

# CTE-STEM

5TH APSCE INTERNATIONAL  
CONFERENCE ON COMPUTATIONAL  
THINKING AND STEM EDUCATION

# 2021

**Conference  
Programme  
Handbook**

**2nd - 4th June 2021**

Organised by:



Hosted by:



An Institute of



Supported by:



School of  
Computing



香港教育大學  
The Education University  
of Hong Kong

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賽馬會運算思維教育  
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**National Institute of Education**

**Programme Handbook of International Conference on  
Computational Thinking and STEM Education 2021 (CTE-  
STEM 2021)**

**2<sup>nd</sup> – 4<sup>th</sup> June 2021**

**National Institute of Education, Nanyang Technological  
University, Singapore**

**Organized by**

Asia-Pacific Society for Computers in Education (APSCE)

**Supporting Organizations**

The Education University of Hong Kong

CoolThink@JC

## **ABOUT THE NATIONAL INSTITUTE OF EDUCATION (NIE), SINGAPORE**

The National Institute of Education, an autonomous institute of Nanyang Technological University (NIE NTU), Singapore, is among the world's top education institutes renowned for its excellence in teacher education and educational research. Founded in 1950, NIE has played a key and pivotal role in shaping and developing Singapore's teaching workforce.

With the vision to be an institute of distinction that leads the future of education in a dynamic milieu, NIE prepares teachers with the requisite values, skills and knowledge to meet the evolving demands of present and future learners. The quality of NIE's programmes is based on evidence-informed reviews and enhancement, and delivered using innovative pedagogies in digitally-mediated learning spaces. There is a keen focus on linking theory to practice and on developing students with a global and inquiring mindset for lifelong learning.

Our degree, higher degree and professional development programmes offer global perspectives through international practical and semester exchanges, while future-ready pedagogies, multidisciplinary curricula and service learning initiatives help us to develop the holistic reflective practitioner and school leader. NIE is ranked among top institutions for research impact and excellence in the field of Education. Our research philosophy is focused on impacting school practices, enhancing programmes, informing policy formation and ultimately, improving student learning outcomes. Our vibrant research culture has seen us ranked consistently among the top in the Bibliometric Indicators of Publications in Education and in the QS World University Rankings for Education as a discipline in recent years.

For more information, please visit: [www.nie.edu.sg](http://www.nie.edu.sg)



Asia-Pacific Society for Computers in Education

The **Asia-Pacific Society for Computers in Education (APSCE)** was formed on 1 January 2004. It is an independent academic society whose broad objective is to promote the conduct and communication of scientific research related to all aspects of the use of computers in education, especially within the Asia-Pacific.

The specific objectives of APSCE are:

- To promote the conduct and dissemination of research employing the use of computing technologies in education within the Asia-Pacific region and internationally.
- To encourage and support the academic activities of researchers in member countries and to nurture a vibrant research community of younger as well as more experienced researchers.
- To enhance international awareness of research conducted by researchers in member countries.
- To obtain greater representation of active researchers from the Asia-Pacific region in committees of related leading academic and professional organizations and the editorial boards of reputable journals.
- To organize and hold the International Conference on Computers in Education (ICCE) conference series in member countries.
- To engage in other appropriate academic and professional activities including but not limited to the setting up of Special Interest Groups (SIGs) and the publication of a Society newsletter and a Society journal.

For more information, please visit: <https://www.apsce.net>

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## *Preface*

The 5th APSCE International Conference on Computational Thinking and STEM Education 2021 (CTE-STEM 2021) is organized by the Asia-Pacific Society for Computers in Education (APSCE). CTE-STEM 2021 is hosted by the National Institute of Education, Nanyang Technological University (NIE/NTU). This conference continues from the success of the previous four international Computational Thinking conferences organised by the Education University of Hong Kong (EdUHK) and JC@Coolthink in Hong Kong. In addition to Computational Thinking, we will be expanding the conference to invite STEM researchers and practitioners to share their findings, processes and outcomes in the context of computing education or computational thinking.

CTE-STEM 2021 is a forum for worldwide sharing of ideas as well as dissemination of findings and outcomes on the implementation of computational thinking and STEM development. The conference will comprise keynote speeches, invited speeches, panel discussions, workshops and paper presentations. All accepted papers will be published in ISSN-coded proceedings.

The International Teachers Forum is organized for teaching practitioners to share their practices in teaching Computational Thinking, Computing and STEM in the classroom. We believe bringing all these would create enriching experiences for educators and researchers to share, learn and innovate approaches to learning through Computational Thinking and STEM education. This year, teachers can participate in Lightning Talks to share ideas about teaching and learning CT.

The Students Forum (BuildingBloCS) is organized by students, for students. It is Singapore's annual Computing education outreach programme. Started back in 2017, it is not only a national computing education outreach programme, but also a platform for leadership development, innovation programme, EVIA (Education & Values In Action) and student-friendly social network. We have been very encouraged by the strong support given by Ministry of Education (Singapore) and many other community and industry partners.

On behalf of APSCE, NIE and the Conference Organizing Committee, we would like to thank the Minister of Education of Singapore, Mr Chan Chun Sing, for being the Guest of Honour, and to NTU President Professor Subra Suresh for his welcome message, during the opening ceremony. Our gratitude also goes to all the invited panelists, the keynote and invited speakers, as well as paper presenters for their contribution to the success of CTE-STEM 2021.

We sincerely hope all of you will enjoy and be inspired from participating in and attending CTE-STEM 2021.

With Best Wishes,

Professor LOOI, Chee-Kit  
*Conference Chair,  
CTE-STEM 2021  
National Institute of Education  
Nanyang Technological  
University, Singapore*

A/P WADHWA, Bimlesh  
*Conference Co-Chair,  
CTE-STEM 2021  
National University of  
Singapore, Singapore*

Professor DAGIENÉ, Valentina  
*Conference Co-Chair,  
CTE-STEM 2021  
Vilnius University, Lithuania*

## **Main Theme and Sub-themes**

“**Computational Thinking and STEM Education**” is the main theme of CTE-STEM 2021 which aims to keep abreast of the latest development of how to facilitate students’ computational thinking abilities and STEM development, in the context of computing education or computational thinking. The conference also aims to disseminate findings and outcomes on the implementation of CT development in school and STEM education. There are 19 sub-themes under CTE-STEM 2021, namely:

- Computational Thinking and Coding Education in K-12
- Computational Thinking and Unplugged Activities in K-12
- Computational Thinking and Subject Learning and Teaching in K-12
- Computational Thinking and Teacher Development
- Computational Thinking and IoT
- Computational Thinking and STEM/STEAM Education
- Computational Thinking and Data Science
- Computational Thinking and Artificial Intelligence Education
- Computational Thinking Development in Higher Education
- Computational Thinking and Special Education Needs
- Computational Thinking and Evaluation
- Computational Thinking and Non-formal Learning
- Computational Thinking and Psychological Studies
- Computational Thinking in Educational Policy
- STEM Learning in the Classroom
- STEM Activities in Informal Contexts
- STEM Education Policies
- STEM Pedagogies and Curriculum
- STEM Teacher Education and Professional Development

## **Paper Submissions to CTE-STEM 2021**

The conference received a total of 47 submissions (29 full papers, 14 short papers and 4 poster papers) by 116 authors from 21 countries/regions (see Table 1)

*Table 1: Distribution of Paper Submissions for CTE-STEM 2021*

<b>Country/ Region</b>	<b>No. of Authors</b>	<b>Country/Region</b>	<b>No. of Authors</b>
Canada	4	Lithuania	2
China	19	Malaysia	5
Cyprus	1	Mexico	4
Estonia	1	Netherlands	1
Finland	4	Peru	2
Greece	2	Singapore	11
Germany	2	Spain	1
Hong Kong	14	Sweden	5
India	4	Taiwan	9
Italy	4	United States	18
Japan	3	Total	116

The International Programme Committee (IPC) is formed by 74 members and 13 co-chairs worldwide. Each paper with author identification anonymous was reviewed by at least three IPC Members or co-chairs. Meta-reviewers then made recommendation on the acceptance of papers based on IPC Members' reviews. With the comprehensive review process, 35 accepted papers are presented (10 full papers, 15 short papers and 10 poster papers) (see Table 2) at the conference.

*Table 2: Paper Presented at CTE-STEM 2021*

<b>Sub-themes</b>	<b>Full Paper</b>	<b>Short Paper</b>	<b>Poster Paper</b>	<b>Total</b>
Computational Thinking and Coding Education in K-12	2	1	2	5
Computational Thinking and Unplugged Activities in K-12	0	0	1	1
Computational Thinking and Subject Learning and Teaching in K-12	3	2	0	5
Computational Thinking and Teacher Development	1	1	0	2
Computational Thinking and IoT	0	0	0	0
Computational Thinking and STEM/STEAM Education	0	0	1	1
Computational Thinking and Data Science	0	0	2	2
Computational Thinking and Artificial Intelligence Education	0	0	0	0
Computational Thinking Development in Higher Education	1	2	1	4
Computational Thinking and Special Education Needs	0	1	0	1



<b>Sub-themes</b>	<b>Full Paper</b>	<b>Short Paper</b>	<b>Poster Paper</b>	<b>Total</b>
Computational Thinking and Evaluation	1	0	0	1
Computational Thinking and Non-formal Learning	2	0	0	2
Computational Thinking and Psychological Studies	0	1	0	1
Computational Thinking in Educational Policy	0	0	0	0
STEM Learning in the Classroom	0	3	0	3
STEM Activities in Informal Contexts	0	1	0	1
STEM Education Policies	0	1	0	1
STEM Pedagogies and Curriculum	0	2	1	3
STEM Teacher Education and Professional Development	0	0	2	2
Total	10	15	10	35

**Paper Submissions to CTE-STEM 2021 International Teachers Forum**

The Forum received a total of 29 papers by 59 authors from 6 countries/regions (see Table 3).

*Table 3: Distribution of Paper Submissions for CTE-STEM 2021 International Teachers Forum*

Country/ Region	No. of Authors	Country/Region	No. of Authors
China	15	Indonesia	3
Hong Kong	10	Singapore	18
India	5	Taiwan	8
		Total	59

The Review Panel for the Forum is formed by 18 members worldwide. Each paper with author identification anonymous was reviewed by at least three Review Panel Members. Meta-reviewers then made recommendation on the acceptance of papers based on Review Panel Members’ reviews. With the comprehensive review process, 24 accepted papers are presented (see Table 4) at the conference. In addition, there will be 4 short sessions of Techers sharing their CT in classroom experiences (see Table 5).

*Table 4: Paper Presented at CTE-STEM 2021 International Teachers Forum*

Sub-themes	Number of Papers
Computational Thinking and Coding Education in K-12	3
Computational Thinking and Unplugged Activities in K-12	4
Computational Thinking and Subject Learning and Teaching in K-12	4
Computational Thinking and Teacher Development	1
Computational Thinking and IoT	0
Computational Thinking and STEM/STEAM Education	6
Computational Thinking and Data Science	0
Computational Thinking and Artificial Intelligence Education	1
Computational Thinking Development in Higher Education	0
Computational Thinking and Special Education Needs	0
Computational Thinking and Evaluation	1
Computational Thinking and Non-formal Learning	2
Computational Thinking and Psychological Studies	0
Computational Thinking in Educational Policy	0
STEM Learning in the Classroom	0
STEM Activities in Informal Contexts	0
STEM Education Policies	1
STEM Pedagogies and Curriculum	1
STEM Teacher Education and Professional Development	0
Total	24

*Table 5: Teachers Experience Sharing Session at CTE-STEM 2021 International Teachers Forum*

<b>Teachers Experience Sharing Session</b>	<b>Country</b>
Computational Thinking and Computer Science: From Standards to Practice	USA
Sharing my Journey on CT with Bebras Indonesia and Google Gerakan PANDAI	Indonesia
Parsons Problem Implementation – Reducing Cognitive Load to Ease Beginners into Python Programming	Singapore
Computing Science Curriculum in Thai Primary Schools: An Integrated Story-based Approach	Thailand

### **Conference Programme**

The conference comprises of keynotes, invited speeches, panel discussions, academic paper and poster presentations, International Teachers Forum, Students Forum and Parents Webinar.

(i) Keynote and Invited Speeches

There are four Keynote Speeches and three Invited Speeches at CTE-STEM 2021:

*Keynote Speeches*

1. “Designing for More Learner Agency using Computational Tools in STEM”  
by Dr Sherry HSI (Principal Scientist, BSCS Science Learning)
  
2. “The Two Types of Computational Thinking”  
by Mr Miles BERRY (Principal Lecturer and the Subject Leader for Computing Education at the University of Roehampton)
  
3. “Teacher Development in Computational Thinking Education in K12: Design of Pedagogy and Scaling”  
by Professor KONG Siu Cheung (Professor of the Department of Mathematics and Information Technology (MIT); and Director of Centre for Learning, Teaching and Technology (LTTC), the Education University of Hong Kong)
  
4. “Computational Thinking Through the Lens of a Mathematics Educator”  
by Associate Professor HO Weng Kin (Associate Professor of Mathematics at the National Institute of Education, Nanyang Technological University)

### *Invited Speeches*

1. “Building AI Readiness”  
by Mr Anshul SONAK (Senior Director, Intel Corporation, Global AI and Digital Readiness, Global Partnerships & Initiatives Group)
2. “Intergenerational Learning with AI for Kids (AI4K)®”  
by Mr KOO Sengmeng (Senior Deputy Director, AI Innovation Team, AI.SG)
3. “Learning Redefined; Skills Reinvented; Developing a Learn-Ready Singapore”  
by Mr Gary LIM (Head of Education, Google Cloud, Southeast Asia)

### (ii) Opening Panel Discussion

Topic for panel: Computational Thinking, Digital Literacy and AI Readiness in University Education

Given the importance of Computational Thinking, Digital Literacy and preparing for AI Readiness in our students, a plenary panel discussion will be held for the presidents or their designate of the 6 main universities in Singapore to talk and share about their plans for computational thinking and digital literacy education as part of undergraduate education. The panelists will respond to any or to all of the questions:

- What are your priorities for undergraduate education?
- How do you see the role of CT and digital literacy education in undergraduate education?  
How do we prepare students to be ready for an AI future?
- Can you share some information on the policies, strategies and implementation of CT education in your university?
- Challenges and opportunities for our university students to learn and develop CT and AI literacies

Panelists:

Professor Bernard Tan Cheng Yian, Senior Vice Provost, National University of Singapore (NUS)

Professor Chua Kee Chaing, Deputy President (Academic) and Provost, Singapore Institute of Technology (SIT)

Professor Venky Shankararaman, Vice Provost (Undergraduate Matters) and Professor of Information Systems (Education), Singapore Management University (SMU)

Professor Cheah Horn Mun, Assistant Provost and Dean (College of Lifelong & Experiential Learning), Singapore University of Social Sciences (SUSS)

Professor Chong Tow Chong, President, Singapore University of Technology and Design (SUTD)

Professor Gan Chee Lip, Associate Provost for Undergraduate Education, Nanyang Technological University (NTU)

Moderator:

Professor Christine Goh, NIE Director, Nanyang Technological University (NTU)

(iii) Closing Panel Discussion

“Finding the Key to Computational Thinking in Teacher Education”

In this panel, speakers from different countries/regions will share insights of CT in contexts familiar to teachers, providing direct support for the integration of CT into international school curricula. Discussions will focus on a series of modules in which CT can be situated in terms of both level of learner development and application context. This helps to refine the definition of CT and simultaneously provide concrete support and resources of STEAM teaching at all curricula levels, from kindergarten to upper secondary school.

Panelists:

Professor Yasemin Gulbahar, Ankara University, Turkey

Associate Professor Mikko-Jussi Laakso, Tuku University, Finland

Professor Claudia Tenberge, Paderborn University, Germany

Professor Valentina Dagiene, Vilnius University, Lithuania

Assistant Professor Ibrahim H. Yeter, National Institute of Education, Nanyang Technological University, Singapore

Professor Kong Siu Cheung, The Education University of Hong Kong, Hong Kong

Moderator:

Associate Professor Bimlesh Wadhwa, National University of Singapore, Singapore

(iv) Academic Paper and Poster Presentations

There are 8 sessions of academic paper presentations and 1 academic poster session with 35 papers (10 full papers, 15 short papers and 10 poster papers) in the conference. Worldwide scholars present and exchange the latest research ideas and findings, which highlight the importance and pathways of computational thinking education covering K-12 education, higher education, teacher development and STEM/STEAM education, etc.

(v) International Teachers Forum

There are 5 sessions of teacher paper presentation with 24 papers in the International Teachers Forum. K-12 teachers will share best practices and key challenges of implementing CTE-STEM in their countries/regions. There are 2 sessions of teachers' experience sharing by 4 teachers from different countries.

(vi) Students Forum— BuildingBloCS

With the increasing importance of Computing education and AI literacy globally, this year's theme is on Computational Thinking and Artificial Intelligence Education. There is a winpetition (a competition whereby not only a minority is awarded, but everyone who exhibits positive learning attitude and puts in time and effort to produce good quality work can be a winner!) where student teams will work on creating AI projects for the betterment of the community and our world. There are also a series of workshops, lightning labs, programming puzzles, pop quizzes, engagement talks, games and more!

## **Pre-conference and Post-conference Webinars**

### **(i) Pre-conference Webinars**

#### **Webinar 1: “Computational Thinking Education Meets Artificial Intelligence”**

There is a global explosion of interest in artificial intelligence. Progress in AI demands that CT education pay attention to the societal impact of computing. CT education is beginning to draw on ideas from ethics and sociology alongside traditional technical disciplines.

#### **Webinar 2: “Computational Thinking Education in India and Indonesia”**

The webinar shares about Bebras Indonesia, what it does and what benefits are brought about from being part of the Bebras Community. The second half of the webinar shares about CSpashala, an association for Computing Machinery (ACM India) initiative.

#### **Webinar 3: “Engaging Students with Computational Thinking—Offline and Online”**

How do “unplugged” activities relate to computation? This talk digs down to the fundamental ideas on computation.

### **(ii) Post-conference Webinar**

#### **Webinar 4: “What Every Parent Should Know about CT and Why Every Student Should Learn CT”**

There is a Parents Webinar to share and introduce Computational Thinking. The session discusses about the learning attitudes that CT encourages in students and how learning and mastering CT will even help students in other subject matter in school like Math, Science, English, History and even Poetry, Art, Music and Sports!

# *Conference Organization*

## **Conference Chair**

Chee Kit Looi, National Institute of Education, Nanyang Technological University

## **Conference Co-Chair**

Bimlesh Wadhwa, National University of Singapore

Valentina Dagienė, Vilnius University

## **Local Organising Committee**

Peter Seow (Chair), National Institute of Education, Nanyang Technological University

Bimlesh Wadhwa (Co-Chair), National University of Singapore

Long Kai Wu (Publicity), National Institute of Education, Nanyang Technological University

Kee Ying Hwa (Proceedings), National Institute of Education, Nanyang Technological University

Oka Kurniawan (Programs), Singapore University of Technology and Design

Ibrahim H. Yeter (Events), National Institute of Education, Nanyang Technological University

Chin Lee Ker (Secretariat), National Institute of Education, Nanyang Technological University

Shiau Wei Chan (Secretariat), National Institute of Education, Nanyang Technological University

## **Teachers Forum Committee**

Beng Keat Liew (Chair), Republic Polytechnic

Hon Wai Leong (Co-Chair), National University of Singapore

Soong Chee Gi, Ministry of Education

Norman Lee, Singapore University of Design and Technology

## **Students Forum Committee**

Soong Chee Gi (Chair), Ministry of Education

Hon Wai Leong (Co-Chair), National University of Singapore



Wendy Huang, National Institute of Education, Nanyang Technological University

Joel Leo Qiyi, Student Lead, Dunman High School

### **International Programme Committee Co-Chairs**

DAGIENE Valentina	Vilnius University
HOPPE Heinz Ulrich	University of Duisburg-Essen
HSU Ting-chia	National Taiwan Normal University
MILRAD Marcelo	Linnaeus University
SHIH Ju-ling	National Central University
SIN Kuen-fung	The Education University of Hong Kong
SONG Ki-sang	Korea National University of Education
SULLIVAN Florence	UMass Amherst
VAHRENHOLD Jan	University of Münster
WADHWA Bimlesh	National University of Singapore

### **International Programme Committee Members**

ALEXANDRON Giora	Weizmann Institute of Science
BOTIČKI Ivica	University of Zagreb
CHAN Edna	Singapore Polytechnic
CHANG Bin Haw	Ngee Ann Polytechnic

CHANG Li-chieh	National Central University
CHANG Samuel Chi-cheng	National Taiwan Normal University
CHANG Shao-Chen	National Taiwan Normal University
CHEN Guang	Beijing Normal University
CHEN Ming-puu	National Taiwan Normal University
CHENG Wei	Nanjing University of Posts and Telecommunications
CHIANG Tosti Hsu-cheng	National Taiwan Normal University
CHOI Hyungshin	Chuncheon National University of Education
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HAUCK Jean	Federal University of Santa Catarina
HEINTZ Fredrik	Linköping University
HERSHKOVITZ Arnon	Tel Aviv University
HO Joshua	The University of Hong Kong
HUANG Nen-fu	National Tsing Hua University
HUANG Shu-hsien	National University of Tainan
HUNG Hui-chun	Taipei Medical University

IYER Sridhar	Indian Institute of Technology Bombay
JANSEN Marc	University of Applied Sciences Ruhr West
JONG Morris Siu-yung	The Chinese University of Hong Kong
KEE Ying Hwa	National Institute of Education
KOHEN-VACS Dan	Holon Institute of Technology
KURNIAWAN Oka	Singapore University of Technology and Design
KWOK Lam-for	City University of Hong Kong
KWOK Linda Wai-ying	The Education University of Hong Kong
LER Darren	National University of Singapore
LIEW Beng Keat	Republic Polytechnic
LU Bin	California State University
LUI Ann Ming	Hong Kong Baptist University
MARCELINO Maria	University of Coimbra
MOLLER Faron	Swansea University
OTERO Nuno	Linnaeus University
PATTON Evan	Massachusetts Institute of Technology
PINKWART Niels	Humboldt University of Berlin
RAISINGHANI Vijay	Narsee Monjee Institute of Management Studies

ROBLES Gregorio	Rey Juan Carlos University
ROMÁN-GONZÁLEZ Marcos	National Distance Education University
SEOW Sen Kee Peter	National Institute of Education
SHANG Junjie	Peking University
SO Hyo-jeong	Ewha Womans University
SWANSON Hillary	Northwestern University
TAN Kok Cheng	Republic Polytechnic
WADHWA Bimlesh	National University of Singapore
WEINTROP David	University of Maryland
WU Longkai	National Institute of Education
YANG Junfeng	Hangzhou Normal University
YETER Ibrahim. H.	Nanyang Technological University
YU Yuen-tak	City University of Hong Kong
ZEIGLER David	California State University
ZHANG Jinbao	Beijing Normal University
ZHONG Baichang	Nanjing Normal University
ÖZÇINAR Hüseyin	Pamukkale University

## *Programme Overview*

Remarks: All the time shown on the schedule are Singapore Time (SGT).

Time	Day 1: 2 June (Wednesday)	Day 2: 3 June (Thursday)	Day 3: 4 June (Friday)	Day 3: 4 June (Friday) Teachers Forum	
0830	Conference Sessions Open for Entry	Conference Sessions Open for Entry	Conference Sessions Open for Entry	Conference Sessions Open for Entry	
0845-0900	Introductory Daynote	Introductory Daynote	Introductory Daynote	Opening Address- Teachers Forum	
0900-1000	Keynote 1- Dr Sherry Hsi	Keynote 3- Prof Kong Siu Cheung	Keynote 4- A/P Ho Weng Kin		
1000-1015	Break	Break	Academic Paper Session 3A	Break	
1015-1030				Lightning Talks	
1030-1045	Conference Opening	Meetings/ Unconference	Academic Paper Session 3A	Teachers Experience Sharing Session	
1045-1100	Panel Discussion (Computational Thinking, Digital Literacy and AI Readiness in University Education)				
1100-1200	Panel Discussion (Computational Thinking, Digital Literacy and AI Readiness in University Education)	Academic Paper Session 2A	Teachers Forum Session 3B	Teachers Forum Session 3C	Teachers Forum Session 3D (Chinese)

Time	Day 1: 2 June (Wednesday)	Day 2: 3 June (Thursday)	Day 3: 4 June (Friday)	Day 3: 4 June (Friday) Teachers Forum	
1200-1215	Academic Paper Session 1A	Academic Paper Session 2B	Break	Break	
1215-1300			Invited Talk 2- AI Singapore		
1300-1400	Break	Break	Break	Break	
1400-1500	Keynote 2- Mr Miles Berry	Invited Talk 1- Intel	Academic Paper Session 3E	Teachers Forum Session 3F	Teachers Forum Session 3G (English and Chinese)
1500-1545	Academic Paper Session 1B	Poster Session	Invited Talk 3- Google Education		
1545-1600			Teachers Experience Sharing Session		
1600-1615	Meetings / Unconference	Meetings / Unconference			
1615-1630	Break	Break	Break		
1630-1715	Academic Paper Session 1C	Academic Paper Session 2C	Panel Discussion (Finding the Key to Computational Thinking in Teacher Education)		
1715-1730			Conference Closing		

## *Programme Schedule*

Day 1: 2 June 2021 (Wednesday)	
0830   0900	Conference Sessions Open for Entry: 0830  Introductory Daynote: 0845-0900
0900   1000	Keynote 1 <i>Designing for More Learner Agency using Computational Tools in STEM</i> Speaker: Dr Sherry Hsi (Principal Scientist, BSCS Science Learning) Session Chair: Professor Ju-Ling Shih
1000   1030	Break
1030   1045	Introductory remarks by Conference Chair, Professor Looi Chee Kit  Welcome address by NTU President, Professor Subra Suresh  Opening by Guest-of-Honour: Minister for Education of Singapore, Mr Chan Chun Sing
1045   1200	Panel Discussion <i>Computational Thinking, Digital Literacy and AI Readiness in University Education</i>  Speakers: Professor Bernard Tan Cheng Yian, Senior Vice Provost, National University of Singapore (NUS)  Professor Chua Kee Chaing, Deputy President (Academic) and Provost, Singapore Institute of Technology (SIT)  Professor Venky Shankararaman, Vice Provost (Undergraduate Matters) and Professor of Information Systems (Education), Singapore Management University (SMU)  Professor Cheah Horn Mun, Assistant Provost and Dean (College of Lifelong & Experiential Learning), Singapore University of Social Sciences (SUSS)  Professor Chong Tow Chong, President, Singapore University of Technology and Design (SUTD)  Professor Gan Chee Lip, Associate Provost for Undergraduate Education, Nanyang Technological University (NTU)  Moderator: Professor Christine Goh, NIE Director, Nanyang Technological University (NTU)

Day 1: 2 June 2021 (Wednesday)	
1200   1300	<p>Academic Paper Session 1A Session Chair: Ibrahim H. Yeter</p> <p>Session Login: 1200-1205</p> <p>1205-1225 <u>Track 3: Computational Thinking and Subject Learning and Teaching in K-12</u> <i>Using the Beginners Computational Thinking Test to Measure Development on Computational Concepts Among Preschoolers (Paper 6F)</i> María ZAPATA-CÁCERES, Nardie FANCHAMPS</p> <p>1225-1245 <u>Track 3: Computational Thinking and Subject Learning and Teaching in K-12</u> <i>Storytelling through Programming in Scratch: Interdisciplinary Integration in the Elementary English Language Arts Classroom (Paper 27F)</i> Emrah PEKTAŞ, Florence R. SULLIVAN</p>
1300   1400	Break
1400   1500	<p>Keynote 2 <i>The Two Types of Computational Thinking</i> Speaker: Mr Miles Berry (Principal Lecturer and the Subject Leader for Computing Education at the University of Roehampton) Session Chair: A/P Bimlesh Wadhwa</p>
1500   1600	<p>Academic Paper Session 1B Session Chair: Nardie Fanchamps</p> <p>Session Login: 1500-1505</p> <p>1505-1525 <u>Track 1: Computational Thinking and Coding Education in K-12</u> <i>Achievement and Effort in Acquiring Computational Thinking Concepts: A log-based Analysis in a Game-based Learning Environment (Paper 23F)</i> Shuhan ZHANG, Gary K. W. WONG, Peter C. F. CHAN</p>



Day 1: 2 June 2021 (Wednesday)	
	<p>1525-1545  <u>Track 3: Computational Thinking and Subject Learning and Teaching in K-12</u>  <i>A Hybrid Approach to Teaching Computational Thinking at a K-1 and K-2 Level (Paper 5F)</i>            Damien ROMPAPAS, Steven YOON, Jonathan CHAN</p> <p>1545-1555  <u>Track 10: Computational Thinking and Special Education Needs</u>  <i>Proposal for the Production of Virtual Reality Environments in Elementary Education with a Constructivist Approach (Paper 43S)</i>            José E. GUZMÁN-MENDOZA, Héctor CARDONA-REYES, M. Lorena BARBA-GONZÁLEZ, Klinge O. VILLALBA-CONDORI, Dennis ARIAS-CHAVEZ, M. Luisa Fernanda RÁBAGO-GONZÁLEZ</p>
1600   1615	Meetings / Unconference
1615   1630	Break
1630   1730	<p>Academic Paper Session 1C            Session Chair: María Zapata-Cáceres</p> <p>Session Login: 1630-1635</p> <p>1635-1655  <u>Track 1: Computational Thinking and Coding Education in K-12</u>  <i>Exploring the Effectiveness of Pair Programming in Developing Students' Computational Thinking Skills through Scratch (Paper 9F)</i>            Wee Meng Frankie LEOW, Wendy HUANG</p> <p>1655-1715  <u>Track 9: Computational Thinking Development in Higher Education</u>  <i>Making the Thinking Results of Programming Visible and Traceable with a Multi-layer Board Game (Paper 29F)</i>            YungYu ZHUANG, Andito SAPUTRO, Mahesh LIYANAWATTA, Jen-Hang WANG, Su-Hang YANG, Gwo-Dong CHEN</p> <p>1715-1725  <u>Track 18: STEM Pedagogies and Curriculum</u>  <i>A Co-design Approach for Developing Computational Thinking Skills in Connection to STEM Related Curriculum in Swedish Schools (Paper 50S)</i>            Rafael ZEREGA, Ali HAMIDI, Sepideh TAVAJOH, Marcelo MILRAD</p>

Day 2: 3 June 2021 (Thursday)	
0830   0900	Conference Sessions Open for Entry: 0830  Introductory Daynote: 0845-0900
0900   1000	Keynote 3 <i>Teacher Development in Computational Thinking Education in K12: Design of Pedagogy and Scaling</i> Speaker: Professor Kong Siu Cheung (Professor of the Department of Mathematics and Information Technology (MIT); and Director of Centre for Learning, Teaching and Technology (LTTC), the Education University of Hong Kong) Session Chair: Professor Looi Chee Kit
1000   1030	Break
1030   1100	Meetings/Unconference
1100   1200	<p>Academic Paper Session 2A Session Chair: Anika Saxena</p> <p>Session Login: 1100-1105</p> <p>1105-1115 <u>Track 3: Computational Thinking and Subject Learning and Teaching in K-12</u> <i>Students' Learning of Computational Thinking in Schools with Different Curriculum Approaches Including Individual Student Characteristics (Paper 17S)</i> Amelie LABUSCH, Birgit EICKELMANN</p> <p>1115-1125 <u>Track 3: Computational Thinking and Subject Learning and Teaching in K-12</u> <i>A Standard Decomposition Process to Inform the Development of Game-Based Learning Environments Focused on Computational Thinking (Paper 28S)</i> Elizabeth L. ADAMS, Ching-Yu TSENG, Paul FOSTER, Vinson LUO, Leanne R. KETTERLIN-GELLER, Eric C. LARSON, and Corey CLARK</p> <p>1125-1135 <u>Track 9: Computational Thinking Development in Higher Education</u> <i>A Framework for Integrating Computational and Design Thinking Processes (Paper 18S)</i> Riccardo CHIANELLA, Diego REITANO, Ettore MORDENTI, George BARITSCH</p>

Day 2: 3 June 2021 (Thursday)	
	<p>1135-1145  <u>Track 9: Computational Thinking Development in Higher Education</u>  <i>The Effects of an AR Programming Game on Students' Different Prior Computational Thinking Skills (Paper 31S)</i>            Huai-hsuan HUANG, Vandit SHARMA, Kaushal Kumar BHAGAT, Wen-min HSIEH, Nian-shing CHEN</p>
1200   1300	<p>Academic Paper Session 2B            Session Chair: Huai Hsuan Huang</p> <p>Session Login: 1200-1205</p> <p>1205-1215  <u>Track 1: Computational Thinking and Coding Education in K-12</u>  <i>Cultivating Computational Thinking through Game-based Scratch Programming (Paper 14S)</i>            Xiaoqian LI, Jing LI, Jiansheng LI</p> <p>1215-1225  <u>Track 15: STEM Learning in the Classroom</u>  <i>An Evolving Definition of Computational Thinking in Science and Mathematics Classrooms (Paper 33S)</i>            Amanda PEEL, Sugat DABHOLKAR, Sally WU, Michael HORN, Uri WILENSKY</p> <p>1225-1235  <u>Track 15: STEM Learning in the Classroom</u>  <i>Action research on Engineering Design-oriented and Project-based STEM Teaching Model (Paper 38S)</i>            Hong YU, Lu ZOU</p> <p>1235-1245  <u>Track 15: STEM Learning in the Classroom</u>  <i>A Case Study of 7th Grade Students Learning Programming to Solve Mathematics Problems (Paper 41S)</i>            Wendy HUANG, Chee-Kit LOOI, Mi Song KIM</p>
1300   1400	Break

Day 2: 3 June 2021 (Thursday)	
1400   1500	<p>Invited Talk 1 <i>Building AI Readiness</i> Speaker: Mr Anshul Sonak (Senior Director, Intel Corporation, Global AI and Digital Readiness, Global Partnerships &amp; Initiatives Group) Session Chair: A/P Bimlesh Wadhwa</p>
1500   1600	<p>Poster Session Session Chair: Peter Seow</p> <p>Session Login: 1500-1505 Pre-recorded videos (3 mins each) - 1505-1535</p> <p><u>Track 1: Computational Thinking and Coding Education in K-12</u> <i>Developing Girls' Computational Thinking by Playing Programming Games (Paper 13P)</i> Jing LI, Jiansheng LI</p> <p><u>Track 1: Computational Thinking and Coding Education in K-12</u> <i>Programming Socio-scientific Games: A Computational Thinking Approach to Real-world Problems (Paper 61P)</i> Marianthi GRIZIOTI, Chronis KYNIGOS</p> <p><u>Track 2: Computational Thinking and Unplugged Activities in K-12</u> <i>Research on the Design of Unplugged Computer Science Teaching Activities in Elementary School—Taking the Fruit Delivery Game Course as an Example (Paper 22P)</i> Bingqing YANG</p> <p><u>Track 6: Computational Thinking and STEM/STEAM Education</u> <i>ARTEC Logic Puzzle: The Role of Computational Thinking with Extension to Extended Logic (Paper 2P)</i> Chung-Oi KOK</p> <p><u>Track 7: Computational Thinking and Data Science</u> <i>Infusing Computational Thinking into the Accounting Practice Course (Paper 24P)</i> Tao WU, Maiga CHANG</p> <p><u>Track 7: Computational Thinking and Data Science</u> <i>VizBlocks: A Data Visualization Literacy Education Tool (Paper 47P)</i> Travis Jia Yea CHING, Bimlesh WADHWA</p> <p><u>Track 9: Computational Thinking Development in Higher Education</u> <i>A Systematic Review of Distributed Pair Programming Based on the Team Effectiveness Model (Paper 37P)</i> Fan XU, Ana-Paula CORREIA</p> <p><u>Track 18: STEM Pedagogies and Curriculum</u> <i>Analysis of the Development Direction of STEM Curriculum in China (Paper 39P)</i> Lihua PENG</p>

Day 2: 3 June 2021 (Thursday)	
	<p><u>Track 19: STEM Teacher Education and Professional Development</u>  <i>Teacher Sensemaking on Computational Thinking in a Community of Math Teachers (Paper 45P)</i>            Chung Yiu SIU, Mi Song KIM, Wendy HUANG, Chee-Kit LOOI</p> <p><u>Track 19: STEM Teacher Education and Professional Development</u>  <i>A Systematic Review of Teachers' Preparedness towards Computational Thinking Integration in Mathematics (Paper 49P)</i>            Shiau-Wei CHAN, Chee-Kit LOOI, Shivani MAHEDIRATA, Mi Song KIM</p>
1600   1615	Meetings/Unconference
1615   1630	Break
1630   1730	<p>Academic Paper Session 2C            Session Chair: Misong Kim</p> <p>Session Login: 1630-1635</p> <p>1635-1655  <u>Track 12: Computational Thinking and Non-formal Learning</u>  <i>Bringing Physical Computing to an Underserved Community in an Informal Learning Space (Paper 48F)</i>            Chin-Lee KER, Bimlesh WADHWA, Peter, Sen-Kee SEOW, Chee-Kit LOOI</p> <p>1655-1715  <u>Track 12: Computational Thinking and Non-formal Learning</u>  <i>Combining Maker Technologies to Promote Computational Thinking and Heart-ware skills through Project-based Activities: Design Considerations and Empirical Outputs (Paper 51F)</i>            Ali HAMIDI, Sepideh TAVAJOH, Marcelo MILRAD</p> <p>1715-1725  <u>Track 16: STEM Activities in Informal Contexts</u>  <i>Developing STEM Makers with Mentoring and Authentic Problem-Solving Strategies (Paper 10S)</i>            Xiaojing WENG, Thomas K.F. CHIU, Morris S.Y. JONG</p>

Day 3: 4 June 2021 (Friday)	
0830   0900	Conference Sessions Open for Entry: 0830  Introductory Daynote: 0845-0900
0830   0900	Conference Sessions Open for Entry: 0830  Opening Address- Teachers Forum: 0845-0900
0900   1000	Keynote 4 <i>Computational Thinking Through the Lens of a Mathematics Educator</i> Speaker: A/P Ho Weng Kin (Associate Professor of Mathematics at the National Institute of Education, Nanyang Technological University) Session Chair: Dr Jon Mason
Parallel Sessions 1000   1100	Academic Paper Session 3A Session Chair: Emrah Pektaş  Session Login: 1000-1005  1005-1025 <u>Track 4: Computational Thinking and Teacher Development</u> <i>Different Paths, Same Direction: How Teachers Learn Computational Thinking in STEM Practices through Professional Development (Paper 30F)</i> Sally WU, Amanda PEEL, Connor BAIN, Michael HORN, Uri WILENSKY  1025-1045 <u>Track 11: Computational Thinking and Evaluation</u> <i>A Preliminary, Systematic Review of Teaching and Learning Computational Thinking in Early Childhood Education (Paper 35F)</i> Anika SAXENA, Gary WONG
1000   1015	Break
Parallel Sessions 1015   1030	Lightning Talks
Parallel Sessions 1030   1100	Teachers Experience Sharing Session Session Chair: Dr Liew Beng Keat  1030-1045 <i>Computational Thinking and Computer Science: From Standards to Practice</i> Speaker: Dr Janice Mak (USA)

Day 3: 4 June 2021 (Friday)	
Parallel Sessions 1030   1100	1045-1100 <i>Sharing my Journey on CT with Bebras Indonesia and Google Gerakan PANDAI</i> Speaker: Ms Connieta Theotirta (Indonesia)
Parallel Sessions 1100   1200	Teachers Forum Session 3B Session Chair: Kester Yew Chong Wong  Session Login: 1100-1105  1105-1115 <u>Track 1: Computational Thinking and Coding Education in K-12</u> <i>Teaching Computational Thinking Skills through Debugging with Scratch (Paper 54S)</i> Wee Meng Frankie LEOW  1115-1125 <u>Track 3: Computational Thinking and Subject Learning and Teaching in K-12</u> <i>Designing a Computational Thinking Curriculum for Everyone with a Differentiated and Gamified Approach (Paper 21S)</i> Phylliscia CHEW, Da LI  1125-1135 <u>Track 3: Computational Thinking and Subject Learning and Teaching in K-12</u> <i>Pedagogical Design of Flowcharts and Tasks to Teach Computational Thinking to Lower Secondary Students (Paper 59S)</i> Kester Yew Chong WONG  1135-1145 <u>Track 3: Computational Thinking and Subject Learning and Teaching in K-12</u> <i>Rethinking Computational Thinking Implementation in K-12 and Challenges Faced (Paper 74S)</i> Susanna SUNIL  1145-1155 <u>Track 3: Computational Thinking and Subject Learning and Teaching in K-12</u> <i>Integration of Computational Thinking in Upper Primary (Grade 6-8) Math in Tamil Nadu, India (Paper 81S)</i> Malarvizhi PANDIAN, Krithika KRISHNAMOORTHY

Day 3: 4 June 2021 (Friday)	
Parallel Sessions 1100   1200	<p>Teachers Forum Session 3C            Session Chair: Cora Ka Yuk Siu</p> <p>Session Login: 1100-1105</p> <p>1105-1115  <u>Track 6: Computational Thinking and STEM/STEAM Education</u>  <i>Computational Thinking in the Mathematics Classroom (Paper 11S)</i>            Tzi Yew Samuel LEE, Wen Qi Jovita TANG, Hee Tee Robin PANG</p> <p>1115-1125  <u>Track 6: Computational Thinking and STEM/STEAM Education</u>  <i>Making Maths Imaginable and Visible: Integrating STEM Education with Spatial Reasoning (Paper 15S)</i>            Chi-Cheung CHING, Ka-shing CHUI, Jessica Tsz-shan SO, Wing-man CHIU, Mei-yin LO</p> <p>1125-1135  <u>Track 6: Computational Thinking and STEM/STEAM Education</u>  <i>Computational Thinking in Mathematics (Grade 2-6): Developing CT Skills and 21st Century Competencies (Paper 55S)</i>            Felicia CHOON, Staphni SIM</p> <p>1135-1145  <u>Track 6: Computational Thinking and STEM/STEAM Education</u>  <i>Computational Thinking in Mathematics: Calculating Riemann Sums with Graphical Calculator and beyond (Paper 56S)</i>            Xiajuan YE</p> <p>1145-1155  <u>Track 6: Computational Thinking and STEM/STEAM Education</u>  <i>Computational Thinking in Statistics (Paper 63S)</i>            Frank NG</p>
Parallel Sessions 1100   1200	<p>Teachers Forum Session 3D (Chinese)            Session Chair: Ting-Chia Hsu</p> <p>Session Login: 1100-1105</p> <p>1105-1115  <u>Track 6: Computational Thinking and STEM/STEAM Education</u>  <i>運算思維模組化教學活動設計：幾何之美</i>  <i>Modeling Instruction Design for Computational Thinking Activities: Geometric Beauty (Paper 68S)</i>            楊心淵, 許庭嘉, 溫韋妮            Hsin-Yuan YANG, Ting-Chia HSU, Wei-Ni WEN</p>



Day 3: 4 June 2021 (Friday)	
Parallel Sessions 1100   1200	<p>1115-1125  <u>Track 8: Computational Thinking and Artificial Intelligence Education</u>            運算思維教育的教學反思: 運用運算思維結合人工智能提升學生的創意解難能力  <i>Using Computational Thinking Combined with Artificial Intelligence to Enhance Students' Creative Problem-Solving Ability (Paper 64S)</i>            陳景康, 許文星, 賴家豪            King Hong Chan, Man Sing Hsu, Ka Ho Lai</p>
	<p>1125-1135  <u>Track 17: STEM Education Policies</u>            中国西部地区STEAM与创客整合课程的现状调查与策略研究  <i>Research on the Current Situation and Strategies of STEAM and Maker Integrated Curriculum in Western China (Paper 79S)</i>            贾越, 陈梅            Yue JIA, Mei CHEN</p>
	<p>1135-1145  <u>Track 18: STEM Pedagogies and Curriculum</u>            初中生STEM学习观念调查研究  <i>An Investigation on STEM Learning Conceptions of Junior School Students (Paper 71S)</i>            马媛媛, 周颖, 朱丹琪            Yuan-yuan MA, Ying ZHOU, Dan-qi ZHU</p>
1200   1215	Break
1215   1300	<p>Invited Talk 2  <i>Intergenerational Learning with AI for Kids (AI4K)®</i>            Speaker: Mr Koo Sengmeng (Senior Deputy Director, AI Innovation Team, AI.SG)            Session Chair: Dr Liew Beng Keat</p>
1300   1400	Break
Parallel Sessions 1400   1500	<p>Academic Paper Session 3E            Session Chair: Anders Berglund            Session Login: 1400-1405</p> <p>1405-1415  <u>Track 4: Computational Thinking and Teacher Development</u>  <i>An Experience of Conducting Online Teacher Development for Computational Thinking Teaching in a Primary School Context (Paper 7S)</i>            Siu-cheung KONG</p>

Day 3: 4 June 2021 (Friday)	
Parallel Sessions 1400   1500	1415-1425 <u>Track 13: Computational Thinking and Psychological Studies</u> <i>Influential Factors of Hong Kong Secondary School Students' Intrinsic Motivation to Coding Education during the COVID-19 Epidemic: A Correlational Analysis (Paper 34S)</i> Xin ZHANG, Gary K. W. WONG, Qiaobing WU, Bill Y. P. TSANG  1425-1435 <u>Track 17: STEM Education Policies</u> <i>Euro-Asia Collaboration for Enhancing STEM Education (Paper 46S)</i> Anders BERGLUND, Valentina DAGIENE, Mats DANIELS, Vladimiras DOLGOPOLOVAS, Siegfried ROUVRAIS, Miriam TARDELL  1435-1445 <u>Track 18: STEM Pedagogies and Curriculum</u> <i>Designing an Interdisciplinary Social-scientific STEM Curriculum on Students' Empathy, Efficacy, and Interest (Paper 44S)</i> Biyun HUANG, Morris Siu-Yung JONG, Ching Sing CHAI, Yun DAI, Darwin LAU
Parallel Sessions 1400   1500	Teachers Forum Session 3F Session Chair: Inggriani Liem  Session Login: 1400-1405  1405-1415 <u>Track 2: Computational Thinking and Unplugged Activities in K-12</u> <i>SWOT Analysis and Strategy of Unplugged Activities to Localize STEM Courses in Rural Schools (Paper 69S)</i> Jiashuo CHANG, Shuo GUO  1415-1425 <u>Track 2: Computational Thinking and Unplugged Activities in K-12</u> <i>Computational Thinking Implementation in Schools – An Experience with Rural Welfare Schools in India (Paper 75S)</i> Pooja PALAPARTHI  1425-1435 <u>Track 2: Computational Thinking and Unplugged Activities in K-12</u> <i>Computational Thinking and Unplugged Activities: Localization Enabling Learning (Paper 76S)</i> Lakshmi Durga PETTA

Day 3: 4 June 2021 (Friday)	
Parallel Sessions 1400   1500	<p>1435-1445  <u>Track 4: Computational Thinking and Teacher Development</u>  <i>Bebras Challenge and PANDAI Movement Introducing Computational Thinking To K-12 Teachers in Indonesia (Paper 65S)</i>            Adi MULYANTO, Irya WISNUBHADRA, Inggriani LIEM</p> <p>1445-1455  <u>Track 11: Computational Thinking and Evaluation</u>  <i>Upscaling Skills-Based Formative Assessment: The Journey Towards a Student-Run Web Application Pilot on Computational Thinking Skills (Paper 73S)</i>            Aaron HO, Yu Jie NG</p>
Parallel Sessions 1400   1500	<p>Teachers Forum Session 3G (English and Chinese)            Session Chair: Wei Sin Ho and Enwei Xu</p> <p>Session Login: 1400-1405</p> <p>1405-1415  <u>Track 12: Computational Thinking and Non-formal Learning</u>  <i>From Computational Thinking to Computational Action with Arduino Programming Projects through Non-formal Learning (Paper 16S)</i>            Poh-tin LEE, Chee-wah LOW</p> <p>1415-1425  <u>Track 12: Computational Thinking and Non-formal Learning</u>  <i>Developing 21st Century Competencies and Computational Thinking through STEM-Based Co-Curricular Activities (Paper 53S)</i>            Wei Sin HO, Alex Han Rong YEO, Lay Teng NEO</p> <p>1425-1435  <u>Track 1: Computational Thinking and Coding Education in K-12</u>  <i>面向计算思维能力发展的思维型编程教学实践：内涵阐释与框架重构 The Teaching Practice of Thinking Programming for the Development of Computing Thinking Ability: Frame Reconstruction and Case Analysis (Paper 67S)</i>            徐恩伟            Enwei XU</p> <p>1435-1445  <u>Track 1: Computational Thinking and Coding Education in K-12</u>  <i>透過Scratch培養學生運算思維之教學實踐 The Teaching Practice of Cultivating Students' Computational Thinking through Scratch (Paper 80S)</i>            楊詠盈, 冼文標            Wing Ying YEUNG, Man Piu SIN</p>

Day 3: 4 June 2021 (Friday)	
Parallel Sessions 1400   1500	1445-1455 <b>Track 2: Computational Thinking and Unplugged Activities in K-12</b> <i>運算思維教育桌遊與圖形化程式設計對初學者學習運算思維之影響</i> <i>The Effects of Computational Thinking Educational Boardgame and Visual Programming on the Novices Learning Computational Thinking (Paper 78S)</i> 楊士弘, 許庭嘉, 陳沐生 Shih-Hung YANG, Ting-Chia HSU, Mu-Sheng CHEN
1500   1545	Invited Talk 3 <i>Learning Redefined; Skills Reinvented; Developing a Learn-Ready Singapore</i> Speaker: Mr Gary Lim (Head of Education, Google Cloud, Southeast Asia) Session Chair: A/P Bimlesh Wadhwa
1545   1615	Teachers Experience Sharing Session Session Chair: Dr Liew Beng Keat  1545-1600 <i>Parsons Problem Implementation – Reducing Cognitive Load to Ease Beginners into Python Programming</i> Speaker: Mr Calvin Heng (Singapore)  1600-1615 <i>Computing Science Curriculum in Thai Primary Schools: An Integrated Story-based Approach</i> Speaker: Mr Mock Panuakdet Suwannat (Thailand)
1615   1630	Break
1630   1730	Panel Discussion <i>Finding the Key to Computational Thinking in Teacher Education</i>  Panelists: Professor Yasemin Gulbahar, Ankara University, Turkey Associate Professor Mikko-Jussi Laakso, Tuku University, Finland Professor Claudia Tenberge, Paderborn University, Germany Professor Valentina Dagiene, Vilnius University, Lithuania Assistant Professor Ibrahim H. Yeter, National Institute of Education, Nanyang Technological University, Singapore Professor Kong Siu Cheung, The Education University of Hong Kong, Hong Kong  Moderator: Associate Professor Bimlesh Wadhwa, National University of Singapore, Singapore
1730   1750	Closing by Conference Chair Speaker: Professor Looi Chee Kit  Announcement of CTE-STEM'2022

# *Keynote and Invited Speeches*

## Keynote Speech

### **Designing for More Learner Agency using Computational Tools in STEM**

**Date: 2 June 2021**

**Time: 0900-1000**

**Venue: Online**



**Speaker: Dr Sherry Hsi**  
*(Principal Scientist, BSCS Science Learning)*

#### ***Abstract***

Computational tools and computational education experiences can be designed in a myriad of ways to support robust learning of STEM disciplinary content, 21st century skills, and important practices that will serve students in school and beyond. Creative uses of computational components stemming from the Maker Movement has generated novel constructionist-oriented materials for learners to use as objects to think and act with. K-12 art classes commonly use low-tech materials like paper, foil, and glue to make projects, however these same materials can be fashioned into activities to learn about the nature of computational systems, scientific phenomena, and key computing concepts. Combining high-tech Internet-of-Thing sensors, programmable microcontrollers, and other emerging computational materials, instructors have design choices for building lessons and selecting curricular activities to support both STEM learning and computational thinking to engage a wider diversity of students' purposes and interests.

In this talk, I invite us to expand our collective imaginations by offering a perspective on design for learning that places value on learners' agency, materiality, and social participation. Drawing from recent projects and research supported by the U.S. National Science Foundation in CSforAll, computational thinking in high school science, youth's computational craft making, and teacher professional learning, I highlight the design possibilities of how all learners can be positioned as creators and producers to recognize the many assets that children bring to learning and valuing the different ways they choose to work with computational tools. I also share some thoughts on how this focus on designing for learner agency has implications for educational equity.

#### ***Speaker Bio***

Dr. Hsi is a Principal Scientist with BSCS Science Learning, a non-profit organization that develops curricular materials, provides professional learning, and conducts research and evaluation in science and technology. For over 20 year, Dr. Hsi has brought her R & D leadership to the creative design and study of STEM learning applications including award winning mobile apps, hands-on exhibits, craft-based STEM

kits, and technology-enhanced curricula in design partnerships with K-12 teachers, science centers, afterschool programs, and museums. From 2002 to 2010, Hsi worked at Exploratorium in San Francisco directing new media research and evaluation to study informal learning mediated by mobile computers, science websites, and STEM digital libraries. From 2010 to 2015 at the University of California Berkeley's Lawrence Hall of Science, Hsi co-created the TechHive Studio, a youth makerspace and STEM project-based leadership innovation program; the Howtosmile.org digital library of curated hands-on activities; and mobile health apps for children's hospitals. Hsi has worked closely with Ann and Mike Eisenberg from the CraftTech Lab at CU Boulder on Paper Mechatronics (papermech.net), a papercraft-based approach to creative engineering education. Most recently with the Concord Consortium's InSPECT project she researched the integration of IoT-enabled sensors and computational thinking with science practices to support student-centered data production in science classrooms. Hsi's design-based research has been published in books and journals with support from the U.S. National Science Foundation, the National Institutes of Health, and private foundations. Hsi reviews for the International Journal of Science Education and has served on the editorial board for the informal learning strand of the Journal of the Learning Sciences.

## Keynote Speech

# The Two Types of Computational Thinking

**Date: 2 June 2021**

**Time: 1400- 1500**

**Venue: Online**



**Speaker: Mr Miles Berry**

*(Principal Lecturer and the Subject Leader for Computing Education at the University of Roehampton)*

### ***Abstract***

Many have used the development of computational thinking as a justification for including computer science in national curricula for all students, and yet there remains some debate about what this means, in both theory and practice. In this talk, Miles explores two contrasting interpretations of computational thinking, and the implications of these for classroom practice.

Turning first to the view that computational thinking is the applications of ideas from computer science to other contexts, Miles shares examples of some of the teaching and assessment resources based on this view. He draws parallels between computational thinking and other discipline specific approaches, such as mathematical reasoning, design thinking and scientific thinking. He investigates the evidence for common approaches to problem solving across STEM disciplines.

Miles goes on to consider a more programming-specific interpretation of computational thinking, in which it is viewed as an approach to automating the solutions to problems. He explores how programmers typically tackle problems and looks at how programming tasks might be used to teach and assess problem solving approaches that sit above the detail of implementation as code in specific languages.

Attempting some synthesis of these two perspectives, Miles concludes by giving examples of how STEM disciplines can offer motivating contexts for programming tasks and how school pupils might apply their programming skills to support their study in mathematics, science and technology subjects.

### ***Speaker Bio***

Miles is principal lecturer in Computing Education at the University of Roehampton. He teaches on the University's secondary computing education teacher training programme and its digital media degree. His research focus is on uptake and achievement in computing education. Prior to joining Roehampton, he spent 18 years in four schools, much of the time as an ICT coordinator and most recently as a head teacher.

He is a board member of England's National Centre for Computing Education, Computing At School, the BCS Academy of Computing and its National Centre for Computing Education. He is a fellow of the BCS, RSA, HEA and Chartered College of Teaching, and a member of the Raspberry Pi Foundation. Over the years he has contributed to a number of computing related projects including the national curriculum computing programmes of study, Switched on Computing, Barefoot Computing, QuickStart Computing, CAS TV, Project Quantum, Hello World and the Royal Society's Mathematical Futures programme.

He gives regular keynotes and CPD workshops on computing and education technology in the UK and abroad and has worked on a number of international consultancy projects involving technology enhanced learning, curriculum development and CPD.



## Keynote Speech

# **Teacher Development in Computational Thinking Education in K12: Design of Pedagogy and Scaling**

**Date: 3 June 2021**

**Time: 0900- 1000**

**Venue: Online**



**Speaker: Professor Kong Siu Cheung**

*(Professor of the Department of Mathematics and Information Technology (MIT); and Director of Centre for Learning, Teaching and Technology (LTTTC), the Education University of Hong Kong)*

### ***Abstract***

Computational thinking education is a growing emphasis in the K12 education sector over the world in the digital era. For an effective implementation of computational thinking education in K12, school teachers play an important role in guiding the young students to access the different entry points for developing competencies related to computational thinking. A quality teacher development is crucial for preparing K12 school teachers to well understand the concepts, master the practices, and develop the perspectives necessary for computational thinking development. This speech will first share a cross-year experience in delivering a well-received and effective teacher development programme on the design of pedagogy for computational thinking education in K12; and then illustrate a follow-up plan for a further cross-year scale-up of teacher development which affords flexibility for teachers in K12 to be ready for the diversity of individual schools on the planning and implementation of computational thinking education. The speaker will talk about the elements of effective teacher development for computational thinking education in K12; introduce the pedagogy of “To Play, To Think, To Code” designed for computational thinking education in K12; share the recent cross-year experience in delivering a teacher development programme on computational thinking education; discuss the success factors and lessons learned for that teacher development programme; and finally share the plan for scaling up the teacher development which features with seven steps to address four dimensions of TPACK specific for computational thinking development through programming education.

### ***Speaker Bio***

Prof. Kong Siu Cheung has produced over 250 academic publications in the areas of pedagogy in the digital classroom and online learning; policy on technology-transformed education and professional development of teachers for learner-centered learning; and computational thinking education. He has completed/conducted 75 research projects since joining the University (the then Hong Kong Institute of

Education). Prof. Kong is at present serving as the Editor-in-Chief of the international journal *Research and Practice in Technology Enhanced Learning (RPTEL)* and *Journal of Computers in Education (JCE)*. He was in the presidential roles for the Asia-Pacific Society for Computers in Education (APSCE) for six years, as the President-Elect in 2012 and 2013, the President in 2014 and 2015, and Past-President in 2016 and 2017. Prof. Kong is the Convener of Computational Thinking Education in Primary and Secondary Schools International Research Network (IRN) under World Educational Research Association (WERA) since May 2019. He also convened the WERA IRN Theory and Practice of Pedagogical Design for Learning in Digital Classrooms from December 2012 to December 2015. Prof. Kong is leading an international project on promoting computational thinking development and coding education for eight years starting from 2016.

## Keynote Speech

### Computational Thinking Through the Lens of a Mathematics Educator

Date: 4 June 2021

Time: 0900- 1000

Venue: Online



**Speaker: Associate Professor Ho Weng Kin**

*(Associate Professor of Mathematics at the National Institute of Education, Nanyang Technological University)*

#### ***Abstract***

This talk examines the integration of Computational Thinking (CT) into school mathematics education. From a mathematics educator perspective, relevant aspects of CT in the teaching and learning of Mathematics would be zoomed into. In particular, we explore the adjunction between Computational Thinking and Mathematical Thinking, and discuss how this interplay of paradigms creates a game-changer for both the Mathematics teacher and learner. We look into the context of the Singapore classroom, and discuss authentic classroom implementation of “Math + C” lessons, pilot studies in schools. We will discuss our research findings of how a secondary school developed a professional learning community for incorporating CT in all their lower secondary Mathematics classes, as well as examine the thinking processes of students as they learn Mathematics with coding. Re-looking and revising the Mathematics curriculum in the direction of CT education would be discussed.

#### ***Speaker Bio***

A/P Ho Weng Kin specializes in programming language semantics, domain theory, and the use of topology in understanding the computational phenomenon. His interests also include the use of technology in teaching and learning mathematics, particularly via coding. Recently his expertise has been drawn upon by the Ministry of Education, Singapore, to promote teachers’ awareness in harnessing Computational Thinking to teach Mathematics.

*Invited Talk*

**Building AI Readiness**

**Date: 3 June 2021    Time: 1400- 1500    Venue: Online**



**Speaker: Mr Anshul Sonak**

*(Senior Director, Intel Corporation, Global AI and Digital Readiness, Global Partnerships & Initiatives Group)*

***Abstract***

The way we live, play, learn, and work has changed drastically with the double disruption of Covid and automation. It is causing nations to re-examine their competitiveness, address the digital skills gap urgently, and build more trust and responsible usages of emerging technologies such as AI to revitalize society. AI is considered as new electricity, an essential technology that cuts across all aspects of human lives. Hence governments worldwide are creating comprehensive national AI strategies to create a sustainable, inclusive, and positive impact on its citizens, industries, and overall societies. However, the AI skill crisis is recognized as the most significant barrier for wider AI adoption. Public awareness and understanding of AI remain low as long as AI-related technical and social skills are limited only to large organizations, technology, or higher education communities. Hence, there is an urgent need to demystify AI and democratize AI through appropriate AI readiness education programs for the current & future workforce and broader citizens. A skilled and competent workforce is the foundation for any nation and industry's growth, enabling the economy to adjust to disruptions. An AI-driven economy will require a new approach to a nation's education system, including ways to empower non-tech audiences with AI social & tech skills for real-world applications. Hence Intel has rolled out a comprehensive AI readiness-focused education program called 'Intel® AI For Youth' in partnership with governments and academia worldwide with the objective of '*empowering youth with AI skills in an inclusive way.*' The session will provide an overview of the program and how STEM educators worldwide can build AI readiness and skill for the next generation.

***Speaker Bio***

Anshul Sonak is a global business strategy and program designer with a focus on digital readiness, future of work -learning -skills and social impact. He is a Public-Private Partnerships creator, thought leadership enabler, reputation enhancer, business development, and market expansion innovator. He excels in the following areas:

Business transformation: He has result-oriented leadership experience in designing public-private partnership programs, enabling business and reputation, policy advocacy, new models for inclusive innovation by bringing in business, technology innovation, and development agendas together for the tech

MNC and ecosystem growth.

Thought leader and respected speaker: He is passionate about technology innovation and changing skills - jobs, youth empowerment, education transformation, reducing inequality. He is recognized as a trusted advisor to governments, civil society, and academia for building new transformational models. He gives keynotes in multiple governments and multi-lateral forums (like of UNDP, UNESCO, UN ESCAP, ADB, USAID etc.). He is the United Nations Development Program (UNDP) Asia's first Youth CoLab Champion. He is a judge in MIT's Inclusive Innovation Challenge.

Stakeholder management through shared value: He has excellent advocacy, communication, and team-building skills, being able to build strong relationships across levels and functions, geographies and culture, to influence decisions and build organizations. He is a respected coach and mentor to many social impact organizations and business leaders.

25 years of global career footprint and leadership journey: He has worked in India, USA, Dubai (UAE), Kuala Lumpur (Malaysia) and now Singapore. He is a board advisor to select social impact organizations across the world in education, skills tech, and social impact sector.

**Invited Talk**

**Intergenerational Learning with AI for Kids (AI4K)®**

**Date: 4 June 2021**

**Time: 1215- 1300**

**Venue: Online**



**Speaker: Mr Koo Sengmeng**

*(Senior Deputy Director, AI Innovation Team, AI.SG)*

***Abstract***

Artificial Intelligence (AI) is arguably one of the most important technology in this decade. Students should acquire basic knowledge and awareness of AI early on so that they understand its implications and how that affect the way they live and work as they grow into adulthood. AI Singapore has developed a programme named AI4K that delivers AI literacy to primary school students aged 10 to 12 years old. We use agile methodology to overcome the shortcomings of traditional curriculum development approach that is inadequate to teach a constantly changing STEM subject like AI. The method produces a curriculum that is adaptive to new developments and able to incorporate ongoing dialogues such as AI ethics. AI4K programme interfaces closely with the ‘AI Educator’ ecosystem and identifies the key role of Parents early on that makes the programme outreach successful and sustainable. The programme was launched in Singapore since June 2019 and achieved significant results within 9 months, and is ongoing.

***Speaker Bio***

Sengmeng loves technology, media and the fusion of both. He has over a decade of experience in the mobile communications and interactive digital media industries, launching first-of-its-kind solutions for the likes of Nokia and Sony Ericsson. He joined the Singapore Public Service in 2012 where his team shaped the billion-dollar Asia-pacific games industry. They also launched the country's first and only mobile experiential platform – Lab on Wheels – demystifying (back-then) frontier technologies like MxR and AI/ML to students and masses. Today Sengmeng is the Deputy Director for AI Singapore, focussing on national talents programmes and AI standards and ethics work with international bodies including ISO/IEC JTC1 SC42, IEEE. He also led alliance partnerships and provided advisory to partners such as Chulalongkorn University. His team also launched Singapore's first national assessment and certification framework for AI Certified Engineers. Sengmeng continues his community contributions with executive appointments in chapters within Singapore Computer Society, where he co-founded the first official augmented/virtual reality special interest group in Singapore. Sengmeng recently co-founded a new AI Professionals Association (AIP) to rally an active community of AI Certified Engineers and AI practitioners to harness the scientific and economic potentials for the betterment of mankind.

### *Invited Talk*

## **Learning Redefined; Skills Reinvented; Developing a Learn-Ready Singapore**

**Date: 4 June 2021**

**Time: 1500- 1545**

**Venue: Online**



**Speaker: Mr Gary Lim**

*(Head of Education, Google Cloud, Southeast Asia)*

### ***Abstract***

Technology is playing an increasing role in everything we do, shaping growth, disrupting industry landscapes and providing the catalyst for transformation. Due to the outbreak of the COVID-19 pandemic, we have all experienced how digital technology allowed for business continuity; how teaching and learning continued on; and how businesses innovated to keep their customers engaged virtually. However, we also need to recognize that it was not smooth sailing for everyone. While technology can and will continue to be the enabler, us as individuals, need to equip ourselves with new skills in order to rebound, and to achieve more in the various roles we each play in our organizations and in society at large. In this session, Gary will share his thoughts about how learning is currently being redefined in our new normal environment, the imperative need for skills to be reinvented and how technology can play an integral role in jobs and skills matching as we look towards a vision of developing a "learn-ready" Singapore.

### ***Speaker Bio***

As the Head of Education for Google Cloud in Southeast Asia, Gary is responsible for helping to transform the government and education agenda in this digital transformation of industries through successful executions of a broad set of initiatives within Singapore and the ASEAN region. He engages with Educators, Government Elites and Policy Leaders as their trusted advisor to ensure all stakeholders are provided with the latest in education technology to enhance learning environments and ensure a steady pool of future-ready individuals. Gary also sits on various advisory boards where he contributes his time and insights with the primary focus on skills development in the infocomm sector. Gary has previously held key appointments in other private sector companies like Microsoft as well as the public sector. Gary is also currently serving as a Strategic Advisor of Inklus, a not-for-profit organization aimed at helping to create an inclusive society for people with disabilities. Gary graduated from the National University of Singapore with a Master's Degree in Computing.

## *Opening Panel Discussion*

Title: Computational Thinking, Digital Literacy and AI Readiness in University Education

Given the importance of Computational Thinking, Digital Literacy and preparing for AI Readiness in our students, a plenary panel discussion will be held for the presidents or their designate of the 6 main universities in Singapore to talk and share about their plans for computational thinking and digital literacy education as part of undergraduate education. The panelists will respond to any or to all of the questions:

- What are your priorities for undergraduate education?
- How do you see the role of CT and digital literacy education in undergraduate education? How do we prepare students to be ready for an AI future?
- Can you share some information on the policies, strategies and implementation of CT education in your university?
- Challenges and opportunities for our university students to learn and develop CT and AI literacies

Panelists:

Professor Bernard Tan Cheng Yian, Senior Vice Provost, National University of Singapore (NUS)

Professor Chua Kee Chaing, Deputy President (Academic) and Provost, Singapore Institute of Technology (SIT)

Professor Venky Shankararaman, Vice Provost (Undergraduate Matters) and Professor of Information Systems (Education), Singapore Management University (SMU)

Professor Cheah Horn Mun, Assistant Provost and Dean (College of Lifelong & Experiential Learning), Singapore University of Social Sciences (SUSS)

Professor Chong Tow Chong, President, Singapore University of Technology and Design (SUTD)

Professor Gan Chee Lip, Associate Provost for Undergraduate Education, Nanyang Technological University (NTU)

Moderator: Professor Christine Goh, NIE Director, Nanyang Technological University (NTU)



## *Closing Panel Discussion*

Title: Finding the Key to Computational Thinking in Teacher Education

Computational Thinking is a crucial, but relatively poorly defined area of competence. On the one hand it has been argued to be central to 21st century citizenship, but, on the other hand the very diffuse nature of current thinking has been identified as problematic. This work focuses on addressing the diffuse nature of CT by proposing a series of modules in which CT can be situated in terms of both level of learner development and application context. This helps to refine the definition of CT and simultaneously provide concrete support and resources of STEAM teaching at all curricula levels, from kindergarten to upper secondary school. Our work provides 10 modules exemplifying CT in contexts familiar to teachers, providing direct support for the integration of CT into international school curricula.

Panelists:

Professor Yasemin Gulbahar, Ankara University, Turkey

Associate Professor Mikko-Jussi Laakso, Tuku University, Finland

Professor Claudia Tenberge, Paderborn University, Germany

Professor Valentina Dagiene, Vilnius University, Lithuania

Assistant Professor Ibrahim H. Yeter, National Institute of Education, Nanyang Technological University, Singapore

Professor Kong Siu Cheung, The Education University of Hong Kong, Hong Kong

Moderator: Associate Professor Bimlesh Wadhwa, National University of Singapore, Singapore

# *Students Forum—Building BloCS*

Theme: Computational Thinking and AI Education

## **Pre-conference Events**

BuildingBloCS would be hosting 12 pre-conference workshops on 22nd May and 29th May- 31st May. The workshops would be split into 3 main tracks (one track per day) namely:

- Programming Languages 101 – 22 May and 29 May
- Making Games (& playing them) – 30 May
- The World of Application Development – 31 May

## **CodeCombat Tournament**

This year, on top of all the workshops, BuildingBloCS would be hosting the National CodeCombat Tournament on 1st June where participants can group into their own teams to battle it out against one another using their wits and skills in the CodeCombat Arenas. Winners of this tournament would be nominated to participate in the International CodeCombat Competition!

## **Conference Events**

### **Keynotes:**

- By Amazon, AI Singapore, Google, ByteDance (& Georgia Tech), DSO (Cybersecurity), Govtech, ClassDo

### **Workshops:**

- “Introduction to Python”
- “Face Recognition with Python”
- “Introduction to Machine Learning”
- “Music with AI”
- “Evolutionary AI”

### **Winpetition:**

- This is an innovation competition in collaboration with AISG. Students will work in teams on given themes to showcase their creative thinking and computational skills. There are theme prizes and even some special awards.

## *Pre-conference Webinars*

### Pre-conference Webinar

#### **Computational Thinking Education Meets Artificial Intelligence**

**Date: 20 February 2021**

**Time: 1030-1145**

**Where: Zoom**



**Speaker: Professor Hal Abelson**

*(Class of 1922 Professor, Electrical Engineering and Computer Science, Massachusetts Institute of Technology)*

#### ***Abstract***

Over the past decade innovations such as social networks, online news and Internet commerce have made information technology omnipresent in daily life for much of the world's population. This has driven the call for K-12 school education to include computational thinking (CT) as an essential topic in preparing students for a world increasingly shaped by information technology. Yet even as educators are assimilating the calls to include computing in K-12, the environment for educational computing is being upended by the global explosion of interest in artificial intelligence. While AI builds on CT foundations, its influence on CT education is transformative. Abstraction and modularity remain key, but algorithmic concepts like sequencing and conditionals become less critical in light of increased emphasis on statistical methods. More fundamentally, progress in AI demands that CT education pay attention to the societal impact of computing. AI practitioners in industry and academia are starting to come to grips with their responsibility for the consequences of their work. Many technology companies have adopted policies around "responsible AI" and university courses in AI increasingly include units on ethical design. That same concern is moving into CT education, and K-12 education is beginning to draw on ideas from ethics and sociology alongside traditional technical disciplines.

### ***Speaker Biography***

Harold (Hal) Abelson is Class of 1922 Professor of Electrical Engineering and Computer Science at MIT and a Fellow of the IEEE. He holds an A.B. degree from Princeton University and a Ph.D. degree in mathematics from MIT. Abelson was recipient in 1992 of the Bose Award (MIT's School of Engineering teaching award), winner of the 1995 Taylor L. Booth Education Award given by IEEE Computer Society and of the 2012 ACM Special Interest Group on Computer Science Education Award for Outstanding Contribution to Computer Science Education, and winner of the 2011 ACM Karl Karlstrom Outstanding Educator Award.

Abelson has played key roles in fostering MIT institutional educational technology initiatives including MIT OpenCourseWare and DSpace. He is a leader in the worldwide movement towards openness and democratization of culture and intellectual resources. He is a founding director of Creative Commons, Public Knowledge and the Free Software Foundation and a former director of the Centre for Democracy and Technology—organisations that are devoted to strengthening the global intellectual commons.

Moderator: Prof Looi Chee Kit (Professor, National Institute of Education, Nanyang Technological University)

Recorded Webinar Link: [https://www.youtube.com/watch?v=jnID\\_yq1EqM](https://www.youtube.com/watch?v=jnID_yq1EqM)

**Pre-conference Webinar**

**Computational Thinking Education in India and Indonesia**

**Date: 23 April 2021**

**Time: 1400-1530**

**Where: Zoom**



**Speaker: Dr Inggriani Liem**

*(Chairperson of Bebras Indonesia NBO)*

***Abstract***

The Bebras Community (<https://bebras.org>) is an international initiative that aims to promote Informatics (Computer Science or Computing) and CT among students of all ages. Indonesia joined Bebras in 2016 as an observer, and in 2017 as a full member. Since 2016, Bebras Indonesia NBO (Bebras NBO) has been running activities related to CT such as organising the annual challenge during Bebras week. Indonesian student participation in the Bebras challenge is small, but has grown from 3,760 students in 2016, to 16,168 students in 2020. Bebras NBO also participates in developing the Indonesian K-12 informatics curriculum, and has obtained a grant from Google to train 22,000 teachers who will reach 2 million students in 22 cities until the end of 2021. The Bebras NBO community comprises 86 universities across Indonesia, collaborating to introduce CT to teachers. Dr Liem will share more about Bebras, what it does and what benefits are brought about from being part of the Bebras Community.

***Speaker Bio***

Dr Inggriani Liem is the current Chairperson of Bebras Indonesia NBO. She is also a faculty and senate member of Institut Teknologi Del, and a member of the National Higher Education Accreditation Board (Indonesia).



**Speaker: Mr Vipul Shah**

***(Head, Education and Skilling, Global Corporate Social Responsibility, Tata Consultancy Services)***

### ***Abstract***

CSPathshala is an Association for Computing Machinery (ACM India) initiative, launched in 2016, to bring a modern computing curriculum, emphasising on problem solving and CT, to Indian schools. To ensure ease of deployment of the curriculum, CSPathshala has created detailed teaching aids. The programme has reached 12,000 teachers and around 300,000 students are learning computing using the CSPathshala curriculum. Additionally, 30,000 government schools are implementing CT as part of the mathematics curriculum. CSPathshala has diverged from the traditional approaches of teaching CT and uses systematic counting, listing and reasoning, iterative patterns and processes, information processing, discrete modelling and following and devising instructions as a theme around which a foundational computing education is imparted, that enables development of problem-solving skills. In this talk, Mr Shah will present this journey along with a glimpse of the CSPathshala curriculum, along with activities carried out by students, and feedback and learnings from schools.

### ***Speaker Bio***

Mr Vipul Shah is presently Head, Education and Skilling, Global Corporate Social Responsibility, at Tata Consultancy Services. He also serves on the Computer Science Teachers Association's International Committee, and initiated and heads the CSPathshala programme.

Moderator: Dr Peter Seow (Research Scientist, Office of Education Research, National Institute of Education, Nanyang Technological University)

Recorded Webinar Link: <https://www.youtube.com/channel/UCUB-MKYZcXk93f-9xRkJbwg/videos>

**Pre-conference Webinar**

**Engaging Students with Computational Thinking—Offline and Online**

**Date: 14 May 2021**

**Time: 1030-1200**

**Where: Zoom**



**Speaker: Professor Tim Bell**

*(Department of Computer Science and Software Engineering, University of Canterbury, Aotearoa, New Zealand)*

***Abstract***

The Computer Science (CS) Unplugged project gives teachers physical activities away from computers—offline—that engage students with ideas in computational thinking. Over the last year we’ve had considerable constraints on what physical activities can be done with students, with many classes needing to be run at a distance, forcing teachers and students online. This has created an opportunity to re-invent CS Unplugged activities so that they work in a variety of constrained situations. In turn, this gives us cause to reflect on what Computational Thinking is about, and in particular, how “unplugged” activities relate to computation. In this talk we will dig down to the fundamental ideas in computation, and look at how they can be brought to life for students, online and offline. This includes looking at the important connection between “unplugged” learning and “plugging it in” through programming.

***Speaker Bio***

Tim Bell is a professor in the Department of Computer Science and Software Engineering at the University of Canterbury, Aotearoa (New Zealand). His main research interest is computer science education. His “Computer Science Unplugged” project, which introduces students and teachers to computer science without using computers, is widely used internationally, and its books and videos have been translated into over 20 languages. In 2018 he received the Association for Computing Machinery’s Special Interest Group on Computer Science Education “Outstanding Contribution to Computer Science Education” award. He has been actively involved in the design and deployment of Digital Technologies as part of the New Zealand curriculum. He is also a qualified musician, and performs regularly on instruments that have black-and-white keyboards.

Moderator: Prof Looi Chee Kit (Professor, National Institute of Education, Nanyang Technological University)

Recorded Webinar Link: <https://www.youtube.com/channel/UCUB-MKYZcXk93f-9xRkJbwg/videos>

## *Post-conference Webinar*

### **What Every Parent Should Know about Computational Thinking and Why Every Student Should Learn Computational Thinking**

**Date: 5 June 2021**

**Time: 1030-1130**

**Where: Zoom**



**Speaker: Professor Leong Hon Wai**

*(School of Computing, National University of Singapore)*

#### ***Abstract***

You probably have heard about the importance of reading, writing and arithmetic (the 3R's), as well as creativity, critical thinking, communication and collaboration (the 4C's) in the 21st century. But do you know that Computational Thinking (and coding) has been added as the 4th-R and the 5th-C? So, what is Computational Thinking (CT) and why should every K-12 student learn CT? And how can CT be taught to young learners?

In this sharing session, we introduce Computational Thinking and talk about the key techniques in Computational Thinking namely decomposition, abstraction, pattern recognition and algorithm development. We will talk about the learning attitudes that CT encourages in students with creating, tinkering, dealing with errors, persevering and collaborating with others and how learning and mastering CT will even help students in other subject matter in school like Math, Science, English, History and even Poetry, Art, Music and Sports!

Finally, we will share what Singapore is doing with CT in K-12 schools as well as the CT initiatives of many other countries.

Note: You do not need any computer background whatsoever. So, come with an open mind, ready to receive new information and maybe even act on them.



### ***Speaker Bio***

Prof. Hon Wai LEONG (梁汉槐) is a "Computational Thinkerer" from the Department of Computer Science, NUS. He received B.Sc. (Hon) in Mathematics from the University Malaya and a Ph.D. in Computer Science from the University of Illinois at Urbana-Champaign (UIUC).

As a teacher, Prof. Leong specializes in finding simple ways to explain complicated subject matters. He loves to integrate computational thinking and mindset-change in his talks and courses. He is passionate about fostering the love for Computing and Mathematics to all, and especially to young students. He gives outreach talks and workshops on CT, creative problem solving, matheMAGIC; he also mentors students' research projects. He founded (in 1992) the Singapore training program for the International Olympiad in Informatics (IOI). Since 2008, he (together with others) initiated coding competition for primary school students in Singapore. In NUS, he is recently involved in teaching broader general education modules: "GEQ1000: Asking Questions" and "GET1031: Computational Thinking".

His research interests are in designing algorithms for all kinds of optimization problems (design of computer circuits, transportation and logistics and computational biology).

URL Homepage: <http://www.comp.nus.edu.sg/~leonghw/>

## *Closing Remarks*

### **CTE-STEM 2021 Conference**

On behalf of the CTE-STEM 2021 organising committee, we express our appreciation to every conference attendee for taking time to participate in our conference. Your participation in many ways will contribute to the advancement in the knowledge and practice in Computational Thinking. This conference would not be possible if not for the contributions of academic paper and poster presenters, session chairs, keynote and invited speakers, reviewers and many who have worked behind the scenes. We thank the National Institute of Education management for their support in hosting the conference even during the challenges of the pandemic. Together, we have made this conference an enriching experience for everyone who are interested in advancing Computational Thinking.

Lastly, I would like to thank all local committee members from various Singapore institutions and organisations such as NIE, NUS, RP, SUTD and MOE for their hard work in making this conference work. This includes committee members in the Teacher and Student Forum sub-committees for their effort organizing the events in their own strand. For many of us, this is the first time we have come together in organizing a conference on a topic that is important to us – Teaching and Learning Computational Thinking. I hope this will be the genesis of a community that would promote Computational Thinking in Singapore with future events and outreach programmes.

Dr Peter Seow

*Local Committee Organising Chair, CTE-STEM 2021*

*National Institute of Education*

*Nanyang Technological University, Singapore*

### **Teachers Forum**

On behalf of the International Teachers Forum, we want to thank all teachers and teaching practitioners for your participation at CTE-STEM 2021. Special thanks to our specially invited teachers from the US, Indonesia, Thailand and Singapore for sharing updates and their experiences on the practice of Computational Thinking (CT) in their respective countries. Thanks as well to all teachers from various countries who have taken time to submit papers that share their innovations, ideas and practices, beside key challenges, with applying CT in various STEM subject matters. The conference would not have been as enriching and beneficial if not for teachers stepping up.

For all participants, we hope you have been inspired and you are taking away with you new ideas or new practices that can be adopted or adapted to enhance the teaching of CT in your respective institutions/schools. We look forward to the next edition of the CTE-STEM conference in 2022 and we hope you will consider paying it forward with your participation as we look to welcome you back again!

Dr Liew Beng Keat

*Teachers Forum Organising Chair, CTE-STEM 2021*

*Republic Polytechnic, Singapore*

## **Acknowledgments**

On behalf of APSCE, NIE and the Conference Organizing Committee, we would like to express our deepest thanks to:

1. The Minister of Education of Singapore, Mr Chan Chun Sing, for being the Guest of Honour, and
2. NTU President, Professor Subra Suresh, for his welcome message
3. NIE Director, Professor Christine Goh, for her support in hosting the conference and moderating the panel discussion
4. Panelists for 1st panel: Professor Bernard Tan Cheng Yian, Professor Chua Kee Chaing, Professor Venky Shankararaman, Professor Cheah Horn Mun, Professor Chong Tow Chong, Professor Gan Chee Lip
5. Panelists for 2nd panel: Professor Yasemin Gulbahar, Associate Professor Mikko-Jussi Laakso, Professor Claudia Tenberge, Professor Valentina Dagiene, Assistant Professor Ibrahim H. Yeter, Professor Kong Siu Cheung
6. Keynote speakers: Dr Sherry Hsi, Mr Miles Berry, Professor Kong Siu Cheung, Associate Professor Ho Weng Kin
7. Invited speakers: Mr Anshul Sonak, Mr Koo Sengmeng, Mr Gary Lim
8. Invited Teachers Forum speakers: Dr Janice Mak, Ms Connieta Theotirta, Mr Calvin Heng, Mr Mock Panuakdet Suwannatat
9. Professor Hal Abelson, Dr Inggriani Liem, Mr Vipul Shah and Professor Tim Bell, our pre-conference webinar speakers
10. Professor Leong Hon Wai, our post-conference webinar speaker
11. Assistant Professor Azilawati Jamaludin, our emcee
12. All members in the International Programme Committee for taking time to help review the submissions received in the conference
13. NTU Events Office, OER Publicity Team, NIE Public, International and Alumni Relations (PIAR) and NIE ACIS Service Management Team



# CTE-STEM

5TH APSCE INTERNATIONAL  
CONFERENCE ON COMPUTATIONAL  
THINKING AND STEM EDUCATION

# 2021

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