (12 of each) problems selected from three lower secondary school mathematics textbooks. The aim of this analysis is to evaluate two specific aspects of problems' situational authenticities and it is based on Palm's (2002) theory of auhtentic problems. Palm's (2002, 2009) theory of authentic problems provides a useful framework for such an analysis, enabling one to establish how adequate these problem formulations are. Palm suggests that a whole authenticity-oriented evaluation of the situation, problem formulation and expected students' performances should take into account the following aspects of school mathematics tasks: (A) Event; (B) Question; (C) Information/data; (D) Presentation; (E) Solution strategies; (F) Circumstances; (G) Solution requirements, and (H) Purpose in the figurative context. In this initial study special attention is paid to two particular aspects: (1) the reason for the asked calculation or other mathematical procedure (related to A and B) and (2) the origin of the quantitative information (related to C). These selected aspects resonant well with the historical fact that both geometry and trigonometry have their roots in solving meaningful practical problems by using specified measuring instrument and measurement procedures; a fact which is reflected in the etymology of their names. The initial results show that in majority of the cases the authors do not give students the reasons why the calculation, or other mathematical procedure, they are supposed to carry out is situationally meaningful. In the cases, when the reasons are given, they appear superfical and limited. The origin of quantitative information is generally

unknown. Measurement-based origin of data is mentioned in four problems, but the type of measuring instrument used is only specified (clinometer) in one problem. The implications of both findings on formation of students' beliefs regarding school mathematics and its learning are briefly discussed.

B26 Analysis of integral and differential calculus textbooks and mathematical modelling activities in the light of the didactic transposition theory.
Lourdes Maria Werle De Almeida, Univ. Estadual de Londrina; **Kassiana Surjus**, PUC, Brazil
The present paper presents the results of research in which we analysed the didactic transposition of the Integral content in Differential and Integral Calculus textbooks, as well as Mathematical Modeling Activities developed by higher education students. Initially, we were based upon Yves Chevallard's Didactic Transposition Theory, and identified the attributes of didactic transposition from scholarly knowledge to knowledge to be taught, regarded to be fundamental in the teaching of Integral, concerning the objectives and interests in the learning of such subject. Once the knowledge adaptation, elucidation of knowledge and operationalization of knowledge attributes were defined, we analyzed two textbooks on Integral and Differential Calculus largely used, especially in Brazilian universities. The results from this analysis indicate that, in such books, the defined attributes are partially met. We then moved on to looking at the development of four Mathematical Modeling Activities, in the way as they are characterized by Mathematics Education, in which the integral content can be highlighted. The relation between the analysis of these activities and the results from the textbooks analysis leads us to defend the articulation between the use of textbooks and the development of mathematical modeling activities. Our argument is intended to highlight the potentiality of such articulation for the teaching of integral, in relation to the characterized didactic transposition attributes.

B41 The characteristics of new mathematics textbooks for junior secondary school in China: A case study.
Fu Ma, Nanjing Normal Univ.; **Chunxia Qi**, Beijing Normal Univ.; **Xiaomei Liu**, Beijing Capital Normal Univ., China
Based on the case study of new version junior secondary school mathematics textbooks published by Beijing Normal University, this article tries to analyse the characteristics and features of reform-oriented middle school mathematics textbooks. A prominent feature of these textbooks is to pay special attention to students' holistic development. As a result, the new mathematics textbooks aims to "four" knowledge basic and "four "problem-solving abilities. In the content of mathematics textbooks, with an emphasis on the acquired knowledge and experience, teaching materials must be real, interesting and challenging. In terms of structure, mathematics textbooks are focused on integration of number and algebra, shape and space, and statistics and probability. A special attention is given to an application of various teaching and learning methods. And in the last, the article show some challenges for the new textbooks.

E58 An introduction to mathematics textbooks policies in China.
Huiying Zhang, Shijiazhuang Research Institute of Education Science, China
Mathematics Textbooks Policy (MTP) focuses on the objectives of mathematics education and practices implemented at different systemic levels by different groups of stake-holders to bring about those objectives. Based on a framework, this poster tries to analyse four aspects of MTP from China: (a) policies about mathematics textbooks, the "what"? (b) agents who are engaged in policy-making, the "who"? (c) factors that influence the design of MTP within a particular "environment", and (d) future directions of MTP.

D61 Korean students' use of mathematics textbook.
Na Young Kwon, Inha Univ.; **Gooyeon Kim**, Sogang Univ., South Korea
This study aims to investigate Korean secondary students' beliefs of their use of mathematics textbook and to make a contribution to further study by providing information on the use of textbook in Korea. For the purpose of this study, we develop a survey asking questions about textbooks' role in students' learning and questions about mathematical concepts, principles and formulas, and problem solving in Korean mathematics textbooks. The results show that Korean students highlight not only the importance of textbooks but they also put great emphasis on their teachers' explanation in studying mathematics. Korean students use their textbook mainly for their learning; however, they selectively work through mathematical tasks suggested in their textbook.

C82 The broken-tree problem: formulations in Mexican middle-school mathematics textbooks and students constructions of the related situation model.
Josip Slisko, **José Antonio Juárez López**, Benemérita Univ. Autónoma de Puebla, Mexico
The broken-tree problem is one of the most popular tasks in mathematics textbooks, both on large temporal and geographic scales. This article has two parts. Firstly, we have analyzed how this problem was formulated in seven Mexican middle-school textbooks. The formulations differ in a few features: (a) the type of the broken object; (b) mention of its historic origin; (c) presence or absence of a drawing with the problem wording; (d) explicit drawing task as a part of solution path. Secondly, we used one formulation without

explicit drawing task to explore middle school students' performances when they were asked to draw how they imagined the situation described in the problem. The results show that the construction of the situation model was not an easy task for many students. In fact, only one out of 30 involved students was able to correctly construct the situation model. The implication of these results is: construction of situation model and its simplification and idealization, leading to the related mathematical model, should be reserved as an explicit task for students.

D92 Mathematics knowledge and skills higher educ. programs expect of high school graduates.
Cengiz Alacaci, Istanbul Medeniyet Univ.; **Gulumser Ozalp**, Gaziantep C. Foundation Private Sch; **Mehmet Basaran**, SANKO Private Sch; **İlker Kalender**, Ihsan Dogramaci Bilkent U., Turkey
Higher education institutions are important recipients of high school graduates. Identifying the mathematical knowledge and skills scientifically that higher education programs would like to see in incoming freshman may help making sound decisions about mathematics curriculum and hence about the contents of mathematics textbooks. In this study, we surveyed university faculty who teach freshman about the mathematical knowledge and skills that they would like to see in incoming high schol graduates so that they would be successful in college. Data were collected from 112 faculty from social science (history, psychology, law) and engineering (computer and electrical and electronics) departments. Participants rated how important they thought certain mathematical topics and skills were to be successful in college and become a well-prepared professional. Results were compared across social science and engineering departments and among mathematical knowledge and skills. Implications were drawn for curriculum design and textbook content in information age.

B93 Forewarned is forearmed: A mathematics textbook.
Peter McWilliam, The College of The Bahamas, Bahamas
This paper reports on a study in The Bahamas where there has recently been an increased focus on the use of a uniform mathematics textbook in all public secondary schools. The primary requirement to tackle debt involves a simple choice between the actions "Earn more" or "Spend less". A similar approach can be applied when students attempt to answer a mathematics problem i.e. "Get it right!" or "Avoid error!" Naturally, students will strive to "Get it right!" in attempting to use their knowledge and experience when confronted by problems on a wide ranging syllabus. In some cases, they may fail unnecessarily. These students are the most vulnerable to the subtle traps which can go unheeded in any problem. Like a speedster oblivious to the presence of hidden cameras, they may be lured unsuspectingly into using wrong approaches which cause marks to be forfeited and valuable time to be wasted. This study uses action research to investigate the impact of a mathematics book designed to help students to "Avoid error!" by making them more aware of some of the common dangers and allowing them to engage the powerful adage "Forewarned is forearmed". Promoting awareness of potential dangers provides the major purpose of this intervention. The study uses primarily quantitative methods, but includes a small qualitative component in the form of interviews and a researcher's journal to enhance the findings. The main research tool was a questionnaire and mathematical competency tests completed by 200 college preparatory students during a 14 week semester. The implications of this study may impact a wide range of professionals in education and the Bahamian education system. It may inform pre-service and in-service teachers, school administrators, mathematics education instructors, textbook designers, and education policy makers, particularly as they work to design mathematics education experiences to foster the use of a culturally rich mathematical application book, designed to highlight common dangers, in the future.

G94 Differential and integral calculus in textbooks: An analysis from the point of view of digital technologies.
Andriceli Richit, State Sao Paulo Univ.; **Adriana Richit**, Federal Univ. of Fronteira Sul; **Maria Margarete Do Rosário Farias**, State Santa Cruz Univ., Brazil
Worldwide, courses of Differential and Integral Calculus have as a basic subsidy the use of textbooks. These constitute an important support for the course, either for the first reading of the students, supplement the lessons taught, motor of research conductions by students or even for solving exercises. Considering the way the concepts of Calculus are presented in textbooks, and the concern of mathematics education community, which began with the movement of Calculus Reformation, which proposes the integration of digital technologies as a way to make concepts meaningful for a larger number of students, we conducted an exercise to understand how the technological component has been privileged in Calculation books, enabling approaches that go beyond the concepts of algebraic approach. Thus, we took textbooks adopted in mathematics courses (in the form degree and bachelor's degree) in six state university units from São Paulo doing a comparative analysis of the work, looking for evidence of how the visual approach is privileged. After we developed the analysis, based on the methodology of content analysis of Bardin (2008), we observed fragmentations in the presentation of some topics in some of the work and a sudden movement of change in more current works, to bring some approaches considering the use of technology.

D102 Enhancing a teacher's fundamental interaction with the textbook through a school-based mathematics teacher research group activity in Shanghai.
Liping Ding, Svein Arne Sikko, Sør-Trøndelag University College, Norway
Previous research (e.g. Ding et al., 2012) indicates that Chinese teachers' knowledge of mathematical instructional content is mainly attained through intensive studies of textbooks via a "supportive" system. In this paper presentation, we explore a teacher's interaction with the reformed textbook under the support of one national leading mathematics educator and one regional leading primary teaching specialist in a school-based teacher research group (TRG) activity in Shanghai (SH). The lesson topic is of division with remainder at grade 2. Our research question is why the ways of treatment of this specific topic from the perspectives of the mathematics educator and specialist is considered more helpful by the teacher than that of the textbook. We take Fan's (2013) conceptual framework of textbooks as an intermediate variable in the context of education. We further analyse the different treatments to the lesson topic according to three components of Gravemeijer's (2004) local instruction theories of the relationship of the learning goals, the selection and use of tasks and tools, and a conjectured learning process. The data analysed are the SH textbook, the teacher's initial lesson plan and lesson video transcript, the video transcript of the TRG discussion, and the teacher's reflection note after the TRG. Results show that in the TRG, the mathematics educator highlighted that the goal of inquiry-based activity embedded in the textbook is to cultivate students' questioning ability in doing mathematics. The specialist emphasized the relationship between the connection of mathematical knowledge in the textbook and the cognitive conflict and process of students in their learning. The teacher reflected that she understood more sufficiently the teacher's role in establishing the connection between the to-be-learned knowledge in the textbook and her students' existing knowledge, and the way to develop students' independent thinking skills in mathematics.

F119 The potential of handwriting recognition for interactive mathematics textbooks.
Mandy Lo, University of Southampton, UK
Exploring mathematical problems, making mathematical conjectures and proving & disproving with standard mathematical arguments play an important role in the development of sound mathematical reasoning (Schoenfeld 1989; Davison and Kroll 1991; Hoyles and Noss, 2003). Web-based interactive textbook, unlike traditional textbooks where there is a "*planned sequence to be followed in a specific order*", allows learners the autonomy to select their own learning sequence, thus facilitating personal construction of knowledge (Yerushalmy 2009, pp.101). However, it has been noted that "*the development of e-learning in the sciences in general, and mathematics in particular, has not met the general expectation*" (Ahmed 2008, pp.1089), which may be in part due to "*practical and intuitive mathematics input for users is still under investigation*" (Mikusa et al 2005, pp. 621). Research on what constitutes 'practical and intuitive' is very limited, and research with a specific focus for mathematics education is sparser still. My conference poster outlines my PhD work completed on the development of handwriting recognition software specifically for mathematics education. I will also discuss my pilot study which provided some indications of its potential to support the flow of mathematical thinking during online interaction with educational resources as well as peers. A preliminary version of the product is available online: http://www.mathpen.co.uk/WhatsOn. In order to encourage discussions and feedback, tablet PCs will also be available on the day for hands-on experience.

ICMT2014 Conference Participant List

Title	Name	Affiliation	Country/Region
Dr	Cengiz Alacaci	Istanbul Medeniyet University	Turkey
Miss	Manahel Alafeq	University of Southampton	UK
Dr	Rúbia Amaral	UNESP-Universidade Estadual Paulista	Brazil
Prof	Mária Almeida	UIED-Universidade Nova de Lisboa	Portugal
Dr	Michal Ayalon	Weizmann Institute of Science	Israel
Dr	Tomas Bergqvist	Umeå University	Sweden
Dr	Christian Bokhove	University of Southampton	UK
Mr	Jeremy Burke	King's College London	UK
Dr	Jenny Byrne	University of Southampton	UK
	Ian Campton	University of Southampton	UK

Dr	Carlos Carvalho	UIED FCT UNL	Portugal
Dr	Charalambos Charalambous	University of Cyprus	Cyprus
Dr	Patricia Charlton	Institute of Education London	UK
Ms	Xiaomei Chen	Jilin No. 1 Experimental Primary School	China
Dr	Andri Christodoulou	University of Southampton	UK
Prof	Jere Confrey	North Carolina State University	USA
Ms	Jill Cornish	Oxford University Press	UK
Mrs	Cristolinda Costa	University of the Algarve	Portugal
Dr	Leslie Dietiker	Boston University	USA
Dr	Jaguthsing Dindyal	National Institute of Education	Singapore
Dr	Liping Ding	HiST, Sør-Trøndelag University College	Norway
Dr	Olivera Djokic	University of Belgrade	Serbia
Prof	António Domingos	Universidade Nova de Lisboa	Portugal
Dr	Julie-Ann Edwards	University of Southampton	UK
Prof	Ruhama Even	Weizmann Institute of Science	Israel
Prof	Lianghuo Fan	University of Southampton	UK
Dr	Taro Fujita	University of Exeter	UK
Dr	Jianliang Gao	University of Southampton	UK
	Caro Garrett	University of Southampton	UK
Dr	Victor Giraldo	UFRJ-Universidade Federal do Rio de Janeiro	Brazil
Dr	Dubravka Glasnović Gracin	University of Zagreb	Croatia
Dr	Haiyan Gong	East China Normal University Press	China
Prof	Marcus Grace	University of Southampton	UK
Prof	Barbro Grevholm	University of Agder	Norway
Dr	Janice Griffiths	University of Southampton	UK
Prof	Jiling Gu	Nanjing Normal University	China
Miss	Li Hao	University of Southampton	UK
Mr	Lifeng He	Zhejiang Education Publishing House	China
Prof	Fengbo He	Jilin Provincial Institute of Education	China
Dr	Kirsti Hemmi	Mälardalen University	Sweden
Prof	Christian Hirsch	Western Michigan University	USA
Mr	Foo Him Ho	Ministry of Education	Singapore
Ms	Huiying Hou	Beijing New Century Jiuzhang Education & Technology Institute	China
Dr	Richard Houang	Michigan State University	USA
Prof	Geoffrey Howson	Southampton University	UK
Ms	Qiong Hua	Zhejiang Education Publishing House	China
Ms	Lihua Huang	Beijing No. 2 Experimental School Chaoyang Campus	China
Mrs	Rosalyn Hyde	University of Southampton	UK
Ms	Jo Issa	Oxford University Press	UK
Dr	Dustin Jones	Sam Houston State University	USA
	Keith Jones	University of Southampton	UK

Mr	Ilyas Karadeniz	University of South Florida	USA
Dr	Jan Kaspar	Charles University in Prague	Czech
Dr	Sibel Kazak	University of Exeter	UK
Prof	Anthony Kelly	University of Southampton	UK
Dr	Tek Hong Kho	Mathematics Education Consultant	Singapore
Prof	Jeremy Kilpatrick	University of Georgia	USA
Dr	Gooyeon Kim	Sogang University	South Korea
Dr	Elizabeth Kimber	Cambridge Mathematics Education Project	UK
Dr	Jennifer Koenig	University of Cambridge	UK
Prof	Yutaka Kondo	Nara University of Education	Japan
Dr	Heidi Krzywacki	Mälardalen University	Sweden
Mr	Ricardas Kudzma	Vilnius University	Lithuania
Prof	Susumu Kunimune	Shizuoka University	Japan
Prof	Na Young Kwon	Inha University	South Korea
Mrs	Moneoang Leshota	University of the Witwatersrand	South Africa
Prof	Frederick Leung	University of Hong Kong	Hong Kong
Ms	Hui-Chuan Li	University of Cambridge	UK
Prof	Pi-Jen Lin	National Hsinchu University of Education	Taiwan
Dr	Yung-Chi Lin	National Chiayi University	Taiwan
Mr	John Ling	School Mathematics Project (SMP)	UK
Ms	Anna Littlewood	Cambridge University Press	UK
Prof	Jian Liu	Beijing Normal University	China
Ms	Keqin Liu	Beijing Zhong Guan Cun No. 3 Primary School	China
Prof	Xiaomei Liu	Beijing Capital Normal University	China
Miss	Liyuan Liu	University of Southampton	UK
Miss	Mandy Lo	University of Southampton	UK
Miss	Mei Yoke Loh	Ministry of Education	Singapore
Mrs	Sue Lowndes	Oxford University Press	UK
Dr	Yuang-Tswong Lue	Taipei Chengshih University of Science and Technology	Taiwan
Prof	Fu Ma	Nanjing Normal University	China
Prof	Constantino José Machado de Sousa	Centro de Educaçao Elementar e Secundaria e Universitaria Professor Paulo Freire	Brazil
Ms	Heather Mahy	Cambridge University Press	UK
Mr	Mailizar Mailizar	Syiah Kuala Univ./Univ. of Southampton	Indonesia/UK
Prof	Peter Main	Institute of Physics	UK
Mr	David Mantovani	Cambridge University Press	UK
Mr	José Matos	UIED-Universidade Nova de Lisboa	Portugal
	Peter McWilliam	The College of The Bahamas	Bahamas
Ms	Zhenzen Miao	University of Southampton	UK
Mr	Takeshi Miyakawa	Joetsu University of Education	Japan
Dr	Ida Ah Chee Mok	University of Hong Kong	Hong Kong
Dr	Hana Moraova	Charles University	Czech

Prof	Candia Morgan	Institute of Education London	UK
Mrs	Debbie Morgan	National Centre for Excellence in the Teaching of Mathematics (NCETM)	UK
Prof	Daniel Muijs	University of Southampton	UK
Prof	Eizo Nagasaki	Shizuoka University	Japan
Mr	Ming Ni	East China Normal University Press	China
Prof	Graham Niblo	University of Southampton	UK
Prof	Hiro Ninomiya	Saitama university	Japan
Dr	Keiichi Nishimura	Tokyo Gakugei University	Japan
Prof	Jarmila Novotna	Charles University	Czech
Dr	Abiodun Ogunkunle	University of Port Harcourt	Nigeria
Ms	Lisa O'Keeffe	University of Bedfordshire	UK
Mr	Shai Olsher	Weizmann Institute of Science	Israel
Mr	Brendan O'Sullivan	St. Patrick's College-Drumcondra- Dublin	Ireland
Mr	Koji Otaki	Hiroshima University	Japan
Prof	Birgit Pepin	HiST, Sør-Trøndelag University College	Norway
Ms	Ping Lu	Ningbo University	China
Mr	Stuart Price	Southampton University	UK
Prof	Chunxia Qi	Beijing Normal University	China
Mr	Shouwang Qian	Beijing New Century Jiuzhang Education & Technology Institute	China
Miss	Rafaela Silva Rabelo	University of Sao Paulo	Brazil
Dr	David Read	University of Southampton	UK
Dr	Janine Remillard	University of Pennsylvania	USA
Prof	Sebastian Rezat	University of Paderborn	Germany
	Andriceli Richit	Sao Paulo State University	Brazil
Mrs	Cydara Ripoll	Universidade Federal do Rio Grande do Sul	Brazil
Prof	Tim Rowland	Cambridge and UEA	UK
Prof	Kenneth Ruthven	University of Cambridge	UK
Dr	Christopher Sangwin	Loughborough University	UK
Dr	Carl Saxton	Cambridge University Press	UK
Prof	William Schmidt	Michigan State University	USA
Mrs	Corina Seal	Institute of Education London	UK
Prof	Sharon Senk	Michigan State University	USA
Prof	Bingxing Shi	Beijing Institute of Education	China
Dr	Helen Siedel	University of Cambridge	UK
Dr	Svein Sikko	HiST, Sør-Trøndelag University College	Norway
Mr	Boaz Silverman	Weizmann Institute of Science	Israel
Prof	Josip Slisko	Benemerita Universidad Autonoma de Puebla	Mexico
Ms	Jinghong Sun	Beijing Haidian Teachers Training College	China
Dr	Petra Surynkova	Charles University in Prague	Czech
Dr	Akihiko Takahashi	Tokyo Gakugei University	Japan
Prof	Paula Teixeira	UIED-New Lisbon University	Portugal

Prof	Mike Thomas	University of Auckland	New Zealand
Prof	Denisse Thompson	University of South Florida	USA
Prof	Edriss Titi	Weizmann Institute of Science	Israel
Mr	Yusuke Uegatani	Hiroshima University	Japan
Mrs	Karen Usiskin	Pearson Education	USA
Prof	Zalman Usiskin	University of Chicago	USA
Prof	Marja van den Heuvel-Panhuizen	Utrecht University	Netherlands
Mr	Stefaan Van Malderen	Plantyn Publishing	Belgium
Dr	Hendrik Van Steenbrugge	Mälardalen University	Sweden
Mr	Marc van Zanten	Utrecht University	Netherlands
Ms	Ingrida Veilande	Latvian Maritime Academy	Latvia
Dr	Chronoula Voutsina	University of Southampton	UK
Dr	Jianbo Wang	Beijing Normal University Publishing Group	China
Miss	Yuqian (Linda) Wang	Durham University	UK
Mr	Yong Wang	BNUP Editorial Board of New Century Textbooks	China
Mr	Karl Warsi	Oxford University Press	UK
Ms	Huinu Wei	Henan Experimental Primary School	China
Dr	Lourdes Maria Werle de Almeida	Universidade Estadual de Londrina	Brazil
Ms	Joanna Williamson	University of Southampton, MASE group	UK
Mr	Ka Lok Wong	University of Hong Kong	Hong Kong
Mr	Oon Hua Wong	Ministry of Education	Singapore
Prof	Binyan Xu	East China Normal University	China
Prof	Der-Ching Yang	National Chiayi University	Taiwan
Ms	Yanmei Yang	Beijing Academy of Educational Sciences	China
Miss	Jinyu Yang	University of Southampton	UK
Prof	Michal Yerushalmy	University of Haifa	Israel
Mr	Michael Zhai	University of Southampton	UK
Prof	Fei Zhang	Nanjing Institute of Education	China
Prof	Huiying Zhang	Shijiazhuang Institute of Education	China
Mr	Bo Zhang	University of Southampton	UK
Ms	Yanhui Zhao	Primary School Attached to Northeast Normal University	China
Mr	Dejiang Zhu	Jiaxing Nanhu Education Research & Training Center	China
Ms	Yuhong Zhu	Tianjin Hexi Education Centre	China
Mr	Saulius Zukas	Baltos Lankos Publishing House	Lithuania

This conference booklet was prepared by Julie-Ann Edwards and Charis Voutsina with technical assistance from Mandy Lo.

ICMT2014 Conference Programme Outline

<table>
<tr><th></th><th>Room: 58/1007</th><th>Room: 58/1009</th><th>Room: 58/1023</th><th>Room: 58/1065</th><th>Room: 58/1067</th></tr>
<tr><td colspan="2">Tuesday, 29 July 2014</td><td colspan="4">08.00– 10.00 Registration Foyer, Level 1, Building 58 (Murray Building)</td></tr>
<tr><td>10.00–10.30</td><td colspan="5">Opening Session (Lecture Theatre, 58/1067)</td></tr>
<tr><td>10.30–11.30</td><td colspan="5">Plenary Session 1 (Lecture Theatre, 58/1067)</td></tr>
<tr><td>11.30–12.00</td><td colspan="5">Coffee Break (Building 40, Garden Court)</td></tr>
<tr><td>12.00–13.00</td><td>Parallel Session 1.1</td><td>Parallel Session 1.2</td><td>Parallel Session 1.3</td><td>Workshop 1</td><td>Parallel Session 1.4</td></tr>
<tr><td>13.00–14.00</td><td colspan="5">Break/Lunch (Building 40, Garden Court)</td></tr>
<tr><td>14.00–15.00</td><td>Parallel Session 2.1</td><td>Parallel Session 2.2</td><td rowspan="2">Symposium 1</td><td>Parallel Session 2.3</td><td rowspan="2">Maths in the Science Curriculum Symposium</td></tr>
<tr><td>15.00–16.00</td><td>Parallel Session 3.1</td><td>Parallel Session 3.2</td><td>Parallel Session 3.3</td></tr>
<tr><td>16.00–16.30</td><td colspan="5">Coffee Break (Building 40, Garden Court)</td></tr>
<tr><td>16.30–17.30</td><td>Symposium 2</td><td>Parallel Session 4.1</td><td>Parallel Session 4.3</td><td>Parallel Session 4.2</td><td>Maths in the Science Curriculum Symposium</td></tr>
<tr><td>17.30–19.00</td><td colspan="5">Happy Hour (Building 40, Garden Court)</td></tr>
<tr><td colspan="2">Wednesday, 30 July 2014</td><td colspan="4">08.00– 09.00 Registration (Foyer, Level 1, Building 58, Murray Building)</td></tr>
<tr><td>09.00–10.00</td><td colspan="5">Plenary Session 2 (Lecture Theatre, 58/1067)</td></tr>
<tr><td>10.00–10.30</td><td colspan="5">Coffee Break (Building 40, Garden Court)</td></tr>
<tr><td>10.30–11.30</td><td>Parallel Session 5.1</td><td>Parallel Session 5.2</td><td>Parallel Session 5.3</td><td>Parallel Session 5.4</td><td>Symposium 3</td></tr>
<tr><td>11.30–13.00</td><td rowspan="2">Exhibition (Garden Court)</td><td colspan="2" rowspan="2">Poster Session (Garden Court)</td><td colspan="2"></td></tr>
<tr><td>13.00–14.00</td><td colspan="2">Break/Lunch (Garden Court)</td></tr>
<tr><td>14.00–15.00</td><td>Parallel Session 6.1</td><td>Parallel Session 6.2</td><td>Parallel Session 6.3</td><td rowspan="2">Workshop 2</td><td>Symposium 4</td></tr>
<tr><td>15.00–16.00</td><td>Parallel Session 7.1</td><td>Parallel Session 7.2</td><td>Symposium 5</td><td>Parallel Session 7.3</td></tr>
<tr><td>16.00–16.30</td><td colspan="5">Coffee Break (Building 40, Garden Court)</td></tr>
<tr><td>16.30–18.00</td><td colspan="5">Plenary Session 3 (Panel Discussion) (Lecture Theatre, 58/1067)</td></tr>
<tr><td>18.30–20.30</td><td colspan="5">Conference Dinner (Building 40, Garden Court)</td></tr>
<tr><td colspan="2">Thursday, 31 July 2014</td><td colspan="4">08.00– 09.00 Registration (Foyer, Level 1, Building 58, Murray Building)</td></tr>
<tr><td>09.00–10.00</td><td>Parallel Session 8.1</td><td>Symposium 6</td><td>Parallel Session 8.2</td><td>Workshop 3</td><td>Parallel Session 8.3</td></tr>
<tr><td>10.00–10.30</td><td colspan="5">Coffee Break (Building 40, Garden Court)</td></tr>
<tr><td>10.30–11.30</td><td>Parallel Session 9.1</td><td>Parallel Session 9.2</td><td>Symposium 7</td><td rowspan="2">Workshop 4</td><td>Parallel Session 9.3</td></tr>
<tr><td>11.30–12.30</td><td>Parallel Session 10.1</td><td>Parallel Session 10.2</td><td>Symposium 8</td><td>Parallel Session 10.3</td></tr>
<tr><td>12.30–13.30</td><td colspan="5">Break/Lunch (Building 40, Garden Court)</td></tr>
<tr><td>13.30–14.30</td><td colspan="5">Plenary Session 4 (Lecture Theatre, 58/1067)</td></tr>
<tr><td>14.30–15.00</td><td colspan="5">Closing Session (Lecture Theatre, 58/1067)</td></tr>
<tr><td>15.00–15.30</td><td colspan="5">Coffee/Tea/Farewell (Foyer, Level 1, Building 58 - Murray Building)</td></tr>
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