

# 卓越 STEM 教育研究与 STEM 教师教育

## 国际理论与实践

### 在线工作坊

2020 年 7 月 21 日-8 月 10 日

新一轮科技革命和产业变革正在蓬勃发展，国际科技竞争日趋激烈，人力资源进入 3.0 时代，科技创新拔尖人才将对社会发展全局产生重大影响。近年来，STEM 教育在我国得到了较快发展，但地区发展不平衡、教育资源配置不均衡的矛盾突出，专业师资仍然缺乏，STEM 教育总体水平与发达国家差距仍然较大。国家的创新与可持续发展需要依托于高质量的科学教育与科学教师教育，借鉴学习以技术谋发展的世界强国在 STEM 教育与 STEM 教师教育中的实践与国际经验，有助于立足我国本土文化、教育实践，寻找新的视野与思路。为此，浙江大学教育学院开展“卓越 STEM 教育研究与 STEM 教师教育的国际理论与实践”工作坊，具体事项如下：

**目标：** 通过协同举办在线工作坊，分享卓越 STEM 教育与 STEM 教师教育的各国实践，拓展参与者的学术视野与国际研究前沿，为卓越 STEM 教师的培养与专业发展提供基础。尝试与海外高校拓展合作机会，在人才培养与科学研究方面等深入交流，为创建“一流”教育学科奠定基础。

**工作坊形式：** 以 ZOOM 视频会议为主，进行在线专家讲座、研讨

以阅读推荐文献为辅，进行线下小组合作学习

**面向对象：**全校对 STEM 教育感兴趣的本科、硕士和博士研究生，不限专业

**人数限制：**人数上限 50 人

**内容和时间：**详见本项目说明中的具体安排

**考勤要求：**参与项目的学生需按时参加线上研讨，出勤率不低于 80%

**考核要求：**项目结束后，参与项目的学生须提交一份文字总结（字数不少于 1000 字）和项目参与期间的照片 2-3 张

**In the Search of Excellence in STEM Education**  
**Research and STEM Teacher Education**

**Online Workshops**

July 21<sup>st</sup> to August 10<sup>th</sup>, 2020

**School of Education, Zhejiang University**



**يونيسرسي تي بروني دارالسلام**  
**UNIVERSITI BRUNEI DARUSSALAM**

Webinar 1:

## **Athena Swan and the implications of gendered differences in chemistry**

**Dr. Kate Hoskins**

Reader in Education

College of Business, Arts and Social Sciences, Brunel University

Time: 16:00 (09:00 London), July 21<sup>st</sup>, 2020

**Symposium:** In this lecture, I present findings from a case study, informed by semi-structured interviews with 11 chemistry students and eight of their lecturers, at a best practice, high performing chemistry department in an English University to explore the distinct gender differences in student aspirations and achievement and the resultant inequalities. I begin by acknowledging the gender equality progress made in the case study department, highlighting the institutional policies recently implemented as part of the Athena Swan award, including, for example, shared parental maternity/paternity leave. However, the data reveals that, even in a high performing department with extensive institutional support, chemistry is not woman friendly and remains a subject overwhelmingly studied by privileged men. Indeed, as one lecturer noted what needs to change are the wider cultures surrounding being a female academic working in chemistry. At conferences, she still regularly observes male colleagues 'boasting in the bar about how many hours they've been working and how many papers they've been writing, and how many grants they've done, and how many conferences they've been to', a factor that puts off many female undergraduates from a career in chemistry within the academy and industry.

### **About the speaker**



Dr. Kate Hoskins is Co-Chair and Treasurer for Gender and Education Association and she is the Reader in Education at Brunel University. Kate is also a member of the editorial board of the *Journal of Education Policy* (IF=3.048). Her research focuses on education policy, identity and inequalities in relation to further and higher education opportunities and experiences. One of her recent research projects explored social mobility within academy schools to understand the likely success of these schools in improving student mobility. Her current funded research project draws on life history interviewing to explore Early Years Educators construction and enactment of their professional identities, with a particular focus on the impact of localism on their higher education pathways.

Webinar 2:

**TBC**

Dr. Aurelio Vilbar

Professor, University of the Philippines Cebu, Lahug, Cebu City, Philippines  
National Director, Philippine Association for Language Teaching

Time: TBC, 22<sup>nd</sup> July, 2020

Webinar 3:

## **Beliefs & Self-Efficacy: How do they help us understand teachers' pedagogical practice?**

**Dr. Melissa Glackin**

Senior Lecturer in Science Education

School of Education, Communication and Society, King's College London

**Time: 16:00 (09:00 London), July 23<sup>rd</sup>, 2020**

**Symposium:** In the lecture, I would consider why some teachers choose to teach outside whilst others do not by exploring the micro influences on their pedagogical practice. In doing so, I would focus on the concepts of beliefs and self-efficacy and introduce some instruments and methods that might be useful when studying teachers' decision making. I would then consider what the implications are for teacher educators and researchers.

### **About the speaker**



Dr. Melissa Glackin is a senior lecturer at the School of Education, Communication and Society, King's College London. Before joining King's College London Melissa's previous posts included secondary science teacher in inner London and project officer for London Outdoor Science (Field Studies Council) where she wrote several outdoor curriculums. She is a trustee at the London Wildlife Trust (2017- ) and is an invited fellow of the National Association of Environmental Education (NAEE) and London Environmental Education Forum (LEEF). Melissa is interested in why teachers teach what they do, and how they do, within the fields of science education and environmental education particularly related to out-of-classroom teaching. To understand teaching behaviour her research has drawn on concepts such as teacher's beliefs and teacher self-efficacy and she has used ideas around power as theorised by Foucault and Bernstein. Melissa's research is often situated within professional development contexts or in secondary school formal education contexts - in and outside school. Her current research seeks to understand the current state of environmental education in secondary schools in England and in Japan. This research has been funded by awards from the British Academy/Leverhulme and the Japanese Promotion of Science.

Webinar 4:

## **Boundary interaction: Towards developing a mobile technology-enabled science curriculum to integrate learning in the informal spaces**

**Dr. Daner Sun**

Assistant Professor in Learning Sciences

Department of Mathematics and Information Technology, The Educational University of Hongkong

Time: 09:30 (09:30 Hongkong), July 24<sup>th</sup>, 2020

**Symopsis:** This paper explores the crossover between formal learning and learning in informal spaces supported by mobile technology, and proposes design principles for educators to carry out a science curriculum, namely Boundary Activity-based Science Curriculum (BAbSC). The conceptualization of the boundary object, and the principles of boundary activity as the key elements to fuse the merits of learning in informal spaces with formal learning, are discussed and elaborated. The key elements of BAbSC are further articulated to provide the framework for curriculum design and development from a holistic perspective. The proposed principles and framework will reinforce the theoretical underpinnings of mobile technology-enabled curriculum design and development, and can be used to guide teachers to implement curriculum in a more principle-based and structured manner.

### **About the speaker**



Dr. Daner Sun is an assistant professor at the Department of Mathematics and Information Technology, The Educational University of Hongkong. Her research interests include ICT-supported curriculum development, ICT-facilitated science/STEM learning, mobile learning and teacher professional development. She has developed strong academic proficiency in the interdisciplinary research. Before joining The Educational University of Hongkong, Daner worked as a research fellow at the National Institute of Education, Nanyang Technological University in Singapore. She has published a number of research articles in top academic journals, such as *British Journal of Educational Technology*, *Research in Science & Technological Education*, *Research in Science Education*, *Journal of Science Education and Technology*.

Webinar 5:

**TBC**

Dr. Tan Poh Hiang

Time: 09:30 (09:30 Hongkong), July 27<sup>th</sup>, 2020



Webinar 6:

## **Integrated STEM education: Challenges and promises**

Dr. Tan Aik-Ling

Associate Professor in Science Education

National Institute of Education, Nanyang Technological University

**Time: 10:00 (10:00 Singapore), July 28<sup>th</sup>, 2020**

**Synopsis:** In this talk, I will discuss the design of integrated STEM activities with science as the lead discipline. Using the STEM Quartet instructional framework, we position complex, persistent and extended problems at the core of these activities. We discuss the challenges such as students' uncertainty and lack of confidence in designing solutions.

### **About the speaker**



Prior to teaching at NIE in 2007, Dr. Aik-Ling Tan taught Biology and Lower Secondary General Science at River Valley High School for 10 years. She was the subject head in charge of Media Resource Library, and later of Thinking and Project Work. She worked in developing young scientists interested in science projects. Aik Ling spent two years at (2005-2006) CRPP, working on research projects, including one that deals with

Science Practical Assessment and another one which examines the infusion of nature of science and ethics of science into the science curriculum. Her current research interests deals with students' perspectives and ideas about science as inquiry and how they construct their learning experiences through co-generative dialogues with their teachers. The students' science learning experiences are studied through their classroom interactions, their ideas articulated at co-generative dialogue sessions, and their performance during term assessment.

Webinar 7:

## **The impact of science education research on schools and teachers**

Dr. Justin Dillon

Professor in Science and Environmental Education  
Graduate School of Education, University of Exeter

Time: 15:00 (08:00 London), July 30<sup>th</sup>, 2020

### **About the speaker**



Dr. Justin Dillon is the professor of science and environmental education in the Graduate School of Education, University of Exeter. He joined Exeter in January 2018 after spending three years at the University of Bristol as Head of the Graduate School of Education. After taking a degree in chemistry, he was trained as a teacher and taught in six London schools before joining King's College London in 1989 as a teacher educator and researcher. During his 26 years there he involved in a number of research and development projects working with schools, museums, science centres, aquariums and botanic gardens. Prof. Dillon was President of the European Association for Research in Science Education from 2007-11 and is currently President of the National Association for Environmental Education and a trustee of the Council for Learning Outside the Classroom. He co-edited the first ever International Handbook on Research in Environmental Education.

Webinar 8:

## **The value of outdoor and environmental education**

Dr. Justin Dillon

Professor in Science and Environmental Education  
Graduate School of Education, University of Exeter

Time: 15:00 (08:00 London), July 30<sup>th</sup>, 2020

### **About the speaker**



Dr. Justin Dillon is the professor of science and environmental education in the Graduate School of Education, University of Exeter. He joined Exeter in January 2018 after spending three years at the University of Bristol as Head of the Graduate School of Education. After taking a degree in chemistry, he was trained as a teacher and taught in six London schools before joining King's College London in 1989 as a teacher educator and researcher. During his 26 years there he involved in a number of research and development projects working with schools, museums, science centres, aquariums and botanic gardens. Prof. Dillon was President of the European Association for Research in Science Education from 2007-11 and is currently President of the National Association for Environmental Education and a trustee of the Council for Learning Outside the Classroom. He co-edited the first ever International Handbook on Research in Environmental Education.

## Webinar 9:

**TBC**

### Dr. Juraidah Musa

Lecturer in ICT Assisted Learning

Sultan Hassanal Bolkiah Institute of Education, Universiti Brunei Darussalam

Time: TBC, Aug 4<sup>th</sup>, 2020

### About the speaker



Dr. Juraidah Musa is a lecturer at Sultan Hassanal Bolkiah Institute of Education, Universiti Brunei Darussalam where she has been a faculty member since 2007. She is currently holding the position of acting Dean of the institute. She was the former Deputy Director of Studies for the office of AVC (Academics Affairs) and the head of teaching and learning centre (TLC) at the Universiti. She obtained her degree in education at Universiti Brunei Darussalam, and University of Leeds for her Master of Education in the field of educational technology. Juraidah completed her PhD at Kings College London with a thesis on investigating how playing digital games on the portable technologies enhance the digital literacy skills of young people aged between 10 to 12 years old. She teaches modules related to the area of technology in education such as Teacher Pedagogy and Content Knowledge (TPACK), Digital Innovation and Learning, and Instructional design for technology integration in school. She has supervised masters and PhD students, mostly in the area of the application of digital technology in education.

## Webinar 10:

# Plant Blindness and Plant Science Communication

## Dr. Dawn Sanders

Associate Professor in Environmental Education

Department of Pedagogical, Curricular and Professional Studies, University of Gothenburg

Time: TBC, Aug 5<sup>th</sup>, 2020

**Symposium:** Contemporary humans have become an urban species. Living in megalopolitan cities reduces intimate contact with the natural world thus placing greater emphasis on 'presented nature' settings, such as zoos, botanic gardens and natural history museums. However, previous research has demonstrated that 'plant blindness' inhibits human perceptions of plants. In view of increasing species extinction the world can no longer afford our citizens to see 'nothing' when they look at plants, the basis of most life on earth. We believe conducting research to understand how we can move beyond 'plant blindness' is imperative for a sustainable world. According to Swedish policy documents for education, students should be provided with knowledge about nature, the environment and sustainable development. It is therefore of interest to develop teacher education in this respect. The aim with our study is to investigate learning experiences that move beyond 'plant blindness'. We will examine our proposed hypothesis if multimodal and sensoric experiences in 'presented nature environments' might create shifts in perception away from 'plant blindness' towards seeing the importance of plants for a sustainable world. The study will focus on teacher students and comprise a variety of ways to capture the students' perceptions of plants.

## About the speaker



Dr. Dawn Sanders is an associate professor at the Department of Pedagogical, Curricular and Professional Studies, University of Gothenburg. She is also an experienced botanical educator and researcher currently based at Gothenburg University, Sweden. She also teaches on the postgraduate seminar programme at the Natural History Museum, London, UK. Dawn trained as an artist before completing her botanical education and draws on art and science as sources of information and practice. She believes outdoor environments can inspire humans of any age and is passionate about making a difference to learning with, and about, plants-the basis of most life on Earth. Now, Dawn is the editor of the journal of *Plants, People, Planet*.

Webinar 11:

**TBC**

**Dr. Chanyah Dahsah**

Assistant Professor in Science Education  
Faculty of Science, Srinakharinwirot University

Time: TBC, Aug 6<sup>th</sup>, 2020

### **About the speaker**



Dr. Chanyah Dahsah is an assistant professor of Science Education and Director of Science Education Center at the Faculty of Science, Srinakharinwirot University, in Bangkok, Thailand. She received a PhD in science education from Kasetsart University, Thailand in collaboration with the University of Waikato, New Zealand in 2007. In 2013 - 2015, she worked as a researcher for the CREATE for STEM Institute at Michigan State University in the US for the NGSS Collaborative Assessment Project, and Interaction Project. Her research interests include K-12 STEM, science learning and assessment, and professional development for in-service science and STEM teachers. Her current projects aim to train kindergarten teachers how to create STEM learning activities and to train primary and secondary school teachers on STEM2 curriculum development.

Webinar 12:

**TBC**

Dr. Lay Hoon Seah

Senior Research Scientist in Science Education

Office of Education Research, National Institute of Education, Nanyang  
Technological University

Time: TBC, Aug 7<sup>th</sup>, 2020

Webinar 13:

## **Students' use of observation in geology: Towards 'scientific observation' in rock classification**

Dr. Kari Remmen

Associate Professor in Geoscience Education

Faculty of Educational Sciences, University of Oslo

Time: TBC, Aug 10<sup>th</sup>, 2020

**Symposium:** Students struggle with observing scientifically and connecting observations to scientific theory. This study investigates how students actually use observation in rock classification – a classical practical task in science education. To describe the level of students' use of observation, data was collected by videotaping 19 small student groups (55 students aged 16–18) in Norway while they were classifying rocks. A modified version of the observation framework is used to analyse how students' notice features of rocks (noticing) and interpret the geological processes forming those features (expectations) at different levels: everyday, transitional or scientific. The findings showed that none of the student groups used everyday observation. Three student groups used observation at a transitional level, whereas twelve groups performed observation that can be described as transitional/scientific level. Four student groups used scientific observation. Based on the findings, an observation framework for rock classification is proposed. The challenges encountered by the students are discussed, thus providing ideas for how teachers can support students to use scientific observation in rock classification.

### **About the speaker**



Dr. Kari Remmen is an associate professor at the Department of Teacher Education and School Research, Faculty of Educational Sciences, University of Oslo. Her research focuses on geoscience education at the Norwegian Centre for Science Education, Norway. This involves developing teaching materials, teacher professional development courses, and research. She also works for the Education Authority in Oslo to develop a collaborative partnership between two upper secondary schools and the University of Oslo. Kari's research findings were published in top academic journals, including *International Journal of Science Education*, *Science Education*, *International Research in Geographical and Environmental Education*, *Journal of Geoscience Education*, and *Nordic Studies in Science Education*.



## Recommended Readings

### Webinar 1

Hoskins, K. and Barker, B. (2020). *STEM, Social Mobility and Equality: Avenues for Widening Access*. Hampshire: Palgrave MacMillan. ISSN 13: 978-3-030-49216-8

### Webinar 2

TBC

### Webinar 3

Glackin, M., & Hohenstein, J. (2018). Teachers' self-efficacy: progressing qualitative analysis. *International Journal of Research and Method in Education*, 41(3), 271-290.

Glackin, M. (2019). 'It's more than a prop': Professional development session strategies as sources of teachers' self-efficacy and motivation to teach outside the classroom. *Professional Development in Education*, 45(3), 372-389.

Lock, R., & Glackin, M. (2009). Teaching out-of-classroom science: implications from the initial teacher training experience. *School Science Review*, 90(333), 111 - 118.

### Webinar 4

Sun, D. and Looi, C. (2018). Boundary interaction in the blended learning space. *Journal of Educational Technology*, 49(3), 505-515.

Sun, D. & Looi, C-K. (2019). An Inspiration from Border Crossing: Principle of Boundary Activity for Integrating Learning in the Formal and Informal Spaces. In: Looi CK., Wong LH., Glahn C., Cai S. (eds) *Seamless Learning. Lecture Notes in Educational Technology*. Singapore: Springer, Singapore.

### Webinar 5

TBC

### Webinar 6

Kelley, T.R., Knowles, J.G. (2016). A conceptual framework for integrated STEM education. *International Journal of STEM Education* 3:11, <https://doi.org/10.1186/s40594-016-0046-z>

Margot, K.C., Kettler, T. (2019). Teachers' perception of STEM integration and education: a systematic literature review. *International Journal of STEM Education* 6:2. <https://doi.org/10.1186/s40594-018-0151-2>

### Webinar 7

TBC

### Webinar 8

Dillon, J., Rickinson, M, Teamey, K., Choi, M.Y., & Benefield, P. (2006). The value of outdoor learning: evidence from research in the UK and elsewhere. *School Science Review*, 87, 107-111.

### **Webinar 9**

TBC

### **Webinar 10**

Nyberg, E., Hipkiss, A. M., & Sanders, D. (2019). Plants to the fore: Noticing plants in designed environments. *Plants, People, Planet*, 1(3), 212-220.

Sanders, D. L. (2019). Standing in the shadows of plants. *Plants, People, Planet*, 1(3), 130-138.

Nyberg, E., Brkovic, I., & Sanders, D. (2020). Beauty, memories and symbolic meaning: Swedish student teachers' views of their favourite plant and animal. *Journal of Biological Education*, DOI: [10.1080/00219266.2019.1643761](https://doi.org/10.1080/00219266.2019.1643761)

### **Webinar 11**

TBC

### **Webinar 12**

TBC

### **Webinar 13**

Remmen, K. & Frøyland, M. (2020). Students' use of observation in geology: towards 'scientific observation' in rock classification, *International Journal of Science Education*, 42:1, 113-13