



ESERA¹⁹ EUROPEAN
SCIENCE
EDUCATION
RESEARCH
ASSOCIATION

13TH CONFERENCE | 26TH-30TH AUGUST 2019
PALAZZO DEI CONGRESSI - BOLOGNA, ITALY





WELCOME TO THE ESERA 2019 BOLOGNA CONFERENCE

Dear Colleagues,

We are delighted to welcome you to the 2019 ESERA conference in Bologna, Italy, August 26-30, 2019.

It is a great honor for us to hold the most important conference on science education that we have in Europe. The first and last time that ESERA was organised in Italy was more than twenty years ago, in 1997, in Rome.

The theme we have chosen for this edition is "The beauty and pleasure of understanding: engaging with contemporary challenges through science education."

We chose this theme for several reasons. The first is that Bologna is considered one of the most beautiful universities in the world due to its historical buildings. We hope that the beauty of the surroundings will inspire our research and create a pleasant context for the discussions during the conference. The second reason is that we think that beauty can be engine of transformation, change and authentic engagement in an increasingly complex world.

Climate change, multiculturalism, the flourishing of new interdisciplinary disciplines (like cognitive neuroscience, artificial intelligence, digital humanities), and the problematic nature of socio-scientific issues in a digital and post-truth era are just a few examples of the contemporary challenges that we will discuss during the conference. As science educators, we believe that understanding is the preferred way to address these challenges, but we also think that they are so deep and novel that they necessitate collectively searching for new narratives, languages and forms of beauty.

For all these reasons, we hope the theme can be intellectually stimulating, contributing to the creation of an overarching layer of reflection and infusing our discussions with a visionary spirit, projected into the future.

Inspired by the conference theme, we have selected four plenary presentations and a panel. Following the custom of previous years, the additional parallel sessions will include symposia, oral presentations, interactive poster sessions and workshops, organised according to the eighteen strands that characterise the richness of the research in the ESERA community.

Together with the Scientific and the Local Organising Committee, we are looking forward to seeing you in Bologna. We are working to create the conditions for a thoughtful and inspirational scientific environment, enriched by social events that will allow you to discover the magical atmosphere of the historical centre of Bologna.

Enjoy the conference!



Olivia Levrini
ESERA 2019
Conference President



Giulia Tasquier
ESERA 2019
Conference Manager





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General Conference Information

CONFERENCE VENUE

The ESERA 2019 Conference will take place at "Bologna Congressi" from 26 to 30 August 2019. Conference sessions will take place in the "Palazzo dei Congressi", at Piazza della Costituzione 4, Bologna.

BUILDINGS

There are three buildings used during the conference:

- Centro Congressi
- Sala Maggiore
- Centro Servizi Fiera di Bologna

Getting to and from the Conference Venue "Bologna Congressi"

BUSES

For the Esera meeting the conference organisation has duplicated the bus runs during the following hours, from 08.00 to 9.30 and from 17.00 to 19.00.

Bologna Centre and Bologna Central train Station are just 15 minutes away from Palazzo dei Congressi and they are connected by bus lines from the Centre (San Pietro bus-stop) or Stazione Centrale to the entrances of Piazza Costituzione and Viale Aldo Moro. Remember to visit the link on the conference website and check the August schedule of buses.

BUS LINES TO/FROM the Conference Venue

BUS N 28

To PALAZZO DEI CONGRESSI:
Departure from Via Indipendenza n. 7 (SAN PIETRO bus-stop)
every 7 minutes
From PALAZZO DEI CONGRESSI:
(FIERA PALAZZO DEI CONGRESSI bus stop) bus going to STAZIONE CENTRALE

BUS N 35

To PALAZZO DEI CONGRESSI:
STAZIONE CENTRALE Bus-stop, Viale Pietramellara on the side of the station
every 10 minutes
From PALAZZO DEI CONGRESSI:
FIERA PALAZZO DEI CONGRESSI bus stop,
bus going to STAZIONE CENTRALE

BUS N 38

To PALAZZO DEI CONGRESSI:
STAZIONE CENTRALE Bus-stop,
Viale Pietramellara on the side of the station
every 30 minutes
From PALAZZO DEI CONGRESSI:
FIERA A. MORO bus stop

TAXI:

COTABO: 051.372727

CAT: 051.4590

Please Note: The taxi rank is under a white gazebo just outside the Congress entrance in Piazza Costituzione.

VENUE CAR PARKING

If you will reach the conference venue by car and require parking during the event, it's possible to park in "Piazza della Costituzione" Parking.

For information:

<http://www.bfparking.it/index.php?lang=en>

WIFI

Wireless Internet access is freely available throughout Wifi; **esera**

Password: **esera2019**

REGISTRATION AND INFORMATION DESK

The registration desk is located on the ground floor of "Sala Maggiore".

All attendees must be registered and are required to wear their official conference badge at all times.

Pre-purchased Conference Dinner tickets will be given at the same time as the conference badge.

Care should be taken with these tickets as replacements cannot be issued.

Registration Desk Opening Times:

08.00 – 19.00 Monday 26 August

08.00 – 19.00 Tuesday 27 August

08.30 – 17.00 Wednesday 28 August

08.30 – 18.00 Thursday 29 August

08.30 – 14.00 Friday 30 August

CATERING

Lunch and Coffee breaks will take place in the Lunch Area placed in the First Floor of Sala Maggiore building.

BAR AND RESTAURANT

There is a bar in Centro Congressi, serving light food and beverages throughout the day (not open in the evenings) and a Bar in the Centro Servizi area.

TOURS

Tours are available to purchase from the Bologna Welcome desk and on the link on the website



Social Events

WELCOME RECEPTION

- Date: 26 August 2017
- Location: Palazzo dei Congressi - Piazza della Costituzione, 4, 40128 Bologna
- Time: 18.30 – 21.00
- Dress Code: Smart/Casual

The Welcome Reception will be held on Monday in the Palazzo dei Congressi from 18,30 -21,00. All delegates are invited to attend the conference Welcome Reception. A cocktail with snacks will be served. During the reception the juggling show - Dreamy physics – by Federico Benuzzi will be performed.

ECR RECEPTION

- Date: 27 August 2017
- Location: Palazzo Isolani - Via Santo Stefano, 16, 40125 Bologna
- Time: 19:30
- Dress Code: Casual

The ECR Reception will be held at Palazzo Isolani on Tuesday from 19.30. This reception is in honour of the Early Career Researchers and their supervisors to encourage informal communication about career options and future development. The ESERA Board and the Local Organising Committee extend an invitation to all delegates to this reception but booking must have been done at the time of registration. Light food and drinks will be served.

DINNER AT PALAZZO RE ENZO

- Date: 29 August 2019
- Location: Palazzo Re Enzo - Piazza del Nettuno, 1/C, 40125 Bologna
- Time: 20:00 – 23:30
- Ticket Price: € 60.50 vat included
- Dress Code: Casual/cocktail (after five)

Delegates can purchase tickets to attend the Dinner at Palazzo Re Enzo. A limited number of tickets are still available to purchase from the conference registration desk until 11.30 am on Tuesday, 27 August.

Organisation of the Conference

STEERING COMMITTEE

Olivia Levrini (Conference President), Department of Physics and Astronomy, Alma Mater Studiorum – University of Bologna
 Giulia Tasquier (Conference Manager), Department of Physics and Astronomy, Alma Mater Studiorum – University of Bologna
 Elena Consolini, Professional Unit Support and Coordination of the Activity and Internationalization Strategies, Alma Mater Studiorum – University of Bologna
 Antonello Piombo, Department of Physics and Astronomy, Alma Mater Studiorum – University of Bologna

LOCAL ORGANISING COMMITTEE

UNIVERSITY PERSONNEL:

Eleonora Barelli, Department of Physics and Astronomy, Alma Mater Studiorum – University of Bologna
 Laura Branchetti, Department of Mathematical, Physical and Computer sciences – University of Parma
 Alessia Cattabriga, Department of Mathematics, Alma Mater Studiorum – University of Bologna
 Michael Lodi, Department of Computer Science and Engineering, Alma Mater Studiorum – University of Bologna
 Barbara Pecori, Department of Physics and Astronomy, Alma Mater Studiorum – University of Bologna
 Giovanni Ravaioli, Department of Physics and Astronomy, Alma Mater Studiorum – University of Bologna
 Sara Satanassi, Department of Physics and Astronomy, Alma Mater Studiorum – University of Bologna
 Niccolò Vernazza, Department of Physics and Astronomy, Alma Mater Studiorum – University of Bologna

ADMINISTRATIVE SUPPORT:

Maria Giovanna Piazza, Department of Physics and Astronomy, Alma Mater Studiorum – University of Bologna
 Luana Izzo, Department of Physics and Astronomy, Alma Mater Studiorum – University of Bologna
 International Scientific Committee

INTERNATIONAL SCIENTIFIC COMMITTEE

Olivia Levrini, Department of Physics and Astronomy, Alma Mater Studiorum – University of Bologna
 Giulia Tasquier, Department of Physics and Astronomy, Alma Mater Studiorum – University of Bologna
 Tamer Amin, Department of Education, American University of Beirut
 Laura Branchetti, Department of Mathematical, Physical and Computer sciences – University of Parma
 Mariana Levin, Department of Mathematics, Western Michigan University

The main responsibility for the review process and the scientific programme of the ESERA 2019 conference rests with an international committee of experienced science education researchers. This committee, besides the members listed above, comprises of the members of the ESERA Executive Board and the Strand Chairs.

ESERA EXECUTIVE BOARD

Constantinos Constantinou (President), University of Cyprus
 Marianne Achiam (Member), University of Copenhagen
 Sibel Erduran (Member), University of Oxford
 Mariona Espinet (Member), Autonomous University of Barcelona
 Bob Evans (Member), University of Copenhagen
 Ellen Henriksen (Secretary), University of Oslo
 Olivia Levrini (Co-opted member – Conference 2019), University of Bologna
 Gjalt Prins (Treasurer), University of Utrecht
 Dimitris Stavrou (Co-opted member – Summerschool 2019), University of Crete

PROFESSIONAL CONFERENCE ORGANIZER (PCO): EGA WORLDWIDE

Claudia M. Golinelli (Supervisor)
 Carla Bugli (Project Manager)
 Ariella Neustadt (Software Service manager)
 Claudia D'Angiolo (Registration manager)



Esera Research Strands

STRAND			CHAIRS
1	Learning Science: Conceptual Understanding	Theories, models, and empirical results on conceptual understanding, conceptual change and development of competences; methodology for investigating students' processes of concept formation and concept use; strategies to promote conceptual development.	<i>Strand Chairs: Odilla Finlayson & Anna De Ambrosis</i>
2	Learning Science: Cognitive, Affective, and Social Aspects	Cognitive, affective, and social dimensions in learning science. Design of in-school and extra school learning environments and study of teaching/learning processes. Representational languages and knowledge organisation. Collaborative construction of knowledge.	<i>Strand Chairs: Florence Le Hebel, Graca Carvalho & Vanessa Kind</i>
3	Science Teaching Processes	Relations between teaching practices and students' cognitive and affective development, design of teaching interventions. Research based intervention and its role for curriculum planning, instructional paths and learning outcomes. Laboratory-based practice. Video studies in science education.	<i>Strand Chairs: Sabine Fechner & Roald Verhoeff</i>
4	Digital Resources for Science Teaching and Learning	Design, evaluation and characterization of resources and environments for teaching/learning science: ICT and TEL in science education. Online learning environments, simulation and modelling tools, virtual laboratories. Self-regulation, reflection and collaboration in digital learning environments.	<i>Strand Chairs: Jasper Haglund & Jesper Bruun</i>
5	Teaching-Learning Sequences as Innovations for Science Teaching and Learning	Design of teaching and learning materials. Classroom implementation, refinement and evaluation of teaching sequences. Exchange and adaptation of teaching-learning sequences. Adoption and transformation of teaching materials. Factors that influence teacher ownership.	<i>Strand Chairs: Italo Testa & Nikos Papadouris</i>
6	Nature of Science: History, Philosophy and Sociology of Science	The implications of nature of science, its history, philosophy, sociology and epistemology, for science education. The significance of models and modelling for science education as reflected in the particular importance attached to the use of metaphors, analogy, visualization, simulations and animations in science.	<i>Strand Chairs: Ebru Kaya & Veli-Matti Vesterinen</i>
7	Discourse and Argumentation in Science Education	Understanding, supporting and promoting use of evidence and argumentation discourse in science education. Scientific practices related to knowledge evaluation and communication. Supporting the development of critical thinking. Discourse analysis. Talking and writing science in the classroom. Meaning making in science classrooms.	<i>Strand Chairs: Maria Andrée & Kalypso Iordanou</i>

Esera Research Strands

STRAND			CHAIRS
8	Scientific Literacy and Socio-scientific Issues	Teaching about scientific literacy, science and citizenship education, science and media education, information literacy, informal reasoning and critical thinking, decision making, debates on socio-scientific issues (SSI), discourse communities, social dimension of science and techno-scientific practices, public engagement in science, schools', students' and teachers' engagement in socio-scientific issues.	<i>Strand Chairs: Antti Laherto & Eliza Rybska</i>
9	Environmental, Health and Outdoor Science Education	Ecological and Environmental Education, Education for Sustainable Development, environmental health, health education and health promotion. Lifestyles and attitudes towards health and the environment. Developing and evaluating the impact of programmes and experiences outside classrooms, including those organized by institutions other than schools.	<i>Strand Chairs: Albert Zeyer & Justin Dillon</i>
10	Science Curriculum and Educational Policy	Curriculum development. Reform implementation, dissemination and evaluation. International comparison studies such as TIMSS and PISA. Evaluation of schools and institutions. Policy and Practice issues: local, regional, national, or international issues of policy related to science education.	<i>Strand Chairs: Jim Ryder & Andreas Redfors</i>
11	Evaluation and Assessment of Student Learning and Development	Development, validation and use of standardized tests, achievement tests, high stakes tests, and instruments for measuring attitudes, interests, beliefs, self-efficacy, science process skills, conceptual understandings, etc.; authentic assessment, formative assessment, summative assessment; approaches to assessment. Monitoring student learning and implications for teaching.	<i>Strand Chairs: Mathias Ropohl & Lukas Rokos</i>
12	Cultural, Social and Gender Issues in Science and Technology Education	Equity and diversity issues: Sociocultural, multicultural, bilingual, racial/ethnic, gender equity studies and science education for the special needs.	<i>Strand Chairs: Lucy Avramidou & Marisa Hernandez</i>



Esera Research Strands

STRAND			CHAIRS
13	Pre-service Science Teacher Education	Professional knowledge of teachers, pre-service teacher preparation, instructional methods in pre-service teacher education, programs and policy, field experience, relation of theory with practice, and issues related to pre-service teacher education reform.	<i>Strand Chairs: Maria Evagorou & María Ruth Jimenez Liso</i>
14	In-service Science Teacher Education, Continued Professional Development	In-service science teacher education, teachers as lifelong learners; methods, innovation and reform in professional development; evaluation of professional development practices, reflective practice, teachers as researchers, and action research.	<i>Strand Chairs: Manuela Welzel- Breuer & Claudio Fazio</i>
15	Early Years Science Education	Emergent science, science pedagogy and learning in the early years, cognitive resources for science learning, early years science and technology curriculum, innovative teaching practices in the early years, children's learning, preschool science, early years teacher education in science.	<i>Strand Chairs: Christina Siry & Bodil Sundberg</i>
16	Science in the Primary School	Procedural skills in science, science investigations, science teaching and learning sequences.	<i>Strand Chairs: Federico Corni & Anna Spyrtou</i>
17	Science Teaching at the University Level	University pedagogy. Teaching and learning at the university level.	<i>Strand Chairs: Jenaro Guisasola & Paula Heron</i>
18	Methodological Issues in Science Education Research	Aspects of epistemology, ontology and axiology.	<i>Strand Chairs: Marianne Odegaard & Shulamit Kapon</i>

Reviewers for Esera 2019

The ESERA 2019 International Scientific Committee (ESERA Executive Board and Strand Chairs) would like to acknowledge the contributions of all the additional reviewers who have evaluated submissions for the conference. We thank you for your efforts in sustaining the good quality research that is associated with ESERA.

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 Roberts Pauline, Australia
 Robin Nicolas, Switzerland
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 Rollnick Marissa, South Africa
 Rusek Martin, Czech Republic
 Russell Tom, Canada
 Rybska Eliza, Poland
 Sá- Pinto Xana, Portugal
 Sahin Emine, Turkey
 Salta Katerina, Greece
 Sanders Martie, South Africa
 Santi Lorenzo, Italy
 Scheid Jochen, Germany
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 Scheuch Martin, Austria
 Schmeling Sascha, Switzerland
 Schmiemann Philipp, Germany
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 Skorsetz Nina, Germany
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 Yeh Jung-Hua, Taiwan
 Yu Shu-Mey, Taiwan
 Zehetmeier Stefan, Austria
 Zoupidis Anastasios, Greece

EU STEM Education Project Posters

The ESERA 2019 conference hosts a corner where posters concerning actual “EU STEM Education Projects” are displayed for the whole week.

The aims of this exposition are to let the community know about recent EU projects, offer a chance to discuss about ongoing researches as well as to foster connections among the community for new future projects.

Lunch or coffee break time can be good informal moments along the whole week for having rich and fruitful exchanges at the “EU STEM Education Project Posters” corner.

- **A COMMUNITY SHARED APPROACH TO A M.ED. PROGRAM ON INTEGRATIVE STEM**
Noa Ragonis, Tili Wagner, Daphne Goldman, Osnat Dagan Beit Berl College, Israel

- **ALIGNING WRITTEN EXPLANATIONS WITH DESIGN REASONING IN ELEMENTARY ENGINEERING CLASSROOMS**
Patricia C. Paugh, Ph.D., University of Massachusetts Boston, Department of Curriculum & Instruction, 100 Morrissey Boulevard, Boston, MA 02125 USA

- **ARTIST – ACTION RESEARCH TO INNOVATE SCIENCE TEACHING**
Ingo Eilks (coordinator), Nadja Belova, University of Bremen, Germany (co-coordinator); Marika Kapanadze (co-coordinator), Ilia State University, Tbilisi, Georgia

- **BOTSTEM - ROBOTICS AND STEM EDUCATION FOR CHILDREN AND PRIMARY SCHOOLS**
Ileana M. Greca,(coordinator) Universidad de Burgos, Burgos, Spain; Andreas Redfors, Björn Cronquist, Marie Fridberg Kristianstad University, Sweden

- **CELL EXPLORERS: STEM ENGAGEMENT IN SCHOOLS DELIVERED BY HIGHER EDUCATION INSTITUTIONS**
Muriel Grenon, Shane Mc Guinness Biochemistry, School of Natural Sciences, National University of Ireland Galway, Galway, Ireland

- **CHEMICAL SYMBOLIC LANGUAGE AS A SOCIAL SEMIOTIC RESOURCE**
Ollie Hunter Secondary school chemistry teacher at Benenden School, Kent, UK and EdD student at the University of Cambridge Faculty of Education, UK

- **DEVELOPMENT OF COMMON APPROACHES TO INVOLVEMENT YOUTH INTO SCIENCE AND TECHNICAL SPHERE - BE TECH!**
Trond Einar Persen, Municipality of Alta (Lead Partner), Norway

- **GO-LAB PLATFORM – LEARNING BY INQUIRY**
Ton de Jong University of Twente

- **I SEE – INCLUSIVE STEM EDUCATION TO ENHANCE THE CAPACITY TO ASPIRE AND IMAGINE FUTURE CAREERS**
Olivia Levrini Alma Mater Studiorum – University of Bologna



- **LET'S GO STEM: ITS INFLUENCE ON PHYSICS' LEARNING, INTEREST AND MOTIVATION**
 Mónica Baptista and Sofia Freire, Instituto de Educação da Universidade de Lisboa (IEUL); Horácio Fernandes, Instituto Superior Técnico (IST); Rui Agostinho, Faculdade de Ciências da Universidade de Lisboa (FCUL); Carla Morais, Faculdade de Ciências da Universidade do Porto (FCUP)
- **MASDIV - SUPPORTING MATHEMATICS AND SCIENCE TEACHERS IN ADDRESSING DIVERSITY AND PROMOTING FUNDAMENTAL VALUES**
 Prof. Dr. Katja Maaß, International Center of STEM Education (ICSE) at the University of Education, Freiburg
 Sabine Mickler
- **MINDS ON HANDS ON STEM GOES ON ERASMUS+ PROJECT**
 Mrs Helen Paju Head of Studies in Juhan Liivi nim Alatskivi Kool; Mr Hilmi Dogan Yeniköy Ortaokulu, Science teacher
- **INCLUSME (INTERCULTURAL LEARNING IN MATHEMATICS AND SCIENCE EDUCATION)**
 Katja Maaß University of Education Freiburg, Germany, Dita Betere
- **MULTICO – CAREER-BASED SCENARIOS PROMOTING STUDENTS' CAREER AWARENESS AND THEIR INTEREST IN SCIENCE**
 Tuula Keinonen University of Eastern Finland, School of Applied Educational Science and Teacher Education
- **RAS200: MAKING SPACE PROGRAMME**
 Adriana Cardinot, Andy Shearer School of Physics, National University of Ireland Galway
- **ROBOCOOP – ROBOTICS EDUCATION DRIVEN BY INTERREGIONAL COOPERATION**
 Wilfried Lepuschitz, Practical Robotics Institute Austria (PRIA)
 Georg Jäggle
- **ACIN**
 Nina Bratkova, Centrum vedecko-technických informácií SR (CVTI ST), Ao.Univ.Prof. Dipl.-Ing. Dr.techn. Markus Vincze, Institut für Automatisierungs- und Regelungstechnik, Technische Universität Wien (ACIN); Richard Balog, PhD. Slovak University of Technology Bratislava (STU); Caroline Jäckl, Stadtschulrat Wien (SSR)
- **SENSOSCIENCE: REACHING STEM OBJECTIVES THROUGH THE INQUIRY**
 Castillo-Hernández, Francisco; Jiménez-Liso, María Rut; Martínez-Chico, María; López-Gay, Rafael
 University of Almería
- **THE "BE STEMPATIC!" PROJECT: MODEL OF THE IDENTIFICATION OF STEM GIFTED AND TALENTED STUDENTS IN SCHOOL**
 Josip Burusic Institute of Social Sciences, Zagreb, Croatia
- **SCIENCE EDUCATION FOR ACTION AND ENGAGEMENT TOWARDS SUSTAINABILITY (SEAS)**
 Erik Knain, University of Oslo, Norway

LOCAL CONFERENCE SUPPORT TEAM

Bergna Beatrice Boldrini Eugenia Bulgarelli Cecilia Caramaschi Martina Dal Maso Alessandro Falcioni Valentina	Ghelli Greta Gombi Alessandro Guermanti Pietro Leban Simon Peter Lorenzo Miani Maines Elena	Martani Sara Martinico Bruno Mulazzi Martina Quadrelli Nicolò Sicignano Mario Spada Roberta	Tomba Lorenzo Tovagliari Eleonora Varrassi Lorenzo Veronesi Federica
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STRAND CHAIR AND SIG CO-ORDINATORS MEETING

DATE/TIME		ROOM
Monday 26 18.30 – 19.30	Strand Chairs meeting	D2
Monday 26 18.30 – 19.30	SIG Coordinators meeting	D3

SIG BUSINESS MEETINGS

DATE/TIME	SIG	ROOM
Tuesday 27 18.30-19.30	SIG 1: Early Years Science	B1
Tuesday 27 18.30-19.30	SIG 2: Video based research of teaching and learning processes	B2
Tuesday 27 18.30-19.30	SIG 3: Science education in out-of-school contexts	B3
Tuesday 27 18.30-19.30	SIG 4: Science Environment Health (SHE)	B4
Tuesday 27 18.30-19.30	SIG 5: Science Identities	B5
Tuesday 27 18.30-19.30	SIG 6: Languages & Literacies in Science Education	B6



Pre-Conference Workshops

Workshops will have a maximum of 40 participants each

N°	TITLE OF THE WORKSHOP	ORGANISERS	LOCATION
1	Building the Community from Within: The Learning Assistant Model as a Mechanism for Creating Collaborative Classrooms and Recruiting STEM Teachers	Hagit Kornreich-Leshem, STEM Transformation Institute, Florida International University, Miami, FL, USA Laurie S. Langdon, Learning Assistant Program, University of Colorado Boulder, Boulder, CO, USA Eleanor W. Close, Department of Physics, Texas State University, San Marcos, TX, USA	<i>Conference centre Room B4</i>
2	Enriched Skeleton Mindmap for learning about developments in STEM education for future teachers	Elise Quant, Eindhoven School of Education, Eindhoven University of Technology	<i>Conference centre Room B1</i>
3	Futurizing Science Education: the I SEE project	I SEE project partnership (https://iseeproject.eu/partners/)	<i>Conference centre Room B2</i>
4	Multicultural Science Education: What is it? Why do we need it? What does it look like?	Katie Wade-Jaimes, University of Memphis Rachel King Askew, University of Memphis	<i>Conference centre Room B3</i>
5	New perspectives for Research on Early years Science	Coral Campbell, Faculty of Arts and Education, Deakin University Estelle Blanquet, ESPE d'Aquitaine, University of Bordeaux	<i>Conference centre Room A1</i>
6	RADIOLAB: an interdisciplinary project for improving awareness about radon exposure	Vera Montalbano, University of Siena and INFN Pisa	<i>Conference centre Room B5</i>
7	Science Environment Health –Towards a Science Pedagogy of Complex Living Systems	Albert Zeyer, Bern University of Applied Science, Department of Health Professions Regula Kyburz-Graber, University of Zurich, Institute of Education Alla Keselman, Two Democracy Plaza, Suite 510	<i>Conference centre Room B6</i>
8	The challenges involved in reviewing papers and proposals for high impact journals and conferences	María Pilar Jiménez-Aleixandre, Universidade de Santiago de Compostela, Spain Knut Neumann, Leibniz-Institute for Science and Mathematics Education (IPN), Germany Sibel Erduran, University of Oxford, United Kingdom	<i>Conference centre Room B7</i>

Pre-Conference Workshops

Workshops will have a maximum of 40 participants each

N°	TITLE OF THE WORKSHOP	ORGANISERS	LOCATION
9	Understandings of Scientific Inquiry; Learning to Score and Administer Valid and Reliable Instruments (Views about Scientific Inquiry and Young Children Views about Science)	Judith S. Lederman, Illinois Institute of Technology Norman G. Lederman, Illinois Institute of Technology Selina L. Bartels, Valparaiso University Juan Jimenez-Pavez, Illinois Institute of Technology	<i>Conference centre Room A2</i>
10	Writing research for publication in science education	Sherry A. Southerland, Florida State University John Settlage, University of Connecticut	<i>Conference centre Room D2</i>
11	SIG3: Science education in out-of-school contexts The beauty and pleasure of understanding in out-of-school settings: engaging with ethical research challenges.	Emily Dawson, Department of Science & Technology Studies at University College London, UK Melissa Glackin, Education, Communication and Society, King's College London, UK Patricia Patrick, Counseling, Foundations and Leadership, Columbus State University, USA	<i>Fondazione Golinelli</i>

Conference Session Formats

SYMPOSIA

A symposium is a group of four presentations on a common topic, together with a Chairperson and Discussant. The symposium contributors are from at least three countries. Symposia are scheduled in sessions of 120 minutes which include the introduction of the chair, four individual presenters and the discussant. Each presenter has 20 minutes and the discussant has 10 minutes. This will leave 5 minutes for discussion after each presentation and 10 minutes for open discussion at the end moderated by the session chairperson.

ORAL PRESENTATION

Single oral presentations are scheduled in sessions of 90 minutes with four individual presenters or in sessions of 120 minutes with five presentations. Papers are grouped by strand and each session has a title that indicates the common trends. The presentation format allows for 15 minutes of individual presentation time followed by a discussion moderated by the session chairperson.

INTERACTIVE POSTER PRESENTATION

Poster sessions are scheduled for 75 minutes. Each poster presentation will include a graphic presentation of a research study on visual display of size A0 (0.841m x 1.189m) in portrait (vertical) format. A short oral introduction of you and the title of your posters for each poster is given to an audience gathered as a group (1 minute at maximum, in front of the poster and without any slides support). After the authors' brief introduction, an in-depth discussion between them and the audience follows in the area of the poster displays.

ICT DEMONSTRATIONS AND WORKSHOPS

ICT demonstrations and Workshops are scheduled for 75 minutes. The precise format and requirements are listed under each workshop.



Guidance for Chairpersons

For all sessions, Chairpersons are asked to do two key things:

- o act as the Master of Ceremonies for the session and maintain the scheduled timekeeping
- o act as enabler of interaction and discussion – this is one of the most important aspects of a research conference, so please foster active discussion.

At the beginning of your session, please ensure that all the presentations are uploaded, introduce yourself to the group, and remind them of the timings. You will have three coloured cards with 5 minutes (white), 2 minutes (yellow) and STOP (red) written on them so that you can give the presenters a clear indication of the time left.

Each room will also have a student host and you can ask him/her to facilitate the session and help with uploading the presentations and staying within the allocated time.

Specific details for different session types are outlined below:

CHAIRING SYMPOSIA

Your role is to manage the smooth flow of the symposium. Introduce the presenters and discussant, and check everyone knows the timing. Each presenter has 20 minutes and the discussant has 10 minutes. This will leave 5 minutes for discussion after each presentation and 10 minutes for open discussion at the end. It is your responsibility to facilitate this. You will be given three colored cards with 5 minutes (white), 2 minutes (yellow) and STOP (red) written on them so that you can give the presenters a clear indication of the time left.

CHAIRING SINGLE ORAL PRESENTATIONS

Your role is to manage the timing of the presentations and check that all runs smoothly. Introduce yourself to the presenters and encourage them to upload their presentations before the session begins. Remind them of the timing: this format allows for 15 minutes of individual presentation time followed by a 5 minutes discussion for each paper. There should be around 10 minutes at the end of the four (or five) presentations for general questions and discussion. You will be given three colored cards with 5 minutes (white), 2 minutes (yellow) and STOP (red) written on them so that you can give the presenters a clear indication of the time left.

CHAIRING INTERACTIVE POSTER SESSIONS

Your role is to make the poster sessions a vibrant opportunity for exchanging research. If presenters have not already done so, encourage them to put up their posters on the boards. Each presenter has 1 minute to present him/herself and the topic of the poster in front of an audience gathered as a group. After the authors' brief introduction, an in-depth discussion between them and the audience follows in the area of the poster displays. Poster sessions are scheduled for 75 minutes. As Chairperson, you will need to explain how the session runs as it may be unfamiliar to some delegates. You will also need to manage the timing and coordinate a fruitful discussion for each poster.





SCIENTIFIC PROGRAMME

Invited Speakers

OPENING CEREMONY

THE BEAUTY AND PLEASURE OF UNDERSTANDING – WORDS OF INTRODUCTION.

It will be a special pleasure for me to introduce the topic of the conference. I will point to the special connection of this topic with the location of the conference. The “beauty and pleasure of understanding” reflects my own preferred way of engaging with science education, where newcomers to scientific culture strive to reach the essential meaning of science as a human endeavor. I will very briefly refine this “slogan” by mentioning three different types of the subject matter that induce interest in science and the desire for understanding through considering scientific knowledge as a special culture. This perspective suggests curricular implications for cultivating the perception of beauty and pleasure that one experiences in science class when one understands.



Igal Galili The Hebrew University of Jerusalem, Israel

Igal Galili is currently Professor Emeritus of Science Education at the Amos de-Shalit Science Teaching Center in the Faculty of Mathematics and Natural Sciences of the Hebrew University of Jerusalem, Israel. He studied physics twice, in Russia and Israel, and graduated in theoretical physics at the Hebrew University of Jerusalem. He learned physics education research in post docs in San Diego and Berkeley. His research interests include the structure of students’ knowledge of physics and the structure of physics knowledge, conceptual knowledge of physics, nature of scientific knowledge and its representation in education and art. His research products include the paradigm of Discipline-Culture and the corresponding to it Cultural Content Knowledge. Those specify the role of the history and philosophy of science for the meaningful learning of science. His research papers, textbooks, learning materials resulted these activities.

PLENARY - MONDAY 26TH

ON TIME AND WATER

During the next 100 years we expect to see a fundamental change of all the elements of water on our planet. Many glaciers will melt and the sea levels will rise at a faster rate than has been seen before. Acidification will bring the oceans to a pH level not seen in 30 million years. Patterns of rain and snow will change dramatically in most areas. We could say that nature is not changing in geological speed anymore but entering human speed. This extreme shift is larger than any metaphor or any words or language we are used to. Just like the huge gravity of a black hole makes it invisible, you could say that this issue is so large that it swallows all words and meaning. We hear words like “climate change” but for most people they are just white noise, 99% of the real meaning is not included in our imagination. To describe a black hole you look at the surrounding galaxies and to understand these issues Andri weaves a web of stories from mythology, to his grandmother’s honeymoon on Europe’s largest glacier, to our understanding of our intimate time. We are faced with the almost impossible task of cutting carbon emissions to zero in 2050 according to newest studies. The question is – are we too late to do something? What can actually be done in 30 years? This calls for nothing less than a new scientific revolution, projects on the scale of the Manhattan project, new paradigms and a new approach to almost everything done in the 20th century. This huge narrative should be a source of motivation for all science studies in the next decades.



Andri Snær Magnason writer, Iceland

Andri Snær Magnason is an Icelandic writer born in Reykjavik. He is a writer of fiction, non-fiction, poetry, plays and documentary films. His book LoveStar won the Philip K. Dick special citation in 2014 and Le Grand prix de l’Imaginaire in France 2016. and his children’s book, The Story of the Blue Planet was the first children’s book to win the Icelandic literary award and has been published in 32 languages. His book Dreamland, a Self Help Manual for a Frightened Nation has contributed to a new energy policy in Iceland and the vision of the Highland National Park in the Central Highlands of Iceland. Andri Snær Magnason ran for president in Iceland in 2016 and came third in the election.

Invited Speakers

PLENARY - TUESDAY 27TH

WHERE ARE WE? SYNTHESSES AND SYNERGIES IN SCIENCE EDUCATION RESEARCH AND PRACTICES

One of the grand projects of research in science education is to understand conceptual change. By conceptual change, I mean the process by which a student's intuitive understanding of the natural world—the understanding that they gain through interaction with the world and other people—is transformed by formal instruction in science. The purpose of this talk will be to provide a sense for where we are, as a field, in this grand project, and to chart a path toward consensus. In the first part of this talk, I will describe what I believe are the main impediments to finding consensus. There are, of course, disagreements among researchers. But the real difficulties, I will argue, arise from misalignments between research programs that go beyond straightforward disagreements. For example, in some cases, researchers are addressing different target phenomena; in other words, when they talk about "conceptual change," they are not even talking about the same thing. In the second part of the talk, I will attempt to chart a way forward. I will argue that, first, there is already a sort of proto-consensus emerging, one that recognizes that some researchers are talking about elements, while others are talking about ensembles of those elements. I will also argue that the field, as a whole, suffers from a sort of ontological slippage. Our theoretical entities—such as the notion of "concept"—should gain precision from the way they are situated in our larger theories. But when we use terms such as "concept," we often do so, tacitly, against a backdrop of shifting theoretical frameworks. Finally, I will argue that a particular type of empirical work is necessary to push us toward a consensus view of conceptual change. This empirical work should be focused on the sensitivity of people to properties of scientific explanations, such as their consistency and adequacy.



Bruce Sherin Northwestern University United States

Bruce Sherin is recognized for his work on conceptual change in science. His early research focused on continuities between children's understanding of the natural world and expert understanding of science. Of particular note with respect to this program is his work on the understanding of physics equations. In that work, he showed how the understanding of physics equations is grounded in a vocabulary of informal and intuitive conceptions. More recently, he has begun to apply computational techniques to the type of text analysis employed by researchers in the Learning Sciences and education more broadly. In addition, with Miriam Sherin, he has explored the use of novel technologies for the study of teacher cognition. He is currently a Professor in Northwestern University's School of Education and Social Policy, which is located in the US, in Evanston, Illinois

Invited Speakers

PLENARY - WEDNESDAY 28TH

EMBODIED COGNITION: FROM NEUROSCIENCE TO SCIENCE EDUCATION

Research on embodied cognition has shifted our perspective on cognitive representations and processes. This research has begun to challenge the long-standing assumption that higher level cognition (such as concept representation, reasoning and planning) is best understood in terms of abstract representations and computational processes. Instead, evidence from neuroscience now suggests that even so-called "higher level" cognition implicates perceptual and motor systems. This session examines this evidence and explores the implications of this shift in perspective on the nature of cognition for understanding science learning and instruction.



Corrado Sinigaglia University of Milan, Italy

Corrado Sinigaglia is Full Professor of Philosophy of Science. He has been at University of Milan since 2001 when he was appointed as Assistant Professor there. Before that he studied at the Husserl-Archives of Leuven (1992-1993), at the Ecole Normale Supérieure of Paris (1994), and at the University of Genova (1995-1999), where he obtained his PhD in Philosophy of Science. His main fields of research are: Cognitive neuroscience and philosophy of mind. He is currently working on the role of motor processes and representations in joint action.



Tamer Amin (discussant), American University of Beirut, Lebanon

Tamer Amin is an Associate Professor of Science Education and Chair of the Department of Education at the American University of Beirut, Lebanon. He obtained his Ph.D. in Developmental Psychology from Clark University, USA. His primary research interest is the development of scientific understanding and reasoning, drawing on the theoretical perspectives of conceptual change and embodied cognition. His work on embodied cognition explores the relevance of the cognitive linguistic theory of conceptual metaphor for understanding science learning and instruction. He has co-edited (with F. Jeppsson and J. Haglund, 2015) a special issue in the International Journal of Science Education on "Embodied Cognition and Conceptual Metaphor in Science Learning" and (with O. Levrini, 2018) *Converging Perspectives on Conceptual Change: Mapping an Emerging Paradigm in the Learning Sciences*, Routledge.

Invited Speakers

PLENARY - THURSDAY 29TH

SOCIOSCIENTIFIC-ISSUES: SEARCHING FOR NEW PERSPECTIVES

A paramount commitment of science education is to enable students to tackle societal, real-life issues by making decisions that are informed by science. This commitment has been the basis of the notion of socio-scientific issues (SSI), which has developed into an important strand of science education research. Despite a range of documented benefits of SSI – such as improving students' learning of content, developing interest, and improving students' argumentation competencies – it is a widespread finding that it is profoundly difficult to change teaching practice into one that regularly harbours high quality SSI-teaching. We discuss the notion of SSI – both from the perspective of its historical development and from the perspective of its present manifestation in curricula and policy documents – and we will focus on the new perspectives of socioscientific issues and point to how some of the most persistent challenges for the uptake of SSI-teaching can be alleviated.



Maria Evagorou University of Nicosia, Cyprus

Maria Evagorou is an Associate Professor in Science Education at the Department of Education, University of Nicosia, and also the Associate Head of the Department of Education. Her research focuses on exploring and enhancing students' and pre-service teachers' argumentation especially in socio-scientific issues. She was the scientific coordinator for the PreSEES project (Preparing Science Educators for Everyday Science). She was the local PI for the Engage Project (FP7) focusing on including responsible research and innovation in school activities, and is currently the PI for the DIALLS project (Horizon2020) aiming to promote dialogue and argumentation. Before returning to Cyprus, Maria has worked as a researcher at the Center for Informal Learning and Schools (CILS) at King's College London, and as a Lecturer at King's College London.



Jan Alexis Nielsen University of Copenhagen, Denmark

Jan Alexis Nielsen is Associate Professor and Head of Section at the Department of Science Education at the University of Copenhagen, Denmark. His research focuses on the understanding and assessment of generic competences. He has investigated students' socioscientific argumentation and teachers' beliefs about teaching socioscientific issues. He has also worked closely with teachers to build assessment frameworks for inquiry and innovation competence. Over the past 12 years, he has participated in a range of international and national projects related to inquiry and/or socioscientific issues. He is the strand co-coordinator of the Scientific Literacy and Socio-scientific Issues Strand for ESERA.

Invited Speakers

PANEL - FRIDAY 30TH

PANEL: SCIENCE EDUCATION IN MULTICULTURAL AND MULTILINGUAL CONTEXTS

This panel seeks to promote more reflective and agentic approaches to science teacher preparation and science education research that could help establish equitable and socially just education for everyone. Through the voices of five science education scholars from different parts of the globe and with diverse cultural backgrounds, gender expression and theoretical frameworks, we will instigate a conversation about the complexity of science education in today's schools. We will also encourage audience participants to reflect on and discuss the following questions: (a) In what ways are our specific science education contexts culturally and linguistically diverse? (b) What research methodologies are appropriate to capture the complexity of the identified culturally diverse classrooms? (c) How can we expand the representation of cultural diversity in schools, ethnicity of scholars, and diversity of scholarship in science education research publications? (d) In what ways can we influence policies related to language learning and use, equitable access and success in education, and research funding for science education? (e) How can we promote more attention to the need of increasing the contextualization of research data in science education research to enhance the impact of research on teacher practice and on student learning? (f) How can we establish more meaningful collaborations with all stakeholders throughout research projects to make science education research more culturally and socially relevant? Drawing from the experiences of the panellists in multicultural and multilingual science education contexts, we will encourage the audience participants to self-reflect on the ways they could promote equity, diversity and social justice in science education practice and research to address the increasing need of providing multiple opportunities for access and success in science for everyone.



Mariona Espinet (ORGANIZER AND CHAIR) Universitat Autònoma de Barcelona, Spain

Mariona Espinet is an associate professor of Science Education at the Autonomous University of Barcelona, in Catalonia, Spain. She earned a PhD in Science Education at the University of Georgia, Athens, USA thanks to a Fulbright-La Caixa scholarship. At present, she teaches science and environmental education in pre-service and in-service pre-school and primary teacher education programs, as well as research courses offered at the master and doctoral levels. She is the coordinator of the Doctorate in Education in Didactics of Science and Mathematics at UAB, and the coordinator of two research groups Gresc@ (Education for Sustainability, School and Community) and SGR ACELEC (School Science Activity: Languages, Tools and Contexts). She is member of the ESERA Board and co-founder of the ESERA SIG on Languages and Literacies in Science Education. Her research and innovation interests are strongly interdisciplinary and focus on science education for sustainability, classroom discourse and critical literacy in multilingual science learning environments, and community learning in school agroecology. Her most recent international publishing activity related to the theme of this panel is to co-edit the International Journal of Science Education Special Issue on Language issues in Science Education in Multilingual Societies to appear in 2019



Saouma Boujaoude (SPEAKER) American University of Beirut, Lebanon

Saouma BouJaoude completed a doctorate in curriculum and instruction/science education in 1988 at the University of Cincinnati, USA. He is presently professor of science education and director of the Center for Teaching and Learning at the American University of Beirut. His research interests include evolution education, teaching science in multilingual settings, curriculum and teaching methods, and the nature of science. BouJaoude has published in international journals such as the Journal of Research in Science Teaching, Science Education, International Journal of Science Education, Journal of Science Teacher Education, the Science Teacher, Science & Education, Research in Science Education, and School Science Review, among others. Additionally, he has presented his research at local, regional and international education conferences. BouJaoude is presently an associate editor of the Journal of Research in Science Teaching.

Invited Speakers

PANEL - FRIDAY 30TH



Sonya N. Martin (SPEAKER) Seoul National University, Korea

Sonya N. Martin is an Associate Professor in science education at Seoul National University in Korea where she also leads the Sociocultural Approaches to Science Education Equity (SASEE) lab. Sonya holds a bachelor's degree in Biology from Bryn Mawr College and two master's degrees in Elementary Education and in Chemistry Education from the University of Pennsylvania in the United States. She also holds a doctoral degree in Science Education from Curtin University in Australia. Her research focuses on expanding learning opportunities and improving achievement for culturally and linguistically diverse students and for students with special education needs while also supporting the professionalization of science teachers so they can be positioned to effectively support all students to learn science. She collaborates with colleagues in Korea, Taiwan, Singapore, and Australia to explore how language and culture shape teacher and student interactions in science classrooms and she also conducts research on how English-language hegemony in academic publishing marginalizes non-native English scholars in science education. She is a co-founder and co-editor of the journal *Asia-Pacific Science Education* (APSE) and serves on the editorial board of several journals including *Cultural Studies of Science Education* (CSSE) and *Research in Science Education* (RISE).



Audrey Msimanga (SPEAKER) University of the Witwatersrand, Johannesburg, South Africa

Audrey Msimanga is the Academic Head of Postgraduate in the School of Education at the University of the Witwatersrand in Johannesburg, South Africa. Her interest is in understanding the role of teacher education in preparing student teachers to teach science in socio-economically diverse and multilingual contexts. At the micro level Dr Msimanga explores the role and dynamics of classroom interaction in the teaching and learning of science, specifically how science teachers and students talk; how talk helps students make sense of science; what talk reveals about student scientific reasoning; the role of silence and language in science learning



Alberto J. Rodriguez (SPEAKER) Purdue University, United States

Alberto J. Rodriguez is the Mary Endres Chair in Elementary Education and Professor of Cross-Cultural Science Education in the Department of Curriculum and Instruction at Purdue University. His research focuses on the use of sociotransformative constructivism (sTc) as a theoretical framework that merges critical cross-cultural education tenets (as a theory of social justice) with social constructivism (as a theory of learning). Dr. Rodriguez recently received the Innovations in Research on Diversity in Teacher Education Award from the American Educational Research Association (AERA), Division K (Teaching and Teacher Education, 2017). He also received the Kappa Delta Pi – Teaching and Teacher Education Research Award from AERA in 2000, and the New Mexico State University's Award for Exceptional Achievements in Creative Scholarly Activity in 2002.

Dr. Rodriguez's work has been published in various journals. His article, *Strategies for counterresistance: Toward sociotransformative constructivism and learning to teach science for diversity and for understanding* (1998), was selected for the *Multicultural Science Education, Equity and Social Justice* special issue of the *Journal of Research in Science Teaching* (JRST).

MONDAY 15:00 - 16:30

15:00 - 16:30 OP01 - STRAND 3 - INQUIRY-BASED SCIENCE TEACHING

Room A1

Chairperson(s): Elizabeth Lewis

TEACHING AND LEARNING ITERATION THROUGH OPEN-ENDED INVESTIGATIONS

Lynda Dunlop; Maria Turkenburg; Kerry Knox; Judith Bennett
University of York

REFLECTION AND INQUIRY-BASED TEACHING: EXPLORING REFLECTIVE PRACTICES IN BEGINNING SECONDARY SCIENCE TEACHERS.

Ana Margarita Rivero¹; Elizabeth Lewis²
¹Seattle University; ²University of Nebraska-Lincoln

EXPLORING VIEWS OF SPANISH MIDDLE, HIGH SCHOOL STUDENTS AND PRE-SERVICE SCIENCE TEACHERS ABOUT SCIENTIFIC INQUIRY

Juan Jimenez¹; Soraya Hamed²; Judith Lederman¹; Norman Lederman¹
¹Illinois Institute of Technology; ²University of Seville

PREDICTORS OF INQUIRY-BASED SCIENCE TEACHING

Elizabeth Lewis¹; Lyrica Lucas¹; Amy Tankersley¹; Elizabeth Hasseler¹; Ana Rivero²; Brandon Holding³
¹University of Nebraska-Lincoln; ²Seattle University; ³Boulder Learning, Inc.

15:00 - 16:30 OP02 - STRAND 3 - MODELS AND ARGUMENTATION IN SECONDARY BIOLOGY EDUCATION Room A2

Chairperson(s): Niklas Schneeweiß

FOSTERING SCIENTIFIC REASONING WITH MODELS OF BIOLOGICAL PROCESSES USING LESSON STUDY

Susanne Jansen¹; Marie-Christine Knippels²; Wouter van Joolingen²
¹Utrecht University; ²Utrecht University - Freudenthal Institute

A MODEL-BASED LEARNING ABOUT MITOSIS: THE ROLE OF MITOTIC SPINDLE THROUGH DIGITAL STORYTELLING

Tamara Esquivel Martín; Beatriz Bravo Torija; José Manuel Pérez Martín; Noelia Sánchez Sánchez
Universidad Autónoma de Madrid

TEACHING BIOLOGY WITH EDUCATIONAL ESCAPE ROOMS: IMPACT ON SUBJECT KNOWLEDGE AND SKILLS

Georgios Villias
University of Cambridge, Faculty of Education

DESCRIBING LEVELS OF ORGANISATION IN BIOLOGY AND SCIENCE EDUCATION — A CRITICAL REVIEW OF LITERATURE

Niklas Schneeweiß; Harald Gropengießer
Leibniz University Hanover

15:00 - 16:30 OP03 - STRAND 2 - ANALYSING EMOTIONS, ENGAGEMENT AND PARTICIPATION

Room B1

Chairperson(s): John Connolly

DIAGNOSIS OF EMOTIONS AND ATTITUDES TOWARDS STEM AREAS IN SECONDARY SCHOOL STUDENTS

Guadalupe Martínez-Borreguero; Milagros Mateos-Nuñez; Francisco Luis Naranjo-Correa
University of Extremadura

LIVING ANIMALS IN THE CLASSROOM: AN ANALYSIS ON EMOTIONS AND INTEREST

Lisa Virtbauer; Jörg Zumbach
Universität Salzburg

ACADEMIC EMOTIONS TOWARDS A PRACTICE OF MICROBIOLOGY ANTICIPATE LEARNING OUTCOMES IN PRE-SERVICE TEACHERS

Rocío Esteban Gallego; José María Marcos Merino; Jesús A. G. Ochoa de Alda
University of Extremadura

STUDENTS' SELF-EFFICACY BELIEFS AND PARTICIPATION IN SECONDARY SCHOOL PHYSICS LESSONS

John Connolly
UCL Institute of Education

15:00 - 16:30 **OP04 - STRAND 2 - VALUES AND WISDOM IN STUDENTS AND EXPERTS** **Room B2**

Chairperson(s): Alexandra Stöckert

BIODIVERSITY VALUES OF SECONDARY SCHOOL STUDENTS

Rafael Gil de Castro; Caio de Castro e Freire; Marcelo Tadeu Motokane
University of São Paulo

EXPLORING WISDOM OF SCIENCE: CAN WISDOM BE LEARNED FROM SCIENCE?

Insook Lim; Jinwoong Song
Seoul National University

HOW DO EXPERTS ARTICULATE THE INTRINSIC VALUE OF CHEMISTRY?

Katherine Aston
King's College London

ENVIRONMENTAL VALUES AND TECHNOLOGY PREFERENCES OF UNIVERSITY BEGINNERS

Alexandra Stöckert; Franz X. Bogner
University of Bayreuth

15:00 - 16:30 **OP05 - STRAND 6 - STUDENTS' PERCEPTIONS** **Room B3**

Chairperson(s): Minjoo Lee

NOT JUST DO SCIENCE INQUIRY, UNDERSTAND IT! PERCEPTIONS OF MIDDLE SCHOOL STUDENTS ABOUT ASPECTS OF SCIENCE INQUIRY.

Einat Ben Eliyahu¹; Orit Ben Zvi Assaraf¹; Judith S. Lederman²
¹Ben Gurion University of the Negev; ²Illinois Institute of Technology

STUDENTS VIEWS ABOUT SCIENCE AND SCIENTISTS

Anne Freitas¹; Michele Medeiros¹; Marcelo Motokane²
¹Postgraduate Program in Science Teaching, University of São Paulo; ²University of São Paulo

CHARACTERIZATION OF STUDENTS' SCIENTIFIC EPISTEMOLOGICAL CONCEPTIONS AND DEVELOPMENT OF A MULTI-DIMENSIONAL INSTRUMENT FOR THE ASSESSMENT

Cristina Sousa¹; João C. Paiva¹; Isabel Chagas²; João C. Paiva³; Isabel Chagas²; Isabel Chagas²
¹Faculdade de Ciências, Universidade do Porto; ²Instituto de Educação, Universidade de Lisboa, Portugal; ³Faculdade de Ciências, Universidade do Porto & CIQUP

EPISTEMIC AGENCY IN STUDENT-LED RESEARCH PROJECT : FOCUSING ON THE R&E PROGRAM IN KOREA

Minjoo Lee
Daejeon Science High School for the gifted

15:00 - 16:30 **OP168 - STRAND 8 - EPISTEMIC ASPECTS OF SSI** **Room B4**

Chairperson(s): Athina Koutsianou

UNDERGRADUATES' EPISTEMIC CAUTION FOR EVALUATING SOCIO-SCIENTIFIC KNOWLEDGE CLAIMS

Won Jung Kim; Alicia Alonzo
Michigan State University

EPISTEMIC CONCERNS ON STUDENTS' USE OF ARGUMENTS ON PSEUDOSCIENCES

Jordi Domènech-Casal; Carolina Sepúlveda; Anna Marbà-Tallada
Universitat Autònoma de Barcelona

ANALYZING EPISTEMOLOGICAL, ONTOLOGICAL AND AXIOLOGICAL COMMITMENTS IN STUDENTS' SPEECHES AS THEY DISCUSS ON MEDICINES AND SELF-MEDICATION

Bruna Herculano da Silva Bezerra; Edenia Maria Ribeiro do Amaral
Federal Rural University of Pernambuco

EXPLORING ASPECTS OF PRE-SERVICE PRIMARY TEACHERS' EPISTEMIC COGNITION WHILE DEALING WITH A SOCIO-SCIENTIFIC ISSUE: A THINK-ALoud STUDY

Lida Desikou¹; Athina Koutsianou²; Anastassios Emvalotis²
¹University of Patras, Department of Primary Education; ²University of Ioannina, Department of Primary Education

15:00 - 16:30 **OP07 - STRAND 9 - TEACHERS' CONCEPTIONS AND WILLINGNESS TO TAKE ACTION** **Room B5**

Chairperson(s): Anthoula Maidou

EVALUATING ENVIRONMENTAL BEHAVIOUR OF PRE-SERVICE PRIMARY SCIENCE TEACHERS

Anat Abramovich¹; shirley Miedijensky²; Avi Assor³

¹Gordon Academic College of Education; ²Oranim Academic College; ³Educational & School Psychology Program, Education Department, Ben-Gurion University

PRE-SERVICE TEACHERS UNDERSTANDING OF CLIMATE CHANGE MITIGATION AND THEIR WILLINGNESS TO TAKE ACTION

Sakari Tolppanen¹; Jingoo Kang¹; Anna Claudelin²

¹University of Eastern Finland; ²LUT University

IN-SERVICE TEACHERS' CONCEPTION OF GLOBAL WARMING, POLLUTION AND OZONE LAYER: A SOUTH AFRICAN CASE STUDY

Headman Hebe

University of South Africa

INTRODUCING PRE-SERVICE EARLY CHILDHOOD TEACHERS TO EDUCATION FOR SUSTAINABLE DEVELOPMENT USING SOCRATES' HOUSE

Anthoula Maidou¹; Katerina Plakitsi¹; Hariton Polatoglou²

¹University of Ioannina; ²Aristotle University of Thessaloniki

15:00 - 16:30 **OP08 - STRAND 12 - STUDENT'S POSITIONING AND STEM CAREER ASPIRATIONS** **Room B6**

Chairperson(s): Hennes Alberding

WHAT YOU WEAR CAN MAKE A DIFFERENCE IN ELEMENTARY STUDENTS' PERCEPTIONS OF STEM CAREERS

Tammy Lee¹; Gail Jones²; Katherine Chesnutt³; Sarah Carrier³; Lauren Madden⁴; Emily Cayton⁵; Megan Ennes³

¹East Carolina University; ²N.C State University; ³N.C. State University; ⁴College of New Jersey; ⁵Campbell University

SECONDARY SCHOOL STUDENTS POSITIONING THEMSELVES IN RELATION TO SCIENCE

Tuula Keinonen; Anssi Salonen; Sirpa Kärkkäinen; Anu Hartikainen-Ahia; Kari Sormunen

University of Eastern Finland

KOREAN HIGH SCHOOL STUDENTS' CAREER INTEREST IN STEM THROUGH THE STEAM R&E PROJECT

Yohan Hwang¹; Kongju Mun²; Sung-Won Kim³

¹Chungnam National University; ²Seoul National University; ³Ewha Womans University

CAREER ORIENTATION IN THE FIELD OF FOOD CHEMISTRY FOR SECONDARY SCHOOL STUDENTS

Hennes Alberding; Verena Pietzner

Carl von Ossietzky Universität Oldenburg

15:00 - 16:30 **OP09 - STRAND 12 - GENDER ISSUES AND PHYSICS** **Room B7**

Chairperson(s): Judith Hillier

REPOSITIONING THE GENDER GAP IN UK PHYSICS: MAPPING PATHWAYS TO SUCCESS

Jaimie Miller-Friedmann

University of Oxford

SCIENCE OUTREACH TO PROMOTE PHYSICS TO GIRLS: AN INVESTIGATION INTO THE IMPACT OF A SCHOOL VISIT PROGRAMME

Grainne Walshe¹; Vincent Casey¹; Michael Cauchi¹; Aaron Cusack¹; Yvonne Kavanagh²; Maria Quinn¹; Ian Clancy¹

¹University of Limerick; ²IT Carlow

BRINGING GIRLS CLOSER TO SCIENCE: GENDER INCLUSIVE STRATEGIES IN PHYSICS' CLASSES

Camila Manni Dias do Amaral

Universidade Federal do Rio de Janeiro

DO WOMEN-ONLY SPACES IN PHYSICS STILL MATTER?

Judith Hillier; Jaimie Miller-Friedmann

University of Oxford

15:00 - 16:30 OP10 - STRAND 1 - LEARNING PHYSICS CONCEPTS: LIGHT, ELECTRICITY AND MAGNETISM Room C1

Chairperson(s): Jan Andersson

INTEGRATING CONFIDENCE ASSESSMENT TO EXPLORE SENIOR HIGH SCHOOL STUDENTS' IDEAS ABOUT ELECTRIC CIRCUIT MODELS: A COMPARISON OF SCIENCE AND NON-SCIENCE MAJORS

Shian-Jang Wang; Jing-Wen Lin
National Taiwan University of Science and Technology

DRAWING MENTAL MODELS OF STATIC ELECTRICITY: WHAT WE CAN GAIN

Constantina Stefanidou¹; Anastasia Ferentinou²; Konstantina Tsalapati¹
¹National and Kapodistrian University of Athens; ²University of Thessaly

DEALING WITH THE RECTILINEAR PROPAGATION OF LIGHT: A COUNTER-INTUITIVE EVOLUTION FROM PRIMARY SCHOOL TO UNIVERSITY

Estelle Blanquet¹; Violette Blé²; Claire Darraud³; Audrey Garnier⁴; Fabienne Goldfarb⁵; Manuela Miron⁶; Fernanda Thevenot²; Eric Picholle⁷
¹LACES ESPE d'Aquitaine Université de Bordeaux (France); ²ESPE d'Aquitaine (France); ³XLIM University of Limoges (France); ⁴ESPE d'Aquitaine; ⁵Laboratoire Aimé Cotton Université Paris Sud (France); ⁶University of Iasi (Romania); ⁷Inphyni UMR7010 CNRS-Université de Nice Sophia-Antipolis membre Université Côte d'Azur (France)

PRIMARY TEACHERS STUDENTS' UNDERSTANDING OF ELECTROMAGNETIC INDUCTION

Jan Andersson¹; Gunnar Jonsson²
¹Karlstad University, Department of engineering and physics; ²Mälardalen University, UKK, Physics

15:00 - 16:30 OP11 - STRAND 5 - TEACHING AND LEARNING ABOUT OR THROUGH MODELING Room D1

Chairperson(s): Veronica Muñoz - Campos

BIODIMOD: A DIALOGIC PROCESS OF MAKING SENSE OF BIODIVERSITY THROUGH MODELLING-BASED TEACHING IN SECONDARY EDUCATION

Gonzalo Bermudez¹; Karen Gimena Cisnero²; Lia Patricia García³; Ana Lia De Longhi²
¹Universidad Nacional de Córdoba - National Scientific and Technical Research Council; ²Universidad Nacional de Córdoba, Facultad de Ciencias Exactas, Físicas y Naturales; ³Universidad Nacional de Córdoba, Facultad de Ciencias Exactas, Físicas y Naturales. IPEM, Min. de Ed

A STUDY OF THE EFFECTS OF AN INQUIRY-BASED WORKSHOP ON ENGINEERING UNDERGRADUATES MODELLING SKILLS

Onofrio Rosario Battaglia; Claudio Fazio
University of Palermo - Dipartimento di Fisica e Chimica

INTEGRATING SCIENTIFIC PRACTICES INTO THE CONTEXT OF DAILY LIFE. ASSESSMENTS CARRIED OUT BY STUDENTS

Verónica Muñoz-Campos; Antonio-Joaquín Franco-Mariscal; Ángel Blanco-López
University of Málaga

15:00 - 16:30 OP12 - STRAND 10 - CURRICULUM DEVELOPMENT 1 Room D2

Chairperson(s): Marie-Hélène Bruyère

DEVELOPMENT OF A COMPETENCY-BASED CURRICULUM FOR SCIENCE EDUCATION IN DENMARK

Jan Sølberg¹; Tomas Højgaard²
¹University of Copenhagen; ²University of Aarhus

NETWORK ANALYSIS OF CHANGES TO AN INTEGRATED SCIENCE COURSE CURRICULUM OVER TIME

Jesper Bruun¹; Ida Viola Katmark Andersen²; Julie Hougaard Overgaard²
¹Department of Science Education, University of Copenhagen; ²Roskilde Gymnasium

PREPARING FOR THE UNPREDICTABLE: DEVELOPING KOREA SCIENCE EDUCATION STANDARDS (KSES) FOR THE NEXT GENERATION

Jinwoong Song¹; Yong Jae Joung²; Yeon-A Son³; Jun Ki Lee⁴; Phil Seok Oh⁵; Suk-Jin Kang⁶; Youngsun Kwak⁷; Jeong Woo Son⁸; Dae Hong Jeong¹; Hyuk Ihm⁹; Hyun Jeung Lee¹⁰; Donggeon Kim¹¹; Jiyeon Na¹²; Jinhee Kim¹; Sung choon Park¹; Jong-Hoon Do¹³
¹Seoul National University; ²Gongju National University of Education; ³Dankook University; ⁴Chonbuk National University; ⁵Gyeongin National University of Education; ⁶Jeonju National University of Education; ⁷Korea National University of Education; ⁸Gyeongsang National University; ⁹Munjeong High school; ¹⁰Ongok elementary school; ¹¹Changdeok Girl's Middle school; ¹²Chuncheon National University of Education; ¹³Seowon University

DESCRIPTIVE ANALYSIS OF THE ISIS PRIMARY SCHOOL SCIENCE CURRICULUM

Marie-Hélène Bruyère¹; Patrice Potvin¹; Olivier Arvais¹; Marianne Bissonnette¹; Chirine Chamsine¹; Mohamed Amine Mahhou¹; Vivek Venkatesh²
¹Université du Québec à Montréal (UQAM); ²Concordia University

15:00 - 16:30 **OP13 - STRAND 11 - STUDENTS' PEER-ASSESSMENT AND ON-THE-FLY ASSESSMENT** **Room D3**

Chairperson(s): Laura Ketonen

WHAT TYPES OF WRITTEN FEEDBACK DO UNDERGRADUATE CHEMISTRY STUDENTS GIVE EACH OTHER?

YewJin Lee; Peter Lee; Norman Lim; Timothy Tan
Nanyang Technological University

FORMS AND FUNCTIONS OF ON-THE-FLY FORMATIVE ASSESSMENT IN PHYSICS INQUIRY

Pasi Nieminen; Markus Hähkiöniemi; Jouni Viiri
University of Jyväskylä

ILLUSTRATING THE APPLICATION OF INTERACTIONS ON THE FLY IN SCIENCE TEACHING USING CONCEPT MAPS

Michalis Livitziis; Nicos Papadouris; Constantinos Constantinou
University of Cyprus

BENEFITS AND BARRIERS: A CASE STUDY OF IMPLEMENTING PEER ASSESSMENT IN LOWER SECONDARY SCHOOL PHYSICS

Laura Ketonen; Jouni Viiri; Pasi Nieminen
University of Jyväskylä

15:00 - 16:30 **OP14 - STRAND 4 - SIMULATIONS AND EDUCATIONAL GAMES IN PHYSICS I** **Room E2 - Italia**

Chairperson(s): Agostinho Serrano

LEARNING WITH FRICTION — A GEOGEBRA SIMULATION IN PHYSICS

Lorena Solvang; Jesper Haglund
Karlstad University

STRUCTURED VS. OPEN SIMULATION-BASED SCIENCE LEARNING ENVIRONMENT — WHAT IS THE DIFFERENCE FOR LEARNING AND ENGAGEMENT FOR DIFFERENT-AGED STUDENTS?

Antti Lehtinen; Markus Hähkiöniemi; Pasi Nieminen
University of Jyväskylä, Department of Teacher Education

LEARNING NEWTONIAN MECHANICS WITH AN INTRINSICALLY INTEGRATED EDUCATIONAL GAME

Anne van der Linden; Wouter van Joolingen; Ralph Meulenbroeks
Freudenthal Institute, Utrecht University

MEANINGFUL LEARNING AFTER USING MULTIPLE MEDIATIONS TO TEACH BOHR ATOM IN SECONDARY SCHOOL IN BRAZIL

Agostinho Serrano; Savana Anjos Freitas
Universidade Luterana do Brasil

15:00 - 16:30 **OP15 - STRAND 7 - TEACHER TRAINING AND TEACHER ARGUMENTATION, EXPLANATION AND EPISTEMOLOGICAL BELIEFS** **Room F1**

Chairperson(s): María de la Paz Domínguez-Crespo

EXPLANATORY POWER OF EXPLANATIONS - TRACKING PRE-SERVICE TEACHERS' CONCEPTUAL DEVELOPMENT DURING DC-CIRCUIT TASKS

Terhi Mäntylä¹; Tommi Kokkonen²
¹Tampere University; ²University of Helsinki

EXAMINING THE EFFECTS OF SCIENCE TEACHER'S EPISTEMOLOGICAL BELIEFS ABOUT LANGUAGE IN CLIL SCIENCE CLASSROOMS

Laura Tagnin¹; Laura Tagnin¹; Máire Ní Ríordáin²; Mary Flamin¹
¹National University of Ireland, Galway; ²University College Cork, Cork, Ireland

DISCOURSE ANALYSIS OF BRAZILIAN STUDIES ON SCIENCE EDUCATION: AN INVESTIGATION OF SCIENTIFIC ARTICLES

Samuel Schnorr; Mauricio Pietrocola
University of São Paulo

VIDEO ANNOTATIONS TO ANALYSE THE CAPACITY TO ARGUE AND COUNTERARGUMENT BY PRE-SERVICE EARLY CHILDHOOD TEACHERS ON WATER CONSUMPTION

María de la Paz Domínguez-Crespo; Daniel Cebrián-Robles; Antonio-Joaquín Franco-Mariscal; Ángel Blanco-López
Malaga University

15:00 - 16:30 OP16 - STRAND 15 - MODELING AND REPRESENTATION IN EARLY CHILDHOOD SCIENCE Room F2

Chairperson(s): Spyros Kollas

THE ROLE OF MULTIMODAL EDUCATIONAL MATERIAL IN UNDERSTANDING SCIENTIFIC (BIOLOGY) CONCEPTS

Kikilia Tsoukala
University of Thessaly - Department of Early Childhood Education

INVESTIGATION OF THE IMPACT OF HAPTIC FEEDBACK ON PRE-SCHOOL STUDENTS' UNDERSTANDING IN THREE SCIENCE DOMAINS

Marios Papaevripidou; Ivoni Pavlou; Eleftheria Panteli; Zacharias Zacharia
University of Cyprus

MODELING-BASED LEARNING IN EARLY CHILDHOOD SCIENCE EDUCATION

Loucas Louca¹; Zacharias Zacharia²
¹European University Cyprus; ²University of Cyprus

CASE STUDIES OF COLLABORATIVE MODEL-BASED REASONING FOR CONCEPTUAL CHANGE IN PRESCHOOL CHILDREN

Spyros Kollas; Eleni Sakellaridi
National and Kapodistrian University of Athens

15:00 - 16:30 OP17 - STRAND 18 - DESIGNING AND VALIDATING METHODS AND TOOLS Room F3

Chairperson(s): Stefan Hartmann

DESIGN AND VALIDATION OF A TEACHER SURVEY ON SPECIAL NEEDS SCIENCE EDUCATION

Tang Wee Teo
National Institute of Education, Nanyang Technological University, Singapore

AN ALTERNATIVE TO STEBI-A: VALIDATION OF THE T-STEM SCIENCE SCALE

Arif Rachmatullah¹; Alonzo Alexander¹; Alana Unfried²; Eric Wiebe¹
¹North Carolina State University; ²California State University Monterey Bay

DESIGN AND VALIDATION OF A QUESTIONNAIRE FOR SURVEY RESEARCH ON SCIENCE TEACHER EDUCATORS' PEDAGOGY AND PRACTICE IN RELATION TO INCLUSION

Todd Milford¹; Christine Tippet²; Karen Goodnough³; Saiqa Azam³
¹University of Victoria; ²University of Ottawa; ³Memorial University of Newfoundland

INVESTIGATING THE VALIDITY AND RELIABILITY OF A SCIENTIFIC REASONING TEST FOR PRE-SERVICE TEACHERS

Stefan Hartmann¹; Dirk Krüger²; Annette Upmeier zu Belzen¹
¹Humboldt-Universität zu Berlin; ²Freie Universität Berlin

15:00 - 16:30 OP18 - STRAND 13 - LEARNING AND TEACHING INQUIRY Room G1

Chairperson(s): Alexander Buessing

HOW DO TEACHERS CHOOSE INSTRUCTIONAL MATERIAL FOR INQUIRY-BASED SCIENCE EDUCATION?

Marco Longhitano; Judith Arnold; Rachel Schwager; Lennart Schalk
PH Schwyz

FROM VAPOR TO ICE; FEATURES OF PST SOCIAL SCIENTIFIC LANGUAGE DURING INQUIRY-BASED LEARNING

Kristin Elisabeth Haugstad; Unni Eikeseth
NTNU - Norwegian University of Science and Technology

HOW TO USE LANGUAGE IN IMMERSIVE ARGUMENT-BASED INQUIRY: A META-SYNTHESIS OF RESEARCH ON SCIENCE WRITING HEURISTIC APPROACH FROM 2000-2018

Jee Suh¹; Brian Hand²; Ying-Chih Chen³
¹University of Alabama; ²University of Iowa; ³Arizona State University

PRE-SERVICE TEACHERS' PSYCHOLOGICAL DISTANCE TOWARDS ENVIRONMENTAL AND HEALTH SOCIO-SCIENTIFIC ISSUES

Alexander Buessing; Susanne Menzel
Didactics of Biology, Osnabrück University

15:00 - 16:30 OP19 - STRAND 13 - PEDAGOGICAL CONTENT KNOWLEDGE I Room G2

Chairperson(s): Doras Sibanda

THE IMPACTS OF AN INITIAL TRAINING PROGRAM IN THE DEVELOPMENT OF CHEMISTRY TEACHER'S KNOWLEDGE

Keysy Nogueira; [Carmen Fernandez](#)
University of Sao Paulo

EXPLORING THE RETENTION OF TSPCK BY CHEMISTRY GRADUATE BEGINNING TEACHERS

[Elizabeth Mavhunga](#); Josephat Miheso
Wits University

DEVELOPMENT OF PRE-SERVICE CHEMISTRY TEACHERS' TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE

[Ayla Cetin-Dindar](#)¹; [Yezdan Boz](#)²
¹Bartın University; ²Middle East Technical University

POST GRADUTE CERTIFICATE IN EDUCATION STUDENTS' TOPIC SPECIFIC PEDAGOGICAL KNOWLEDGE (TSPCK) ON PARTICULATE NATURE OF MATTER

[Doras Sibanda](#)¹; [Marissa Rollnick](#)²
¹University of kwaZulu Natal; ²Marang Centre, School of Education, Wits University, South Africa

15:00 - 16:30 OP20 - STRAND 13 - CHALLENGES OF PRE-SERVICE TEACHER EDUCATION Room G3

Chairperson(s): Da Yeon KANG

TEACHING CHEMISTRY INCLUSIVELY - ARE WE PREPARED?

[Katharina Gross](#)
University of Vienna

A 360 VIEW OF A SECONDARY SCIENCE TEACHERS EDUCATION PROGRAM: RECRUITING AND PREPARING WELL-STARTED TEACHERS

[Julie Luft](#); Paula Lemons; Dorothy Y. White; Elana Worth; Julia Przybyla-Kuchek; Blake Whitt
University of Georgia

PRE-SERVICE TEACHER PREPARATION FOR WORKING IN RURAL SCHOOL

[Natalia Demeshkant](#); [Katarzyna Potyrała](#); [Karolina Czerwec](#)
Pedagogical University of Cracow

EXAMINING STRUCTURES AFFECTING KOREAN TEACHERS' AGENCY TO TEACH SCIENCE TO CULTURALLY AND LINGUISTICALLY DIVERSE STUDENTS: IMPLICATIONS FOR TEACHER EDUCATION PROGRAM

[Da Yeon KANG](#)¹; [Hye-Eun CHU](#)²; [Hojung KIM](#)¹; [Seung-Urn CHO](#)¹; [Sonya MARTIN](#)¹
¹Seoul National University; ²Macquarie University

15:00 - 16:30 OP21 - STRAND 14 - ACTION RESEARCH AND PROFESSIONAL LEARNING COMMUNITIES I Room G4

Chairperson(s): Helena Berglund

USING PRACTICAL WORK EFFECTIVELY IN THE SCHOOL SCIENCE LABORATORY: A TEACHER TRAINING PROGRAMME BASED ON THE LEARNING COMMUNITY APPROACH

[Marta Carli](#); [Ornella Pantano](#)
Department of Physics and Astronomy, University of Padova

"WE WANT TO CONTINUE!": FACTORS THAT CONTRIBUTE TO MAINTAIN A SCIENCE TEACHER LEARNING COMMUNITY IN TIME

[Corina Gonzalez Weil](#)¹; [María Isabel Reyes](#)¹; [Andoni Arenas](#)¹; [Lilian Vergara](#)¹; [Francisca Sánchez](#)¹; [Ignacio Rojas](#)²; [Paulina Bravo](#)³; [Felipe Acuña](#)³
¹Pontificia Universidad Católica de Valparaíso; ²Universidad de Playa Ancha, Valparaíso, Chile; ³UCL Institute of Education

ADOPTION OF UNIVERSAL DESIGN FOR LEARNING (UDL) IN SCIENCE: AN ACTIVITY THEORY PERSPECTIVE

[Karen Goodnough](#)
Memorial University of Newfoundland

DEVELOPING BIOLOGY EDUCATION THROUGH COLLABORATION BETWEEN TEACHERS

[Helena Berglund](#)
Department of educational science, Lund University

15:00 - 16:30 OP22 - STRAND 17 - REASONING AND MODELLING SKILLS AT UNIVERSITY LEVEL Room G5

Chairperson(s): Vera Montalbano

THE OBSTACLE OF A MISLEADING MATHEMATICAL LEGITIMACY: DISCUSSING THE IRREVERSIBLE EXPANSION OF AN IDEAL GAS WITH BEGINNING TEACHERS

Laurence Viennot

Université Paris Diderot, Matière et Systèmes Complexes UMR 7057

THE DEVELOPMENT OF UNDERGRADUATES' MECHANISTIC EXPLANATIONS OF GENE ENVIRONMENT INTERACTION

Michal Haskel-Ittah¹; Ravit Golan Duncan²; Anat Yarden¹

¹Weizmann Institute of Science; ²Rutgers

INFLUENCE OF CONTEXT ON THE ARCHITECTURE OF STUDENT-GENERATED MODELS IN AN UNDERGRADUATE INTRODUCTORY BIOLOGY COURSE

Joelyn de Lima; Tammy Long

Michigan State University

RECOVERY OF MATHEMATICAL INADEQUACIES AND DEVELOPMENT OF TRANSVERSAL SKILLS FOR PHYSICS AND MATHEMATICS STUDENTS

Vera Montalbano

University of Siena

15:00 - 16:30 OP23 - STRAND 16 - STEM IIN PRIMARY SCHOOL Room G6

Chairperson(s): Edna Tan

TRANSNATIONAL STEM MAKERSPACES: A NEW APPROACH TO LEARNING

Rekha Koul; Rachel Sheffield

Curtin University

ANALYSIS OF THE LEVEL OF KNOWLEDGE AND COMPETENCE OF PRIMARY SCHOOL PUPILS IN STEM AREAS

Milagros Mateos-Núñez; Guadalupe Martinez-Borreguero; Francisco Luis Naranjo-Correa

University of Extremadura

THE DEVELOPMENT OF INTEREST FOR STEM SCHOOL SUBJECTS AND STEM CAREERS DURING PRIMARY SCHOOLING

Josip Burusic¹; Toni Babarovic¹; Marija Sakic Velic¹; Leila Selimbegovic²; Dubravka Glasnovic Gracin³

¹Ivo Pilar Institute of Social Sciences, Zagreb, Croatia; ²Université de Poitiers, Département de psychologie, Poitiers, France; ³University of Zagreb, Faculty of Teacher Education, Zagreb, Croatia

ENGINEERING FOR SUSTAINABLE COMMUNITIES: TOOLS IN SUPPORT OF EQUITABLE AND CONSEQUENTIAL MIDDLE SCHOOL ENGINEERING.

Edna Tan; Angela Calabrese Barton; Aerin Benavides

University of North Carolina at Greensboro

15:00 - 16:30 OP24 - STRAND 17 - PROBLEM SOLVING AT UNIVERSITY LEVEL Room G7

Chairperson(s): David Woitkowski

USING A HYBRID OF ARGUMENTATION AND PROBLEM SOLVING PROMPTS TO FACILITATE UNDERGRADUATES' PROBLEM SOLVING PERFORMANCE AND CONFIDENCE

Carina Rebello; Yuri Piedrahita Uruena

Purdue University

ABSTRACTION IN DYADIC CHEMISTRY PROBLEM SOLVING

Jessica Karch; Hannah Sevian

University of Massachusetts Boston

INVESTIGATING GROUP-SPECIFIC DIFFERENCES IN SOLVING MECHANISTIC PROBLEMS IN ORGANIC CHEMISTRY

Nicole Graulich¹; Julia Eckhard¹; Marc Rodemer²; Sascha Bernholt²

¹Justus-Liebig University; ²Christian-Albrechts-Universität Kiel

SURVEYING UNIVERSITY STUDENTS' PROBLEM SOLVING SKILLS IN REALISTIC SETTINGS

David Woitkowski

Universität Paderborn

15:00 - 16:30 **OP189 - STRAND 4 - INNOVATION AND ENGINEERING IN ONLINE AND ICT-RICH ENVIRONMENTS** **Room G8**

Chairperson(s): Eleni Kyza

INVESTIGATING STUDENTS' ACTIONS AND DISCUSSIONS WHEN EXPERIMENTING WITH PHYSICAL AND VIRTUAL MANIPULATIVES IN SCIENCE

George Olympiou; Zacharias Zacharia; Tasos Hovardas
University of Cyprus

UNPACKING THE PROMISES OF THE MAKER MOVEMENT IN STEM EDUCATION: THE DEVELOPMENT OF SCIENTIFIC AND ENGINEERING PRACTICES THROUGH TINKERING

Cristina Simarro¹; Elizabeth McGregor²; Digna Couso¹; Mark Winterbottom²
¹CRECIM, Universitat Autònoma de Barcelona (UAB); ²Faculty of Education, Cambridge University

MOOCS AS CHANGE AGENTS FOR PROMOTING INNOVATIVE THINKING AMONG SCIENCE AND ENGINEERING STUDENTS

Abeer Watted¹; Miri Barak²
¹Al-Qasemi Academic College of education; ²Technion - Israel Institute of Technology

THE USE OF TECHNOLOGY TO PROMOTE HIGH SCHOOL CHEMISTRY STUDENTS' CONCEPTUAL UNDERSTANDING ABOUT NANOTECHNOLOGY AND UNDERSTANDING OF RRI

Panayiotis Stylianou¹; Eleni Kyza²; Yiannis Georgiou²
¹Cyprus Ministry of Education and Culture; ²Cyprus University of Technology

MONDAY 17:00 - 18:30

17:00 - 18:30 **OP163 - STRAND 3 - SCIENCE, IMAGINATION AND ART** **Room A1**

Chairperson(s): Ann Mutvei

THE NARRATIVE INSIDE: TEACHING PHYSICS WITH A NARRATIVE-BASED APPROACH

Michele Canducci; Silvia Demartini
Department of Education and Learning (DFA), University of Applied Sciences and Arts of Southern Swit

SCIENCE AND ART: AN INTEGRATED EDUCATIONAL PATH ON COLOUR VISION

Claudia Daffara¹; Nicole De Manincor²; Francesca Monti¹; Luca Perlini¹
¹Dept of Computer Science, Univ of Verona; ²Dept of Cultures and Civilizations, Univ of Verona

THE LEARNING SCIENCE THROUGH THEATER INITIATIVE AS A BEST PRACTICE - CREATIVITY-ENRICHED INQUIRY BASED APPROACHES

Eleni Georgakopoulou¹; Zacharoula Smyrnaio¹; Menelaos Sotiriou²; Sofoklis Sotiriou³
¹National and Kapodistrian University of Athens; ²Science View; ³Research and Development Department, Ellinogermaniki Agogi

IMAGINATION; WHERE SCIENCE FORMULATE DIFFERENT HYPOTHESIS AND EXPLANATIONS HELPING THE UNDERSTANDING OF THE LANGUAGE AND SOUL OF CHEMISTRY

Ann Mutvei¹; Ulrika Tobieson²
¹School of Natural Sciences, Technology and,Environmental Studies, Södertörn University; ²Södertörn University

17:00 - 18:30 **OP164 - STRAND 3 - FOSTERING INQUIRY-BASED LEARNING** **Room A2**

Chairperson(s): Gábor Z. Orosz

FOSTERING SCIENTIFIC PRACTICES THROUGH EXPLICIT INSTRUCTION - IS IT HAPPENING? AN ANALYSIS OF INQUIRY-BASED INSTRUCTION IN GERMAN CLASSROOMS

Andreas Vorholzer; Verena Petermann
Justus Liebig University Gießen

CHARACTERIZATION OF LEARNING CHALLENGES LINKED TO INQUIRY-BASED PRACTICAL WORK: A SYSTEMATIC LITERATURE REVIEW

Fru Akuma¹; Estelle Gaigher¹; Jenna Koenen²
¹University of Pretoria; ²Technical University of Munich

A SECONDARY ANALYSIS OF THE ASSOCIATION BETWEEN INQUIRY-BASED SCIENCE TEACHING PRACTICES AND NORWEGIAN STUDENTS' SCIENTIFIC LITERACY IN PISA 2015

Fredrik Jensen; Marit Kjærnsli; Erik Knain
Department of Teacher Education and School Research, University of Oslo

INQUIRY-BASED LEARNING IN A CHEMISTRY CLASS WITH 9TH GRADERS

Gábor Z. Orosz¹; Erzsébet Korom²

¹Doctoral School of Education, University of Szeged, Hungary; MTA-SZTE Science Education Research Gro; ²Institute of Education, University of Szeged, Hungary; MTA-SZTE Science Education Research Group

17:00 - 18:30 OP165 - STRAND 2 - REASONING AND CRITICAL SKILLS

Room B1

Chairperson(s): Yustika Syabandari

CRITICAL THINKING DISPOSITION IN SCIENCE RESEARCH APPRENTICESHIP PROGRAM FOR HIGH SCHOOL STUDENTS

Yehudit Judy Dori¹; Edy Merchi¹; Irit Sasson²

¹Technion, Israel Institute of Technology; ²Tel-Hai College, Upper Galilee

THE ROLE OF METALANGUAGE IN DEVELOPING METACOGNITION OF SCIENTIFIC EXPLANATION

Kok-Sing Tang

Curtin University

THE NECESSITY OF BEING AWARE OF ANOMALOUS DATA - CONCEPTUAL DEVELOPMENT WITHIN PEER COLLABORATION

Julian Heeg; Sarah Hundertmark; Johanna Kanne; Sascha Schanze

Leibniz Universität Hannover - Institute for Science Education

EXAMINING THE RELATION OF GENDER AND TRACK IN HIGH SCHOOL STUDENTS' ATTITUDE TOWARD CONVERGENCE

Yustika Syabandari¹; Rahmi Qurota Aini¹; Ai Nurlaelasari Rusmana¹; Minsu Ha¹; Jun-Ki Lee²; Sein Shin³

¹Kangwon National University; ²Chonbuk National University; ³Chungbuk National University

17:00 - 18:30 OP166 - STRAND 2 - OUT OF SCHOOL LEARNING

Room B2

Chairperson(s): Michaela Marth

ANALYSIS OF A MONITORED VISIT TO A PALEONTOLOGY MUSEUM IN BRAZIL

Marcelo Pereira; Valéria Cristina Bedin Nogueira; Rafael Gil de Castro; Marcelo Tadeu Motokane
Universidade de São Paulo

EVALUATING THE COGNITIVE EFFECTIVENESS OF OUT-OF-SCHOOL LEARNING: A PRETEST-POSTTEST RESEARCH DESIGN

Nóra Füz; Erzsébet Korom

University of Szeged, Institute of Education

MIXED-METHODS APPROACH FOR INVESTIGATING LEARNING PROCESSES IN A SCIENCE OUT-OF-SCHOOL LAB

Sönke Janssen; Gunnar Friege

Leibniz Universität Hannover

TECHNOLOGY INTEREST IN A STUDENT-CENTERED INTERVENTION ABOUT BIONICS

Michaela Marth; Franz X. Bogner

University of Bayreuth

17:00 - 18:30 OP167 - STRAND 6 - LEARNING ABOUT SCIENCE AND SCIENTISTS

Room B3

Chairperson(s): Constantinos P. Constantinou

THE DEVELOPMENT OF "NATURE OF SCIENCE" REPRESENTATIONS WITHIN AN INTERNSHIP IN LABORATORIES

Vincent VOISIN¹; Juliane MIOT²

¹Laboratoire ÉRCAÉ, Université d'Orléans; ²Université d'Orléans

DO STUDENTS GAIN SCIENTIFIC INQUIRY KNOWLEDGE BY PARTICIPATING IN A SCHOOL GARDEN INQUIRY UNIT?

Carmen Carrion; Renee Schwartz

Georgia State University

AESTHETIC ENCOUNTERS IN A COLLEGE MICROBIOLOGY LAB

Sarah El Halwany; Larry Bencze

OISE, University of Toronto

INVESTIGATION OF CONNECTIONS BETWEEN UNDERSTANDING SCIENCE CONCEPTS AND APPRECIATION OF THE NATURE OF SCIENCE

Maria Charalambous; Nicos Papadouris; [Constantinos P. Constantinou](#)
University of Cyprus

17:00 - 18:30 **OP06 - STRAND 8 - STUDENTS' UNDERSTANDING OF BODY AND HEALTH** **Room B4**

Chairperson(s): Pei-Ling Lin

CONCEPTUAL CHANGE IN SOCIOSCIENTIFIC ISSUES: LEARNING OF OBESITY

[Jessica Shuk Ching Leung](#)¹; Maurice Man Wai Cheng²
¹The University of Hong Kong; ²The University of Waikato

DEBATING ABOUT ORGAN TRANSPLANTATION: SCIENTIFIC MODELS AND ETHICAL CONCERNS

[Isabel Pau-Custodio](#); [Conxita Márquez](#)
Universitat Autònoma de Barcelona

WHAT CAN MAKE US SLIM? MEDIA USAGE INFLUENCE PARTICIPANT'S SCIENTIFIC LITERACY IN MEDIA

[Pei-Ling Lin](#); Chun-Yen Chang
Science Education Centre, National Taiwan Normal University

"THE BRAIN NEEDS NUTRITION" STUDENTS METAPHORICAL LANGUAGE ABOUT FOOD DEGRADATION AND NUTRITIONAL UPTAKE ON A NATIONAL TEST

[Alma Jahic Pettersson](#)¹; Kristina Danielsson²; Carl-Johan Rundgren³
¹Department of Social and Welfare Studies, Technology and Science Education Research; ²Department of Swedish; ³Department of Mathematics and Science Education

17:00 - 18:30 **OP169 - STRAND 9 - ENGAGING WITH SUSTAINABILITY I** **Room B5**

Chairperson(s): Daniel Olsson

DEVELOPING A SUSTAINABLE SCHOOL: THE ROLE OF SCIENCE TEACHERS AS CHANGE AGENTS

[Birgitte Bjønness](#); Astrid Sinnes
Norwegian University of Life Sciences

WHAT STUDENTS THINK AND DO FOR AN ALTERNATIVE FUTURE THREE YEARS AFTER A SCIENCE-INFORMED ENERGY COURSE

[Shih-Yeh Chen](#); Shiang-Yao Liu
National Taiwan Normal University

DEVELOPMENT AND VALIDATION OF AN INSTRUMENT FOR MEASURING STUDENTS' SUSTAINABILITY COMPETENCES

[Eva-Maria Waltner](#)¹; Werner Rieß²
¹University of Education Freiburg; ²University of Education Freiburg, Department of Biology and Pedagogy of Biology

EFFECTS OF GREEN SCHOOLS IN TAIWAN ON STUDENTS' SUSTAINABILITY CONSCIOUSNESS

[Daniel Olsson](#)¹; Niklas Gericke¹; Tzuchau Chang²
¹Department of Environmental and Life Sciences, Karlstad University; ²Graduate Institute of Environmental Education, National Taiwan Normal University, Taiwan

17:00 - 18:30 **OP170 - STRAND 9 - THE PEDAGOGY OF ENVIRONMENTAL EDUCATION I** **Room B6**

Chairperson(s): Wisam Sedawi

EXPLORING GREEK PRIMARY STUDENTS' INTENTION OF CONSUMING SEASONAL, ORGANIC, LOCAL FRUITS

[Athanasia Papadopoulou](#); Dimitrios Charalampous; Alexandros Georgopoulos; George Malandrakis
Aristotle University of Thessaloniki

THE EFFECTS OF GARDENING ON STEM IDENTITY FOR UNDERREPRESENTED YOUTH

[Rita Hagevik](#)¹; Kathy Trundle²
¹The University of North Carolina at Pembroke; ²Utah State University

THE ROLE-PLAYING GAME AS AN INNOVATIVE DIDACTIC PROPOSAL TO PROMOTE ATTITUDES AND VALUES FOR THE ENVIRONMENT IN HIGH SCHOOL SCIENCE STUDENTS

[Erika Gonzalez-Sanchez](#); Vito Brero; Maria del Carmen Acebal
University of Malaga

EXPLORING ENVIRONMENTAL IDENTITY THROUGH PLACE-BASED EDUCATION AND INTERGENERATIONAL SOCIAL DISCOURSE

Wisam Sedawi; Orit Ben-Zvi Assaraf
Ben Gurion University of the Negev

17:00 - 18:30 **OP171 - STRAND 12 - IDENTITIES, BELONGINGNESS AND ENGAGEMENT IN STEM** **Room B7**

Chairperson(s): **Eva Silfver**

(DIS)EMBODIED MASCULINITY AND THE MEANING OF (NON)STYLE IN PHYSICS AND COMPUTER SCIENCE AND ENGINEERING EDUCATION

Andreas Ottemo¹; Allison Gonsalves²; Anna Danielsson³
¹University of Gothenburg; ²McGill University; ³Uppsala University

THE 'BEYONCÉ GIRLS' AND THE SHIFTING ENGAGEMENT WITH SCIENCE ACROSS HOME, SCHOOL AND THE SCIENCE MUSEUM

Spela Godec
UCL Institute of Education

UNDERGRADUATE SCIENCE MAJORS' IDENTITY WORK IN THE CONTEXT OF A SCIENCE OUTREACH PROGRAM: UNDERSTANDING THE ROLE OF SCIENCE CAPITAL

Allison Gonsalves; Alexandre Cavalcante; Hailey Iacono
McGill University

UAE CHILDREN'S PERCEPTIONS OF SCIENTISTS AND THEIR WORK: THE 'DRAW A SCIENTIST' TEST

Martina Dickson
Emirates College for Advanced Education

THE OUTSIDER WITHIN: GIFTEDNESS AND GEEKINESS AS POTENTIAL SIGNIFIERS OF BELONGING IN SCIENCE EDUCATION

Eva Silfver; Anna Danielsson
Department of Education

17:00 - 18:30 **OP172 - STRAND 1 - MODELING, STRUCTURE AND FUNCTION** **Room C1**

Chairperson(s): **Erlina Erlina**

REPRESENTATIONS OF STUDENTS ABOUT THE INTERNAL STRUCTURE OF A CARBONATED DRINK. PRELIMINARY STUDY

Joaquín Cañero-Arias¹; Ángel Blanco-López¹; José María Oliva-Martínez²; Isabel María Cruz-Lorite¹
¹University of Málaga; ²University of Cádiz

USING MODELING PERSPECTIVE TO SOLVE REAL-LIFE PHYSICS PROBLEMS VIA MATHEMATICAL MODELING

Tugba Yuksel; Demet Baran Bulut
Recep Tayyip Erdogan University

DEVELOPING BIOMIMETICS STEM ACTIVITY QUERYING THE RELATIONSHIP BETWEEN STRUCTURE AND FUNCTION IN ORGANISMS

Hilmi DOĞAN¹; Ayşe SAVRAN GENCER²; Kadir BİLEN³
¹Yeniköy Ortaokulu; ²Pamukkale University; ³Alaattin Keykubat University

SHAPE OF MOLECULE CARDS (SOMCARDS) AND MOLECULAR MODEL BUILDING (MMB) TO ENHANCE STUDENT'S UNDERSTANDING OF MOLECULAR GEOMETRY

Erlina Erlina¹; Chris Cane²; Dylan Williams³
¹Department of Chemistry Education, Faculty of Teacher Training and Education, Universitas Tanjungpur; ²GENIE-CETL Department of Genetics, University of Leicester, UK; ³Department of Chemistry, University of Leicester, UK

17:00 - 18:30 **OP173 - STRAND 5 - TEACHING AND LEARNING ABOUT ELECTROMAGNETISM** **Room D1**

Chairperson(s): **Daniele Buongiorno**

TEACHING THE CONTINUOUS SPECTRUM OF THE STARS WITHIN PHYSICS COURSES: A MODULE AND THE STUDENTS' LEARNING OUTCOMES

Ioannis Kardaras; Maria Kallery
Department of Physics, Aristotle University of Thessaloniki

DEMONSTRATING THE ROLE OF TRANSDUCTION IN THE TEACHING AND LEARNING OF SCIENCE: THE CASE OF STUDENTS LEARNING ABOUT MAGNETIC FIELD

John Airey¹; Trevor Volkwyn²
¹Department of Mathematics and Science Education Stockholm University; ²Department of Physics, Uppsala University

CONCRETENESS FADING IN LEARNING FARADAY'S LAW

[Tommi Kokkonen](#)¹; Lennart Schalk²

¹University of Helsinki, Department of Physics; ²PH Schwyz

DESIGN-BASED RESEARCH METHODS TO DEVELOP AN EDUCATIONAL PROPOSAL ON OPTICAL SPECTROSCOPY FOR SECONDARY SCHOOL STUDENTS

[Daniele Buongiorno](#); Marisa Michelini

University of Udine

17:00 - 18:30 OP174 - STRAND 10 - COMPARATIVE STUDIES IN CURRICULUM

Room D2

Chairperson(s): Eva Lundqvist

AN ASSESSMENT FRAMEWORK FOR HIGHER EDUCATION IN PHYSICS: OUTCOMES OF THE CALOHEE PROJECT

[Ornella Pantano](#)

Department of Physics and Astronomy, University of Padova

A COMPARISON OF THE EXTENT TO WHICH INDONESIAN AND SOUTH AFRICAN SCIENCE TEACHERS PREFER THE CITIZENSHIP-CENTRED IDEOLOGY FOR SCHOOL SCIENCE

[Lindelani Mnguni](#)¹; Ahmad Zaky El Islami²

¹University of South Africa; ²Universitas Sultan Ageng Tirtayasa

A COMPARATIVE SURVEY REFERRING TO SCIENCE TEACHING AND LEARNING IN TWELVE COUNTIES

[Rachel Mamlok-Naaman](#); Ron Blonder

Weizmann Institute of Science

TEACHING TRADITIONS IN TEACHERS' TALK ABOUT SCIENCE EDUCATION IN SWEDEN, ENGLAND AND FRANCE

[Eva Lundqvist](#); Malena Lidar

Department of Education, Uppsala University

17:00 - 18:30 OP175 - STRAND 11 - ASSESSING STUDENTS ACHIEVEMENTS

Room D3

Chairperson(s): Pascale Montpied

IDENTIFICATION AND DEVELOPMENT OF SCIENTIFIC TALENTS OF LOWER ELEMENTARY STUDENTS IN SOUTH KOREA

[Soo-Young Lee](#)¹; Youngseok Jhun¹; Kapsu Kim¹; Yoonkyung Seo¹; Hae-Ae Seo²

¹Seoul National University of Education; ²Busan National University

SCIENTIFIC METHODS IN HIGH STAKES CHEMISTRY EXAMINATIONS: DIVERSITY OR DISPARITY?

[Alison Cullinane](#)¹; Sibel Erduran²; Stephen Wooding³

¹Department of Education; ²University of Oxford; ³AQA

EXPLORING PHYSICS TEACHERS' ASSESSMENT PRACTICES - A STUDY ABOUT THE ROLE OF LANGUAGE

[Markus Sebastian Feser](#); Dietmar Höttecke

Universität Hamburg - Physikdidaktik

STATISTICALLY DETECTED PATTERNS ASSOCIATING SPECIFIC VARIABLES CHARACTERIZING PISA-SCIENCE ITEMS ARE INTERFERING SIGNIFICANTLY WITH FRENCH POPULATION/SUBPOPULATIONS SCORES.

[Pascale Montpied](#)¹; Mylene Duclos²; Florence Le Hebel³; Valerie Fontanieu⁴

¹Centre National de la Recherche Scientifique; ²University Lyon 2 (LEL doctorat); ³University Lyon 2; ⁴Ecole Normale Supérieure

17:00 - 18:30 OP176 - STRAND 4 - SIMULATIONS AND EDUCATIONAL GAMES IN PHYSICS II

Room E2 - Italia

Chairperson(s): Marta Koc Januchta

USING SMARTPHONES AND TABLETS AS EXPERIMENTAL TOOLS IN PHYSICS LESSONS: EFFECTS ON LEARNING AND MOTIVATION AT SECONDARY SCHOOL LEVEL

[Alice Gasparini](#); Marine Delaval; Andreas Müller

University of Geneva

EVALUATION OF A FEEDBACK-SUPPORTED LEARNING APP TO PROMOTE STUDENTS' UNDERSTANDING OF PCR AND GEL ELECTROPHORESIS DURING HANDS-ON EXPERIMENTATION

[Markus Bergmann](#); Angela Sandmann; Christine Florian

Duisburg-Essen University

PROMOTING SCIENTIFIC UNDERSTANDING FOR LOW-SKILLED COMPREHENDERS THROUGH ANIMATED MULTIMODAL TEXTS

Maximiliano Montenegro¹; Alejandra Meneses¹; Len Unsworth²; Soledad Véliz¹; Pablo Escobar¹; Marion Garolera¹; María Paz Ramírez¹

¹Pontificia Universidad Católica de Chile; ²Australian Catholic University

ASKING QUESTIONS TO ENGAGE WITH BIOLOGY: INVESTIGATING STUDENTS' INTERACTION AND LEARNING WITH AN AI-BASED TEXTBOOK

Marta Koc-Januchta¹; Konrad Schönborn¹; Lena A. E. Tibell¹; Vinay K. Chaudhri²; Craig Heller³

¹Department of science and technology, Linköping University; ²Independent Consultant; ³Biology Department, Stanford University

17:00 - 18:30 **OP177 - STRAND 7 - LOCATING SCIENTIFIC THINKING, CRITICAL THINKING AND ARGUMENTATION IN SCIENCE CURRICULA** **Room F1**

Chairperson(s): Sarah Hayes

5TH, 6TH, 7TH GRADERS' UNDERSTANDINGS ABOUT SCIENTIFIC INQUIRY: AN INTERTWINED PBL & HOS APPROACH

Ferah Ozer¹; Nihal Dogan²

¹Bogazici University; ²Abant Izzet Baysal University

LOOKING BACKWARDS TO MOVE FORWARDS: CHANGING OPPORTUNITIES FOR ARGUMENTATION IN BRITISH SCIENCE CURRICULA SINCE 1989

Liam Guilfoyle; Judith Hillier; Ann Childs

University of Oxford

PROMOTING ARGUMENTATION THROUGH OUTREACH IN POST-PRIMARY SCIENCE CLASS

Laurie Ryan; Peter Childs; Sarah Hayes

University of Limerick

SCIENCE EDUCATION AS THINKING: THE BEAUTY OF SCIENTIFIC THINKING AND CRITICAL THINKING

María-Antonia Manassero-Mas¹; Angel Vazquez-Alonso²

¹University of the Balearic Islands; ²University of Balearic Islands

17:00 - 18:30 **OP178 - STRAND 15 - LEARNING ABOUT BIOLOGY AND HEALTH IN EARLY CHILDHOOD SCIENCE** **Room F2**

Chairperson(s): Lisa Borgerding

YOUNG CHILDREN'S REASONING ABOUT VARIATION WITHIN POPULATIONS IN THE CONTEXT OF A PROBLEM-EXPLORING TASK

Corinne Jegou¹; Marida Ergazaki²; Julie Gobert¹; Alice Delserieys¹

¹Aix-marseille Université; ²University of Patras (Greece)

MY HEART IS HAPPY: AN EXPERIENCE WITH EARLY CHILDHOOD EDUCATION CHILDREN TO TEACH THEM HOW TO TAKE CARE OF THEIR HEARTS

Esther Cascarosa; Beatriz Mazas Gil; Ester Mateo González

University of Zaragoza

PRESCHOOL CHILDREN'S IDEAS ABOUT BIOLOGICAL ADAPTATION DURING A SUMMER SCIENCE CAMP

Lisa Borgerding; Fatma Kaya

Kent State University

17:00 - 18:30 **OP179 - STRAND 18 - METHODOLOGICAL ISSUES IN SCIENCE EDUCATION RESEARCH - PERSPECTIVES ON ISSUES OF AFFECT AND ATTITUDES** **Room F3**

Chairperson(s): Anni Loukomies

A SYSTEMATIC REVIEW OF SCIENCE EDUCATION ATTITUDE INSTRUMENTS PSYCHOMETRIC PROPERTIES

Radu Bogdan Toma¹; Norman G. Lederman²; Jesús Ángel Meneses Villagrà¹

¹Universidad de Burgos; ²Illinois Institute of Technology

THE STRANGE CASE OF CREATIONISTS THAT ACCEPT EVOLUTION: METHODOLOGICAL CONSIDERATIONS

Anna Beniermann¹; Dittmar Graf²

¹Humboldt University of Berlin; ²Institute of Biology Education

IS IT TIME TO RE-EXAMINE THE DOMINANT NARRATIVE IN PRIMARY SCIENCE?

Hellen Remnant
Canterbury Christ Church University

INSTANT VIDEO BLOGGING AS A METHOD FOR EXPLORING SCIENCE-RELATED ACADEMIC EMOTIONS

Anni Loukomies¹; Kalle Juuti²; Jari Lavonen²
¹University of Helsinki, Viikki teacher training school; ²University of Helsinki, Faculty of education

17:00 - 18:30 **OP118 - STRAND 13 - TEACHER IDENTITY AND SELF-UNDERSTANDING** **Room G1**

Chairperson(s): Dekant Kiran

TEACHER IDENTITY: WHAT THE COMPONENTS OF THE INSTITUTIONAL TUITION PROGRAM FOR TEACHING INITIATION (PROGRAMA INSTITUCIONAL DE BOLSAS DE INICIAÇÃO A DOCÊNCIA - PIBID) IN A UNIVERSITY (SP-BRAZIL) UNDERSTAND BY THAT CONCEPT.

Gustavo Leme; Magda Pechliye
Presbiteriana Mackenzie University

WHAT IT TAKES TO BE A GOOD SCIENCE TEACHER? PROJECT-BASED LEARNING AS AN IMPETUS FOR STUDENT-TEACHERS' PROFESSIONAL GROWTH

Dina Tsybulsky; Yulia Muchnik-Rozanov
Technion Israel Institute of Technology

PRE-SERVICE ELEMENTARY TEACHERS' RECOGNITION OF SELF-UNDERSTANDING AND CHANGE CAPACITY RELATED TO SCIENCE EDUCATION

Yong Jae Joung¹; Heekyong Kim²; Kwanghee Jo³; Jaehyeok CHOI⁴
¹Gongju National University of Education; ²Kangwon National University; ³Chosun University; ⁴Chonnam National University

ANTECEDENTS OF PRESERVICE SCIENCE TEACHERS' SCIENCE TEACHING EFFICACY BELIEFS

Dekant Kiran
Tokat Gaziosmanpasa University

17:00 - 18:30 **OP181 - STRAND 13 - PEDAGOGICAL CONTENT KNOWLEDGE II** **Room G2**

Chairperson(s): Isabel Zudaire

PEDAGOGICAL CONTENT KNOWLEDGE ABOUT REDOX REACTIONS: A CROSS-LEVEL STUDY

Luciane Goes¹; Carmen Fernandez²
¹Postgraduate Program in Science Teaching, University of São Paulo; ²Institute of Chemistry - University of São Paulo

CONSTRUCTING PROFICIENCY LEVELS FOR PRE-SERVICE PHYSICS TEACHERS' PEDAGOGICAL CONTENT KNOWLEDGE

Dustin Schiering; Stefan Sorge; Knut Neumann
IPN

LAND USE CHANGE AND FUTURE SPATIAL DEVELOPMENT. AN EDUCATIONAL RECONSTRUCTION OF GEOSPATIAL CK AND PCK FOR PRE-SERVICE PRIMARY SCHOOL TEACHERS

Karin Huser¹; Kai Niebert²; Norman Backhaus²; Sibylle Reinfried³
¹Universität Zürich; Pädagogische Hochschule Zürich; ²Universität Zürich; ³emeritus

PRESERVICE BIOLOGY TEACHERS' PROFESSIONAL KNOWLEDGE FOR GENETICS INSTRUCTION

Isabel Zudaire; Irantzu Uriz; Maria Napal
Public University of Navarra

17:00 - 18:30 **OP182 - STRAND 13 - AFFECT AND EMOTION IN PRE-SERVICE TEACHER EDUCATION** **Room G3**

Chairperson(s): Carolina Pipitone

ASSESSING EMOTIONS AND TASK VALUES TOWARDS THE INTEGRATIVE USE OF MATHEMATICS IN BIOLOGY

José María Marcos Merino; Rocío Esteban; Jesús A. G. Ochoa de Alda
University of Extremadura

PRIMARY PRE-SERVICE TEACHERS' EMOTIONS AND INTERESTS ABOUT INSECTS

Borja Gómez Prado¹; Blanca Puig Mauriz²; Maria Evagorou³
¹Universidade de Santiago de Compostela; ²Universidade Santiago de Compostela; ³University of Nicosia

AFFECTIVE EFFECTS OF IMPLEMENTING TECHNICAL RESEARCH IN TEACHER TRAINING

Andrea Maria Schmid¹; Markus Rehm²; Dorothee Brovelli¹
¹University of Teacher Education Lucerne; ²University of Education Heidelberg

EMOTIONS & SCIENCE IN THE INITIAL TEACHER TRAINING: THE IMPORTANCE OF REFLECTING ON THEIR RELATIONSHIP

Carolina Pipitone; Àngela García Lladó; Fina Guitart; Carlos Agudelo
 Universitat de Barcelona

17:00 - 18:30 **OP183 - STRAND 14 - ACTION RESEARCH AND PROFESSIONAL LEARNING COMMUNITIES II** **Room G4**

Chairperson(s): Majken Korsager

JAPANESE LESSON STUDY AS A FORM OF ACTION RESEARCH TO IMPROVE DISCIPLINE LITERACY IN SCIENCE AND MATH

Irina Falls; Rita Hagevik
 University of North Carolina at Pembroke

EXPLORING TEACHER'S BELIEFS AND ATTITUDES TOWARDS TEACHING PHYSICS DURING A LESSON STUDY INTERVENTION.

Estelle Gaigher; Ayodele Ogegbo
 University of Pretoria

TEACHER KNOWLEDGE EXCHANGES AND TRANSFORMATIONS DURING COLLABORATIVE CORE DESIGN

Jared Carpendale¹; Anne Hume²
¹Monash University; ²University of Waikato

TEACHERS ON THE "MATH AND SCIENCE TRAILS" (MAST) TO BECOME REFLECTIVE PRACTITIONERS

Majken Korsager; Maria Gaare Dahl; Berit Reitan
 Norwegian Centre for Science Education, University of Oslo

17:00 - 18:30 **OP184 - STRAND 14 - DEVELOPMENT OF REFLECTIVE PRACTICE** **Room G5**

Chairperson(s): Corina González-Weil

EXPLORING SECONDARY SCIENCE TEACHER BELIEFS AND PRACTICES THROUGH REFLECTIVE PRACTICE

Preethi Titu¹; Gillian Roehrig¹; Joshua Ellis²
¹University of Minnesota; ²Florida International University

INTERDISCIPLINARY REFLECTIVE TOOL ON SCHOOL SCIENCE AND MATHEMATICS

Georgios Kritikos; Andreas Moutsios-Rentzos; Vasileia Pinnika; Fragkiskos Kalavasis
 University of the Aegean

EARLY CHILDHOOD AND PRIMARY TEACHERS' EXPECTATIONS OF REFLECTIVITY IN SCIENCE EDUCATION

Ana Moncada-Arce
 Universidad de O'Higgins

LESSON STORIES: TEACHER REFLECTION AND RESEARCH TOOL FOR SCIENCE TEACHING

Camilo Henríquez-Miranda¹; Corina González-Weil¹; Paulina Bravo²
¹Pontificia Universidad Católica de Valparaíso; ²UCL Institute of Education

17:00 - 18:30 **OP185 - STRAND 16 - MICRO AND MACRO SCALE SCIENCE IN PRIMARY SCHOOLS** **Room G6**

Chairperson(s): Sinem Güçhan Özgü

WHAT IS CITY AIR MADE OF? AN ANALYSIS OF PUPILS' CONCEPTIONS OF CLEAN AND POLLUTED AIR FROM THE MODEL MATTER PERSPECTIVE

Èlia Tena; Digna Couso
 CRECIM-UAB

A TEACHING APPROACH ABOUT NANOSCALE SCIENCE AND TECHNOLOGY CONTENT: EVALUATION OF PRIMARY SCHOOL STUDENTS' LEARNING

George Peikos; Anna Spyrtou; Dimitris Pnevmatikos; Penelope Papadopoulou
 University of Western Macedonia, Greece

INTRODUCING IRANIAN PRIMARY CHILDREN TO ATOMS AND MOLECULES

Fatima Baji¹; Carole Haeusler²
¹Ahvaz Jundishapur University of Medical Sciences, ahvaz, Iran; ²University of Southern Queensland

THE EXAMINATION OF QUESTIONING METHODS ON YOUNG CHILDREN'S CONCEPTUAL UNDERSTANDING OF ASTRONOMY

Sinem Güçhan Özgül¹; Mesut Saçkes¹; Berrin Akman²
¹Balikesir University; ²Hacettepe University

17:00 - 18:30 **OP186 - STRAND 17 - FIRST YEAR UNIVERSITY COURSES** **Room G7**

Chairperson(s): **Elina Laurila**

"WHAT I KNOW AND HOW DO I KNOW WHAT I KNOW?" - THE DEVELOPMENT OF PHARMACY STUDENTS' CONCEPTUAL AND EPISTEMOLOGICAL UNDERSTANDING DURING THE FIRST STUDY YEAR

Ilona Södervik; Nina Katajavuori; Leena Hanski
 University of Helsinki

SCAFFOLDING RESEARCH-LIKE LABORATORY PROJECTS FOR FIRST YEAR SCIENCE AND TECHNOLOGY STUDENTS

Rikke Frøhlich Hougaard; Birgitte Lund Nielsen
 Aarhus University

NARRATIVES AND EXPECTATIONS: FIRST-YEAR STUDENTS' TRANSITION INTO HIGHER EDUCATION

Andrea Fransiska Møller Gregersen; Lars Ulriksen
 Department of Science Education, University of Copenhagen

THE EFFECTS OF THE FIRST LABORATORY COURSE ON THE PRACTICAL AND SCIENTIFIC REPORTING SKILLS OF CHEMISTRY STUDENTS

Elina Laurila; Piia Nuora
 University of Jyväskylä

17:00 - 18:30 **OP187 - STRAND 17 - PRACTICAL WORK AND ENGAGEMENT AT UNIVERSITY LEVEL** **Room G8**

Chairperson(s): **Marina Constantinou**

PRACTICAL EXERCISES IN UNIVERSITY MECHANICS

Jesper Haglund; Jan Andersson; Marcus Berg
 Department of Engineering and Physics, Karlstad University

SCAFFOLDING AFFECTIVE ENGAGEMENT IN COLLEGE: THE CASE OF AN LA-SUPPORTED COLLEGE BIOLOGY COURSE

Hagit Kornreich-Leshem¹; Sat Gavassa-Becerra²; Laird Kramer³
¹STEM Transformation Institute, Florida International University; ²Department of Biological Sciences, Florida International University; ³Department of Physics, STEM Transformation Institute, Florida International University

HOW DO STUDENTS USE THE ACTIVE LEARNING ACTIVITIES AVAILABLE TO THEM IN A UNIVERSITY CHEMISTRY COURSE?

Mildrid Kyte; Matthias Gregor Stadler
 University of Bergen

DOES PRACTICAL WORK, WORK? A LOOK INTO UNDERGRADUATE BIOLOGY EDUCATION

Marina Constantinou; Ian Abrahams
 University of Lincoln

TUESDAY 9:00 - 11:00**09:00 - 11:00 Symposium 28 - CRITICAL AND ACTIVIST-ORIENTED SCIENCE EDUCATION: ATTUNEMENTS TO CONTEXTS Room A1****Chairperson(s): Sarah El Halwany, Discussant: Ralph Levinson****TEACHING POWER RELATIONS IN SOCIOSCIENTIFIC ISSUES: TOWARDS ACTIVISM IN SCIENCE EDUCATION**Majd Zouda; Sarah El Halwany; Minja Milanovic; Nadia Qureshi; Zoya Padamsi; John Bencze
OISE, University of Toronto**FOSTERING STUDENTS' UNDERSTANDING OF SOCIOSCIENTIFIC ISSUES AND THEIR WILLINGNESS TO TAKE ACTION: USE OF RESEARCH-BASED SSI INSTRUCTION**Yunhee Choi¹; Hyunju Lee²
¹Soongmoon Middle School, Seoul, South Korea; ²Ewha Womans University, Seoul, South Korea**FINDING A 'GOOD' PLACE: A 'PLEASURABLE' IMPLEMENTATION OF NEW SCIENCE PEDAGOGY**Minja Milanovic; Sarah El Halwany; Nadia Qureshi; Zoya Padamsi; Majd Zouda; John Bencze
OISE, University of Toronto**INTERNATIONAL PRESERVICE TEACHER COLLABORATIONS: CONCEPTIONS OF, AND ORIENTATIONS TO, ACTIVISM IN SCIENCE EDUCATION**Lyn Carter¹; John Bencze²
¹Australian Catholic University, Melbourne; ²OISE, University of Toronto**09:00 - 11:00 Symposium 47 - SCIENCE (&) EDUCATION: CONTRIBUTIONS FROM HISTORY, PHILOSOPHY AND SOCIOLOGY OF SCIENCE Room A2****Chairperson(s): Kostas Kampourakis; Discussant: Igal Galili****RECONSIDERING THE MEANING OF CONCEPTS IN BIOLOGY EDUCATION**Kostas Kampourakis
University of Geneva**EPISTEMIC CORE OF CHEMISTRY IN TEACHER EDUCATION: PRACTICAL APPROACHES AND EMPIRICAL EVIDENCE**Sibel Erduran¹; Ebru Kaya²
¹University of Oxford; ²Bogazici Univeristy**THE RELEVANCE OF NATURE OF SCIENCE PERSPECTIVES IN SCIENCE TEACHING AIMING FOR SOCIAL JUSTICE**Lena Hansson¹; Hagop A. Yacoubian²
¹Kristianstad University; ²Lebanese American University**WORLDVIEWS, PHILOSOPHY AND SCIENCE EDUCATION**Michael Reiss
UCL Institute of Education**09:00 - 11:00 Symposium 05 - AESTHETICS AS SENSING AND UNDERSTANDING: A CRITICAL INQUIRY INTO POTENTIALS AND CHALLENGES OF AN AESTHETICS-ORIENTED SCIENCE EDUCATION Room B1****Chairperson(s): Edvin Østergaard; Discussant: Elizabeth Cavicchi****HOW TO CARE WITH POLAR BEARS AND JACQUES RANCIERE: AN EXPLORATION OF POLITICAL AESTHETICS IN SCIENCE EDUCATION**Steven Alsup
Faculty of Education and Department of Science and Technology Studies**TASTE IN SCIENCE AND TRANSDISCIPLINARY EDUCATION**Erik Fooladi
Dep. of science and mathematics, Volda University College**THE BEAUTY THAT EMERGES WITHIN AESTHETIC LEARNING PROCESSES OPENS THE POSSIBILITIES FOR A DEEPER UNDERSTANDING AND KNOWLEDGE OF SCIENCE**Ulrika Tobieson; Ann Mutvei
Södertörns University**BEING A LISTENER. EXPLORING AND UNDERSTANDING SOUND**Edvin Østergaard
Norwegian University of Life Sciences

09:00 - 11:00 **Symposium 06 - DIVERSITY OF APPROACHES TO COGNITIVE ACCELERATION IN SCIENCE AND MATHEMATICS EDUCATION** **Room B2**

Chairperson(s): Reuven Babai, Geneviève Allaire-Duquette; **Discussant:** Anita Backhouse

TONGAN TEACHERS' PERCEPTIONS ON IMPLEMENTING A COGNITIVE ACCELERATION IN MATHEMATICS EDUCATION PROGRAM

David Treagust; Teukava Finau; Mihye Won
Curtin University, Australia

EXPLORING AND CATEGORISING SMALL GROUP TALK IN CASE LESSONS

Alan Edmiston¹; Geneviève Allaire-Duquette²
¹University of Brunel & Let's Think Charity, UK; ²Tel Aviv University, Israel

LEARNING TO TEACH THROUGH QUESTIONING AMONG PRE-SERVICE ELEMENTARY TEACHERS

Jean-Philippe Ayotte-Beaudet¹; Alexandra Auclair²
¹University of Sherbrooke, Canada; ²University of Quebec in Montreal, Canada

AN INTERVENTION OF SEVERAL CASE LESSONS SIGNIFICANTLY ACCELERATES STUDENTS' INQUIRY ABILITIES

Reuven Babai; Adi Mor Yosef
Tel Aviv University, Israel

09:00 - 11:00 **Symposium 07 - UPCOMING RESEARCH IN SCIENCE IDENTITIES** **Room B3**

Chairperson(s): Henriette Holmegaard, Louise Archer; **Discussant:** Justin Dillon

"IT'S LIKE HAVING TO GO BACK INTO THE CLOSET EVERY DAY": A NARRATIVE INQUIRY EXAMINING THE IMPACTS HETERONORMATIVITY AND HETEROSEXISM HAVE ON THE EXPERIENCES OF GAY MEN IN STEM MAJORS

David Paul Steele
University of Georgia

DOING FIELDWORK IN GEOLOGY: PROCESSES OF NEGOTIATIONS AND IDENTITY

Rie Hjørnegaard Malm
University of Oslo

A COMPARISON OF GENDER IDENTITY CONSTRUCTION FOR ELITE FEMALE BIOSCIENTISTS AND PHYSICISTS IN THE UK

Jaimie Miller-Friedmann
University of Oxford

POSITIONS IN DISCOURSE: A CRITICAL REWORKING OF IDENTITY PERSPECTIVES IN PHYSICS EDUCATION RESEARCH

Anders Johansson
University of Uppsala

09:00 - 11:00 **Symposium 08 - TEACHERS UNDERSTANDING OF LANGUAGE AND LITERACY AS A KEY FOR INCLUSIVE SCIENCE EDUCATION (ISE)** **Room B4**

Chairperson(s): Anders Jakobsson; **Discussant:** Russell Tytler

TEACHERS' REFLECTIONS ON SCIENCE EDUCATION FROM A LANGUAGE PERSPECTIVE

Anders Jakobsson¹; Clas Olander¹; Maaïke Hajer²
¹Malmö University; ²Utrecht University

PHYSICS TEACHERS' DESIGN PROCESS FOR CONTEXTUALIZING LANGUAGE-BASED PHYSICS ACTIVITIES IN MULTILINGUAL MAINSTREAM CLASSES

Maria Kouns
Malmö University

A DESIGN FOR LANGUAGE SENSITIVE TEACHER EDUCATION IN SCIENCE AND TECHNOLOGY

Gerald Van Dijk
Utrecht University

REALIZING INCLUSIVE TEACHING IN PRIMARY SCIENCE CLASSROOMS: TEACHERS' DEVELOPMENT ACROSS THREE NATIONAL CONTEXTS

Jantien Smit¹; Anne Bergliot Øyehaug²; Maria Kouns³; Elwin Savelsbergh¹; Maaïke Hajer¹
¹Utrecht University; ²Faculty for teacher education and pedagogy, Hamar; ³Malmö University

09:00 - 11:00 Symposium 09 - THE QUESTION OF RESPONSIBILITY IN SCIENCE|ENVIRONMENT|HEALTH Room B5

Chairperson(s): Alla Keselman; Discussant: Albert Zeyer

HEALTH EDUCATION IN SCHOOL — A PARADOX OF RESPONSIBILITY?

Claes Malmberg; Anders Urbas
Halmstad University

CREATING PEDAGOGIES FOR SUSTAINABILITY IN CHILE THROUGH CHEMISTRY EDUCATION: BENEFITS AND CHALLENGES FROM TEACHERS' PERSPECTIVES

Denise Quiroz Martinez
University College, London

WHAT KNOWLEDGE DO STUDENTS NEED IN ORDER TO FORM DECISIONS CONCERNING PREVENTIVE HEALTH ACTIONS? THE EXAMPLE OF SUGAR CONSUMPTION AND TYPE II DIABETES

Julia Arnold; Leah Kahl
University of Applied Sciences and Arts Northwestern Switzerland

THE IMPACT OF SCIENTIFIC KNOWLEDGE ON UNIVERSITY STUDENTS' RISK PERCEPTION OF A CONTROVERSIAL HABIT

Benedikt Heuckmann; Finja Krüger
University of Muenster

09:00 - 11:00 Symposium 10 - CONNECTING THE EPISTEMIC DOTS: ADDRESSING EPISTEMIC ISSUES IN VARIOUS LEVELS OF SCIENCE EDUCATION Room B6

Chairperson(s): Frauke Voitle; Discussant: Richard Duschl

"REAL SCIENCE IS MORE DIFFICULT": INTRODUCING AND EXPLORING STUDENTS' CLASSROOM-SPECIFIC EPISTEMIC BELIEFS ABOUT SCIENCE

Frauke Voitle¹; Nele Kampa¹; Irene Neumann¹; Julia Schwanewedel²; Kerstin Kremer¹
¹Leibniz Institute for Science and Mathematics Education (IPN) at Kiel University; ²Humboldt-Universität zu Berlin

EPISTEMIC ACTIVITIES IN BIOLOGY INSTRUCTION: USING A GENERIC FRAMEWORK OF SCIENTIFIC REASONING AND ARGUMENTATION

Tobias Dorfner; Christian Förtsch; Michael Germ; Birgit J. Neuhaus
Ludwig-Maximilians-Universität München

COMPARING SCIENCE AND EDUCATION STUDIES: THE ROLE OF EPISTEMIC BELIEFS IN THE ACCEPTANCE OR REJECTION OF EDUCATION STUDIES AS PROFESSIONALLY USEFUL

Liam Guilfoyle¹; Orla McCormack²; Sibel Erduran¹
¹University of Oxford; ²University of Limerick

EXPLORING TEACHERS' UNDERSTANDINGS OF THE EPISTEMOLOGICAL DIMENSIONS OF SCIENCE AFTER PARTICIPATION IN RESEARCH

Shannon G. Davidson
Florida State University

09:00 - 11:00 Symposium 11 - COMPARING THE CONTEXTS TO UNDERSTAND SCIENCE Room B7

Chairperson(s): Thomas Forissier; Discussant: Alain Stockless

CONTEXT EFFECT BASED LEARNING PRINCIPLE AND EXPERIMENTAL MODALITIES

Thomas Forissier¹; Alain Stockless²; Jacqueline Bourdeau³
¹Université des Antilles; ²UQAM; ³TELUQ

COGNITIVE ELEMENT ANALYSIS IN LEARNERS' DRAWINGS

Claire Anjou¹; Frédéric Fournier²; Thomas Forissier¹; Audur Palsdottir³
¹Université des Antilles; ²UQAM; ³University of Iceland

ELABORATION OF A MODELING TOOL FOR THE CONTEXT EFFECTS BASED TEACHING

Roger Nkambou¹; Claire Anjou²; Yves Mazabraud²; Valéry Psyché³; Wafa Fennani¹
¹UQAM; ²Université des Antilles; ³TELUQ

CONTEXT EFFECTS IN COLLABORATIVE LEARNING: VERBAL AND NON-VERBAL INDICATORS

Lionel Pevost¹; Chloé Le Bail²; François-Xavier Bernard³; Michael Baker²; Françoise Detienne²; Jordan Gonzalez¹
¹ESIEA; ²Telecom Paristech; ³Université Paris Descartes

09:00 - 11:00 **Invited Symposium 02 - GIREP - DISCIPLINE-BASED EDUCATIONAL RESEARCH TO IMPROVE ACTIVE LEARNING AT UNIVERSITY** **Room C1**

Chairperson(s): Marisa Michelini ; **Discussant:** Robert Evans

INNOVATING PHYSICS TEACHING AND LEARNING IN THE BIO-AREA DEGREES

Daniele Buongiorno; Marisa Michelini; Alberto Stefanel
Physics Education Research Unit. Department of Mathematics, Computer Science, Physics. University of Udine, Italy

GUIDING AND ASSESSING STUDENTS' WORK IN PROJECT LABORATORY

Sergej Faletič
University of Ljubljana, Slovenia

"INTENTIONAL TEACHING": USING STUDENTS' IDEAS AS THE BASIS FOR TEACHING PHYSICS

Paula Heron
University of Washington, Seattle, USA

THE ROLE OF EXERCISES IN LEARNING. EXAMPLES BY RESEARCH IN ENGINEERING DEGREE

Jenaro Guisasaola; Kristina Zuza; Paulo Sarriugartewickman
Donostia Physics Education Research Group. Department of Applied Physics. University of the Basque Country

09:00 - 11:00 **Invited Symposium 03 - SIG 2 - VALIDITY IN VIDEO-BASED RESEARCH OF TEACHING AND LEARNING PROCESSES** **Room D1**

Chairperson(s): Andreas Vorholzer; **Discussant:** Claudia von Aufschnaiter

VALIDITY IN QUALITATIVE VIDEO-BASED RESEARCH — THE USE OF THE DOCUMENTARY METHOD IN SCIENCE EDUCATION

Helge Gresch
Westfälische Wilhelms-Universität Münster

A TYPE OF VALIDATION FOR A MULTI-SCALES APPROACH OF SCIENCE VIDEODED CLASSROOM PRACTICES

Andrée Tiberghien¹; Patrice Venturini²
¹Centre national de la recherche scientifique, laboratoire ICAR / Ecole Normale Supérieure de Lyon; ²Université Toulouse Jean Jaurès

A QUESTION OF CREDIBILITY: ANALYSING VIDEO WITH STUDENTS

Kathrin Otrell-Cass
University of Graz

CODING SCIENTIFIC QUALITY IN VIDEOTAPED INQUIRY PROCESSES: VALIDITY OF DATA INTERPRETATION

Joé Weber; Rüdiger Tiemann; Annette Upmeier zu Belzen
Humboldt-Universität zu Berlin

09:00 - 11:00 **Invited Symposium 04 - SIG 3 - A 21ST CENTURY PERSPECTIVE ON DIORAMAS** **Room D2**

Chairperson(s): Doris Ash; **Discussant:** Emily Dawson

HOW DIORAMA PROVOKE QUESTIONS CONCERNING LIFE, DEATH, SELF AND OTHER

Dawn Sanders
Unlv of Gothenborg

HOW DIORAMAS MEDIATE CULTURAL CONFLICT: 'WHAT WAS AND WHAT CAN BE'

Doris Ash
UC Santa Cruz

DIORAMAS AND DISCONNECTEDNESS FROM NATURE

Annette Scheersoij
University of Bonn

TALKING ABOUT EVOLUTION WITH NATURAL HISTORY DIORAMAS

Jesús Piqueras¹; Marianne Achiam²
¹Stockholm University; ²Univ. of Copenhagen

09:00 - 11:00 **Invited Symposium 05 - SIG 6 - RESEARCH TRADITIONS ON LANGUAGES AND LITERACIES IN SCIENCE EDUCATION** **Room D3**

Chairperson(s): Kristina Danielsson; Discussant: Brian Hand

CONTENT AND LANGUAGE INTEGRATED LEARNING (CLIL) AND SECOND LANGUAGE ISSUES IN SCIENCE EDUCATION

Angel M.Y. Lin
Faculty of Education, Simon Fraser University

TOWARDS A PEDAGOGICAL CONTENT KNOWLEDGE FOR LITERACY IN SCIENCE

Jonathan Osborne
Graduate School of Science Education, Stanford University

PRACTISING THE LITERACIES OF SCIENCE: STUDENTS CONSTRUCTING REPRESENTATIONS

Vaughan Prain; Russell Tytler
Deakin University

METALANGUAGE FOR DESCRIBING AND ANALYZING MULTIMODAL DISCOURSE OF SCIENCE

Kok-Sing Tang
Curtin University

09:00 - 11:00 **Invited Symposium 01 - THE INTERPLAY BETWEEN EDUCATIONAL DESIGNS AND DEVELOPING THEORIES OF LEARNING** **Room E2 - Italia**

Chairperson(s): Mariana Levin, United States; Discussant: Richard Noss

MAINTAINING DRAGGING IN A DYNAMIC GEOMETRY ENVIRONMENT: THE INTERPLAY BETWEEN A PSYCHOLOGICAL MODEL AND TASK DESIGN

Anna Baccaglioni-Frank
University of Pisa

TEACHERS' AND RESEARCHERS' SHARED ACTIVITIES AS A WAY TO DEVELOP LOCAL THEORIES OF LEARNING

Kalle Juuti; Jari Lavonen
University of Helsinki

LOCAL THEORIES IN STEM EDUCATION: A CRITICAL PHENOMENOLOGICAL PERSPECTIVE

Pratim Sengupta; Marie-Claire Shanahan; Miwa Takeuchi
University of Calgary

PATTERNS OF THEORY BUILDING WITHIN AND FOR INSTRUCTIONAL DESIGN

Andrea A. diSessa
University of California, Berkeley

09:00 - 11:00 **Symposium 51 - A MATURE EXAMINATION OF JUVENILE TECHNOLOGIES IN SCIENCE EDUCATION** **Room F1**

Chairperson(s): Karolina Broman, Sascha Bernholt; Discussant: Pernilla Nilsson

TEACHING CHEMISTRY WITH ONLINE DATABASES

Ron Blonder¹; Inbal Tuvi-Arad²
¹Weizmann Institute of Science; ²The Open University of Israel

EXAMINATION OF MASSIVE NUMBER OF STUDENTS' PERCEPTION OF SUCCESSFUL MOOCS

Anat Cohen
Tel Aviv University

LEARNING WITH EXPERIMENTS AND COMPUTER SIMULATIONS: A COMPARATIVE STUDY ON LEARNING PROCESSES IN THE STUDENT LABORATORY

Johanna Krüger¹; Tim Höffler²; Ilka Parchmann²
¹Kiel Science Outreach Campus, KiSOC; ²IPN, Kiel

APPLICATION OF DIGITAL TOOLS IN CHEMISTRY EDUCATION - VIRTUAL REALITY, AUGMENTED REALITY AND GAMIFICATION

Karolina Broman¹; Eva Mårell-Olsson²
¹Umeå University; ²Umeå university

09:00 - 11:00 **Symposium 38 - REPRESENTATIONAL PLURALISM IN SCIENCE EDUCATION, PHILOSOPHY AND PSYCHOLOGY** **Room F2**

Chairperson(s): Michel Bélanger; Discussant: Patrice Potvin

TENSIONS BETWEEN SCIENCE AND INTUITION ACROSS AGE, EDUCATION AND CONTEXT

Andrew Shtulman
Occidental College

COGNITIVE PLURALISM: MODELS IN AND OF SCIENTIFIC UNDERSTANDING

Stephen Horst
Wesleyan University

CONCEPTUAL PROFILES: A MODEL TO HANDLE THE PLURALISM OF MEANINGS IN SCIENCE TEACHING

Eduardo Mortimer¹; Charbel Nino El-Hani²; Edenia Maria Ribeiro do Amaral³
¹Universidade Federal de Minas Gerais; ²Universidade Federal da Bahia; ³Universidade Federal Rural de Pernambuco

EMERGENT PROPERTIES OF REPRESENTATIONAL COMPLEXES

Michel Bélanger
Université du Québec à Rimouski

09:00 - 11:00 **Symposium 03 - NEW MATERIALISM AND ITS IMPLICATIONS FOR SCIENCE EDUCATION RESEARCH METHODOLOGY -I** **Room F3**

Chairperson(s): Lindsay Hetherington

ENTANGLING METHODS: IMPLICATIONS OF NEW MATERIALIST THEORY FOR MIXED METHODS IN STE(A)M EDUCATIONAL RESEARCH

Lindsay Hetherington
University of Exeter

BEYOND DICHOTOMIES/BINARIES: 21ST CENTURY POST HUMANITIES ETHICS FOR SCIENCE EDUCATION USING A BARADIAN PERSPECTIVE

Kate Scantlebury
University of Delaware

HOW MATTER COMES TO MATTER IN THE DIFFRACTIVE ANALYSIS: SCIENTIFIC PHENOMENA AS CO-CREATORS OF KNOWLEDGE PRODUCTION

Anna Gunther-Hanssen
Uppsala Universiteit

MODULATING STORIES: STUDENT PRODUCED KNOWLEDGE CREATIONS

Kathrin Otrell-Cass
Aalborg Universiteit

09:00 - 11:00 **Symposium 13 - UNVEILING SCIENTIFIC PRACTICES IN PRE-SERVICE TEACHER EDUCATION: A FOCUS ON CHALLENGES, POTENTIALITIES, STRATEGIES AND TOOLS** **Room G1**

Chairperson(s): MARIA MARTINEZ CHICO; Discussant: MARIA PILAR JIMENEZ ALEIXANDRE

SCIENTIFIC PRACTICES TO DEVELOP A BALANCED MODEL OF ENERGY IN PRE-SERVICE SECONDARY SCHOOL TEACHER EDUCATION

Macarena Soto¹; Digna Couso²
¹University of Santiago de Compostela; ²Autonomous University of Barcelona

INQUIRY-BASED PRACTICES TO TRAIN PRE-SERVICE TEACHERS: POTENTIALITIES TO DEVELOP THE TEACHING COMPETENCY

M. Rut Jiménez-Liso; Maria Martinez Chico; Rafael López-Gay; Francisco J. Castillo Hernández
University of Almería

UNRAVELLING PRE-SERVICE TEACHERS' PEDAGOGICAL DESIGN CAPACITY AND PEDAGOGICAL CONTENT KNOWLEDGE FOR INQUIRY-BASED LEARNING

Marios Papaevripidou; Maria Irakleous; Zacharias C. Zacharia
University of Cyprus

PRESERVICE ELEMENTARY TEACHERS' VIDEO ANALYSIS OF SCIENCE TEACHING

Carla Zembal-Saul
Penn State University

09:00 - 11:00 **Symposium 14 - DRAMA AND LEARNING SCIENCE : PEDAGOGY, PARTICIPATION AND PASSION** **Room G2**

Chairperson(s): Debra McGregor; Discussant: Sarah Frodsham

A DRAMA-BASED APPROACH TO ENGAGE SECONDARY STUDENTS IN ENVIRONMENTAL ISSUES

Roald Verhoeff

Freudenthal Institute for Science and Mathematics Education, Utrecht University, Utrecht

THE ROLE OF SCIENCE IN DRAMAS OF SUSTAINABILITY

Marianne Odegaard

University of Oslo

IDENTIFYING CRITICAL EPISODES IN TEACHING SCIENCE USING ROLE-PLAY

Martin Braund

Cape Peninsula University of Technology

PEDAGOGIC PRINCIPLES THAT AFFORD PARTICIPATIVE INQUIRY OPPORTUNITIES : DRAMATISING FROM A SCIENTISTS' CONTEXT.

Debra McGregor

Oxford Brookes University

09:00 - 11:00 **Symposium 15 - GLOBAL PERSPECTIVES ON SCIENCE TEACHER COMPETENCIES: A SYMPOSIUM FROM THE INTERNATIONAL REGION OF THE ASSOCIATION FOR SCIENCE TEACHER EDUCATION (ASTE)** **Room G3**

Chairperson(s): Christine Tippett; Discussant: Wayne Melville

A CANADIAN CROSS-FACULTY OF EDUCATION COMPARISON: PROGRAM STRUCTURES AND PRACTICES TO FOSTER TEACHER CANDIDATE PROFESSIONAL LEARNING

Karen Goodnough¹; Xavier Fazio²; Saiqa Azam¹

¹Memorial University; ²Brock University

PREPARING "COMPETENT" SCIENCE TEACHERS IN AUSTRALIA: STANDARDS AND ASSESSMENTS

Patricia Morrell; Jodie Miller

The University of Queensland

STANDARDS FOR SCIENCE TEACHER PREPARATION IN THE UNITED STATES

Patricia Morrell¹; Meredith Park Rogers²; Eric Pyle³; Gillian Roehrig⁴; William Veal⁵

¹The University of Queensland; ²Indiana University; ³James Madison University; ⁴University of Minnesota; ⁵College of Charleston

MODELLING IN STEM: THE TALE OF TWO COUNTRIES IN CENTRAL ASIA

Kathy Malone¹; Ozkan Yilmaz²; Janet Helmer¹; Arman Assanbayev¹; Gulnara Namyssova¹

¹Nazarbayev University; ²Erzincan University

09:00 - 11:00 **Symposium 16 - INTERNATIONAL PERSPECTIVES ON MODELING AND SYSTEMS THINKING** **Room G4**

Chairperson(s): Tom Bielik; Discussant: David Fortus

INTEGRATING DIFFERENT MODELING APPROACHES TO INVESTIGATE COMPLEX PHENOMENA

Tom Bielik¹; Sharona T. Levy²; Ravit Golan-Duncan³

¹CREATE for STEM at Michigan State University; ²University of Haifa; ³Rutgers University

MAKING SENSE OF STUDENTS' STATIC EQUILIBRIUM MODELS

Lynn Stephens; Steven Roderick

The Concord Consortium

USING MODELS FOR SCIENTIFIC INQUIRY IN 10TH GRADE CHEMISTRY CLASSES. RESULTS OF A QUANTITATIVE STUDY.

Marvin Rost; Rüdiger Tiemann

Humboldt-Universität zu Berlin

THE ROLE OF EXPERIMENT STRUCTURE TO SUPPORT SCIENTIFIC MODELS AND ARGUMENTS

İbrahim Delen¹; Ayşe Buber²; Gül Unal Coban²

¹Usak University; ²Dokuz Eylül University

09:00 - 11:00 Symposium 17 - MEASURING AND FACILITATING STUDENTS' INQUIRY SKILLS Room G5

Chairperson(s): Martin Schwichow, Andrea Moeller; Discussant: Andreas Nehring

DISCIPLINES VERSUS SUB-SKILLS: WHAT INFLUENCE STUDENTS' PERFORMANCE IN AN INTERDISCIPLINARY CONTROL OF VARIABLES TEST?

Martin Schwichow¹; Martina Brandenburger¹; Silke Mikelskis-Seifert¹; Johanna Kranz²; Andrea Moeller²
¹PH Freiburg; ²University of Vienna

WHAT MATTERS MORE FOR LEARNING DURING INQUIRY-LEARNING: SCIENTIFIC REASONING OR COGNITIVE SKILLS?

Anita Stender¹; Martin Schwichow²; Hendrik Haertig¹
¹Universität Duisburg-Essen, Physikdidaktik; ²PH Freiburg

PERFORMANCE ASSESSMENT OF EXPERIMENTAL COMPETENCES IN SCIENCE

Angela Bonetti¹; Christoph Gut¹; Livia Murer¹; Susanne Metzger²; Maik Walpuski³
¹Zurich University of Teacher Education; ²University of Applied Sciences and Arts Northwestern Switzerland; ³University of Duisburg-Essen

ENHANCING STUDENTS ACQUISITION OF SCIENTIFIC INQUIRY SKILLS THROUGH TESTING?

Johanna Kranz¹; Tobias Tempel²; Andrea Moeller¹
¹Austrian Educational Competence Center Biology (AECCB), University of Vienna, Austria; ²Psychology and Diagnostics, Ludwigsburg University of Education, Germany

TUESDAY 13:45 - 15:00

13:45 - 15:00 SP04 - SUMMER SCHOOL 2019 Room A1

Chairperson(s): Dimitris Stavrou

INTERPRETATION AND UTILIZATION OF WRITTEN FEEDBACK COMMENTS BY ELEMENTARY SCHOOL STUDENTS WORKING ON SCIENCE INVESTIGATION TASKS

Evangelia Irakleous
 University of Cyprus

THE RELATIONSHIP BETWEEN TEACHERS' PEDAGOGICAL CONTENT KNOWLEDGE AND STUDENT LEARNING IN ELECTROSTATICS

Ernest Mazibe; Estelle Gaigher; Corene Coetzee
 University of Pretoria

TEACHERS' PEDAGOGICAL PRACTICES IN INTEGRATED CONTEXTS OF EDUCATION: THE CASE OF STUDY VISITS TO SCIENCE MUSEUMS – FIRST RESULTS

Vanessa Souza; Vitor Bonifácio; Ana V. Rodrigues
 University of Aveiro

STEM EDUCATION IN DENMARK: CHALLENGES AND PROSPECTS FOR IMPLEMENTATION

Nina Waaddegaard
 Department of Science Education, University of Copenhagen

ASSESSMENT OF PRE-SERVICE TEACHERS' SCIENTIFIC REASONING IN THE CONTEXT OF MODELING AND INVESTIGATION TASKS

Pantelitsa Karnaou¹; Costas P. Constantinou¹; Christiana Th. Nicolaou²
¹University of Cyprus; ²Cyprus Ministry of Education and Culture

CREATIVITY IN PRIMARY SCIENCE EDUCATION

Maren Fredagsvik
 University of Southeast Norway

THE SUCCESS OF FAILURE: UNDERSTANDING STUDENTS' PERSPECTIVES ON FAILURE IN SCIENCE AND SCIENCE EDUCATION

Sandhya Krishnan
 The University of Georgia

LEARNING CUTTING-EDGE RESEARCH SCIENCE TOPICS VIA SCHOOL VISITS TO RESEARCH CENTERS

Kalliopi Giannakoudaki; Dimitris Stavrou
 University of Crete

NANOSCALE PHENOMENA AND CONCEPTS: LEARNING AND TEACHING ISSUES IN PRIMARY SCHOOL

George Peikos; Anna Spyrtou
 University of Western Macedonia, Greece

REASONING ON AND REASONING IN TEACHING SITUATIONS WITH EXPERIMENTAL EVIDENCE DEVIATING FROM EXPECTATION

Christoph Holz; Susanne Heinicke
Westfälische Wilhelms-Universität Münster

EMPIRICAL STUDY OF THE EFFECTIVENESS OF TWO PROFESSIONAL DEVELOPMENT FORMATS FOR TEACHERS ON "DISCOVERY EXPERIMENTATION", A SCIENTIFIC INQUIRY APPROACH

Arne Bewersdorff¹; Armin Baur¹; Markus Emden²
¹University of Education Heidelberg; ²Zurich University of Teacher Education

STRUCTURAL CHARACTERISTICS OF LEARNING OPPORTUNITIES IN TEACHER TRAINING PROGRAMS AND THEIR EFFECTS ON PRE-SERVICE PHYSICS TEACHERS' PROFESSIONAL KNOWLEDGE

Dustin Schiering; Stefan Sorge; Knut Neumann
IPN

TEACHERS' COLLECTIVE AGENCY THROUGH SELF-ORGANISING COMMUNITIES WITHIN THE PRAXIS OF SCIENCE EDUCATION: A FREIREAN APPROACH TO SCIENCE EDUCATION RESEARCH

Betzabe Torres
University of Bristol

IMPROVING BIOLOGY AND CHEMISTRY PRE-SERVICE TEACHERS' USE OF EXTERNAL REPRESENTATIONS THROUGH FEEDBACK

Büsrâ Tonyali¹; Mathias Ropohl¹; Julia Schwanewedel²
¹University of Duisburg-Essen; ²Humboldt University of Berlin

FLIPPED CLASSROOM — A RESEARCH PROJECT BETWEEN HIGH HOPES AND LACKING EVIDENCE

Lars-Frederik Weiß
Institute for Didactics of Mathematics and Physics

13:45 - 15:00 SP05 - SUMMER SCHOOL 2019**Room A2****Chairperson(s): Robert Evans****DESIGNING A TEACHING-LEARNING SEQUENCE ABOUT ELECTROMAGNETIC RADIATION FOR GRADE EIGHT**

Sarah Zloklikovits; Martin Hopf
University of Vienna

ENHANCING STUDENTS' INTEREST IN SCIENCE AND STEM CAREERS: THE ROLE OF CAREER-BASED SCENARIOS

Irene Drymiotou
University of Cyprus

DEVELOPMENT AND EVALUATION OF A TEACHING UNIT IN PARTICLE PHYSICS TO PROMOTE STUDENTS' CRITICAL THINKING

Farahnaz Sadidi; Gesche Pospiech
Technische Universität Dresden, Faculty of Physics, Physics Education

INVESTIGATING TEACHERS' BELIEFS IN TRINIDAD AND TOBAGO: A CASE OF INQUIRY-BASED LEARNING ADOPTION IN THE PRIMARY SCIENCE CLASSROOM

Ainsley Carnarvon
University of Aberdeen

WHAT COUNTS AS SCIENTIFIC ARGUMENT? LANGUAGE IDEOLOGIES AND THE ENGAGEMENT OF MULTILINGUAL STUDENTS IN DISCOURSE

Emily Reigh
Stanford University

EXPLORING THE PRESENTATION OF CLIMATE CHANGE IN AQUARIUM EXHIBITS.

Jenn Idema; Kristy Daniel
Texas State University

CHILD LEADERS OF SCIENCE: NAVIGATING THE HIGH SEAS OF POSSIBILITY

Carole Kenrick
University College London Institute of Education

UNFOLDING CHILDREN'S SCIENCE LEARNING JOURNEYS BY USING ARTEFACTS IN INTERVIEWS

Stine Mariegaard; Stine Mariegaard
University of Southern Denmark

PLANTS ARE BORING, THEY ALL LOOK THE SAME

Amélie Tessartz; Jonathan Hense; Annette Scheersoif
Biology Education, University of Bonn

CHARACTERISATION OF SCIENCE CONTENT INTEGRATION IN HIGH SCHOOL STEM PROJECTS

Miquel Pérez-Torres; Conxita Márquez; Digna Couso
Autonomous University of Barcelona

UNDERSTANDING & ENHANCING STUDENTS' EPISTEMOLOGICAL BELIEFS ABOUT MODELS IN SCIENCE THROUGH MODELLING PROCESSES

Stavros Koukioglou; Dimitrios Psillos
Aristotle University of Thessaloniki Faculty of Education School of Primary Education

INVESTIGATING UPPER SECONDARY STUDENTS' DIFFICULTIES IN EVALUATING EXPERIMENTAL DATA

Steffen Brockmüller; Mathias Ropohl
University of Duisburg Essen

NATURE OF SCIENCE THROUGH PROBLEM-BASED LEARNING: EFFECTS ON SCIENCE EPISTEMOLOGICAL CONCEPTIONS AND STUDENTS' PERFORMANCE

Cristina Sousa¹; João C. Paiva²; Isabel Chagas³
¹Faculdade de Ciências, Universidade do Porto; ²Faculdade de Ciências, Universidade do Porto & CIQUP - Centro de Investigação em Química da Universi; ³Instituto de Educação, Universidade de Lisboa, Portugal.

EMPIRICAL INVESTIGATION OF STUDENTS' MOTIVATIONAL QUALITIES IN CONTEXT OF BIOLOGY LEARNING

Lisa-Maria Kaiser; Nadine Großmann; Matthias Wilde
Bielefeld University

BEYOND THE BACHELOR'S DEGREE - LEGITIMATE CHOICES AND IMAGINED FUTURES

Katia Kromann Nielsen
Department of Science Education, University of Copenhagen

STUDY CULTURE AND STUDY PRACTICES OF FIRST-YEAR UNIVERSITY STUDENTS

Andrea Fransiska Møller Gregersen
Department of Science Education, University of Copenhagen

DEVELOPING LEARNERS' INTEREST IN INSECTS AS A WAY OF COUNTERING THE BIODIVERSITY CRISIS

Julian Kokott; Jonathan Hense; Annette Scheersoi
Biology Education, University of Bonn

DEVELOPMENT AND EVALUATION OF AN ONLINE LEARNING ENVIRONMENT PROVIDING BUG-RELATED FEEDBACK FOR GENERAL CHEMISTRY COURSES

Florian Trauten; Carolin Eitemüller; Maik Walpuski
University of Duisburg-Essen

YOUNG CHILDREN'S CONCEPTIONS OF ENERGY

Franziska Detken
Zurich University of Teacher Education

INVESTIGATION OF THE IMPACT AN INTERTWINED PBL & HOS APPROACH ON TURKISH MIDDLE SCHOOL STUDENTS PROBLEM SOLVING SKILLS, SCIENTIFIC INQUIRY, CRITICAL AND CREATIVE THINKING

Ferah Ozer¹; Nihal Dogan¹
¹Bogazici University; ²Abant Izzet Baysal University

13:45 - 15:00 **Workshop 01 - LET THE LIONS HEART ROAR AS THE IMAGINATION CRYSTALIZES AND MANIFESTS ITSELF AND ITS EXPERT KNOWLEDGE** **Room B1**

Chairperson(s): **Ulrika Tobieson**

LET THE LIONS HEART ROAR AS THE IMAGINATION CRYSTALIZES AND MANIFESTS ITSELF AND ITS EXPERT KNOWLEDGE

Ulrika Tobieson; Ann Mutvei
Södertörns University

13:45 - 15:00 **Workshop 02 - BUILDING POWERFUL TEACHER PROFESSIONAL DEVELOPMENT TO LEVERAGE WHY HOW AND WHAT LEVEL THINKING TO MOTIVATE SHIFTS IN PEDAGOGY** **Room B2**

Chairperson(s): **Joseph Sunshine**

BUILDING POWERFUL TEACHER PROFESSIONAL DEVELOPMENT TO LEVERAGE WHY, HOW, AND WHAT LEVEL THINKING TO MOTIVATE SHIFTS IN PEDAGOGY

Joseph Sunshine; Andre Botello
Chicago Public Schools

13:45 - 15:00 **Workshop 03 - A PLAY-CENTRIC APPROACH TO SCIENCE EDUCATION** **Room B3**

Chairperson(s): Adriana Cardinot

A PLAY-CENTRIC APPROACH TO SCIENCE EDUCATION

Adriana Cardinot; Jessamyn Fairfield
National University of Ireland Galway

13:45 - 15:00 **Workshop 04 - EMPLOYING CURIOSITY-DRIVEN VIDEO-BASED DISCOURSE TO FACILITATE TEACHERS AS MENTORS OF TEACHERS** **Room B4**

Chairperson(s): Avraham Merzel

EMPLOYING CURIOSITY-DRIVEN VIDEO-BASED DISCOURSE TO FACILITATE TEACHERS AS MENTORS OF TEACHERS

Yaron Lehavi¹; Avraham Merzel²; Ruti Segal³; Ami Baram⁴
¹The David Yellin Academic College of Education; ²The Hebrew University of Jerusalem; ³Oranim Academic College of Education; ⁴The Weizmann Institute of Science

13:45 - 15:00 **Workshop 05 - PROFESSIONAL DEVELOPMENT FOR ICT-BASED TEACHING** **Room B5**

Chairperson(s): Kai-Mikael Jää-Aro

PROFESSIONAL DEVELOPMENT FOR ICT-BASED TEACHING

Kai-Mikael Jää-Aro; Pernilla Josefsson; Sofia Lundmark; Ann Mutvei Berrez
Södertörn University

13:45 - 15:00 **Workshop 06 - TEACHING COSMOLOGY AND GENERAL RELATIVITY IN HIGH SCHOOL: EFFECTS ON PHYSICS LEARNING AND EXAMPLES OF ACTIVITIES FOR PUPILS** **Room B6**

Chairperson(s): Alice Gasparini

TEACHING COSMOLOGY AND GENERAL RELATIVITY IN HIGH SCHOOL: EFFECTS ON PHYSICS LEARNING AND EXAMPLES OF ACTIVITIES FOR PUPILS

Alice Gasparini; Andreas Müller; Laura Weiss
University of Geneva

13:45 - 15:00 **Workshop 07 - UNDERSTANDING COMPLEX BIOLOGICAL PROCESSES THROUGH EMBODIED SIMULATIONS** **Room B7**

Chairperson(s): C.L. Geraedts

UNDERSTANDING COMPLEX BIOLOGICAL PROCESSES THROUGH EMBODIED SIMULATIONS

C.L. Geraedts
Vrije Universiteit Amsterdam

13:45 - 15:00 **SP01 - SUMMER SCHOOL 2017** **Room C1**

Chairperson(s): Iva Stuchlíková

ACADEMIC EMOTIONS BEHIND OPTIMAL LEARNING AND GROUP SIZE IN HIGHER EDUCATION

Laura Timonen¹; Anu Tuomela¹; Kalle Juuti²; Sari Harmoinen¹
¹University of Oulu; ²University of Helsinki

THE PILOT OF AN INSTRUMENT USED TO ANALYSE INTEREST IN SCIENCE: A CASE STUDY OF THE ADAPTION OF AN INSTRUMENT TO MEASURE IMPACT A CITIZEN SCIENCE PROJECT HAS ON LEARNER INTEREST.

Lubabalo Albert Bhulana
Wits University

THE EFFECTS OF ARGUMENT BASED DESIGN ACTIVITIES ON PRE-SERVICE SCIENCE TEACHERS' PHYSICS SELF EFFICACY AND ARGUMENTATION SKILLS

Ayse Buber; Gul Unal Coban
Dokuz Eylül University

IDENTITY AND SUBJECT CHOICE IN UK SECONDARY SCHOOLS: COMPARING STUDENTS' REASONS FOR TAKING AND/OR DROPPING PHYSICS AND FOREIGN LANGUAGES

Sandra Takej
King's College London

WHAT STUDENTS' REPORTS OF SCIENTIFIC PHENOMENA TELL US ABOUT THEIR CONCEPTS OF FORCE AND MOTION?

Katharina Gierl; Patrick Löffler; Alexander Kauertz
University of Koblenz-Landau

IMPLEMENTATION OF THE PRE-LEARNING STRATEGY IN CHEMISTRY EDUCATION

Snjezana Smerdel
Faculty of Science, University of Split, Croatia

TEMPORAL LAG SEQUENTIAL ANALYSIS AS A METHOD TO INVESTIGATE DIFFERENCES BETWEEN SCAFFOLDED AND NON-SCAFFOLDED GROUPS' INQUIRY-BASED LEARNING PROCESSES

Joni Lämsä; Raija Hämäläinen; Pekka Koskinen; Jouni Viiri; Joonas Mannonen
University of Jyväskylä

SUPPORTING SCIENCE TEACHERS TEACHING OUTSIDE THEIR SCIENCE SPECIALISM

Doreen Mizzi
University of Malta

REPRESENTATIONS AS TOOL IN THE FORCE CONCEPT CONSTRUCTION IN PRE-SERVICE PRIMARY TEACHER TRAINING

Angela Garcia-Lladó; Marina Castells; Mercè Garcia-Milà
Universitat de Barcelona

USING CASE-BASED LEARNING SCENARIOS TO FOSTER PRE-SERVICE CHEMISTRY TEACHERS' DIAGNOSTIC ABILITIES REGARDING STUDENTS' CONCEPTIONS

Julian Heeg; Sascha Schanze
Leibniz Universität Hannover - Institute for Science Education

CHEMISTRY TEACHING AND LEARNING DURING PRIMARY — SECONDARY TRANSITION IN ENGLAND. AN EXPLORATION OF HOW THE STATUTORY CURRICULUM IS INTERPRETED, ENACTED AND EXPERIENCED.

Elizabeth Coppard
Oxford Brookes University

BUILDING OF INTERPERSONAL COMMUNICATION SKILLS OF NEW GENERATION STUDENTS EMPLOYING RESPONSIBLE RESEARCH AND INNOVATION

Audrius Ivanauskas
Vytautas Magnus University

MODELLING TEACHERS' CONTENT KNOWLEDGE IN PARTICLE PHYSICS

Michaela Oettle; Silke Mikelskis-Seifert
University of Education Freiburg

INVESTIGATING THE EFFECT OF FORMATIVE ASSESSMENT DESIGN ACTIVITIES ON SENIOR BIOLOGY STUDENT TEACHERS' PEDAGOGICAL CONTENT KNOWLEDGE AND LEARNING PROGRESSIONS ON MODERN GENETICS

Nazlı Ruya Taskın
Balıkesir University

THE ADEQUATE USE OF PHYSICS KNOWLEDGE IN EXPERIMENTAL ENVIRONMENTS

Vanessa Schad; Eva Cauet; Alexander Kauertz; Jochen Scheid
University of Koblenz-Landau

STUDENTS' LEARNING PROCESSES OF SCIENTIFIC INQUIRY KNOWLEDGE AND ABILITIES

Jörn J. Hägele
Justus-Liebig-Universität Gießen

ENERGY TRANSITION TO RENEWABLES - RECONSTRUCTION OF STUDENTS' AND SCIENTISTS' CONCEPTIONS FOR SCIENCE EDUCATION

Sybille Hüfner
University of Hildesheim

A SELF-STUDY ON DEVELOPMENT OF STUDENTS IN STEM CAREERS BY ENRICHED APPLICATIONS WITHIN HISTORY OF SCIENCE

İsmail Dönmez¹; Mehmet Fatih TAŞAR²
¹Muş Alparslan University; ²Gazi University

13:45 - 15:00 **Workshop 08 - UNDERSTANDING AND IMPROVING INTEGRATED STEM INSTRUCTION THROUGH AN OBSERVATION PROTOCOL** **Room D1**

Chairperson(s): Emily Dare

UNDERSTANDING AND IMPROVING INTEGRATED STEM INSTRUCTION THROUGH AN OBSERVATION PROTOCOL

Emily Dare¹; Joshua Ellis¹; Elizabeth Ring-Whalen²; Gillian Roehrig³
¹Florida International University; ²St. Catherine University; ³University of Minnesota

13:45 - 15:00 **Workshop 09 - DEVELOPING KNOWLEDGE-IN-USE ASSESSMENT TASKS** **Room D2**

Chairperson(s): Marcus Kubsch

DEVELOPING KNOWLEDGE-IN-USE ASSESSMENT TASKS

Marcus Kubsch¹; Phyllis Haugabook Pennock²; Brian Gane³
¹IPN; ²CREATE for STEM Institute, Michigan State University; ³Learning Sciences Research Institute (LSRI), University of Illinois at Chicago

13:45 - 15:00 **Workshop 10 - ASSESSING WITHOUT MARK SCHEMES OR RUBRICS: A COMPARATIVE JUDGEMENT APPROACH TO MEASURING CONCEPTUAL UNDERSTANDING IN SCIENCE** **Room D3**

Chairperson(s): Jasper Green

ASSESSING WITHOUT MARK SCHEMES OR RUBRICS: A COMPARATIVE JUDGEMENT APPROACH TO MEASURING CONCEPTUAL UNDERSTANDING IN SCIENCE

Jasper Green
 University College London Institute of Education

13:45 - 15:00 **SP02 - SUMMER SCHOOL 2018** **Room F1**

Chairperson(s): Pasi Nieminen

BECOMING A TEACHER: REFLECTIVE PRACTICE AS A WAY OF EXPLORING SECONDARY SCIENCE TEACHER BELIEFS AND PRACTICES

Preethi Titu¹; Gillian Roehrig²; Joshua Ellis³
¹University of MN; ²University of Minnesota; ³Florida International University

VALIDATION OF A 'SOURCES OF SCIENCE SELF-EFFICACY' SCALE ADAPTED FOR PRIMARY CHILDREN FOR THE INFORMAL SCIENCE CONTEXT

Sarah Carroll¹; Veronica McCauley²; Muriel Grenon¹
¹School of Natural Sciences, National University of Ireland Galway; ²School of Education, National University of Ireland Galway

SCIENCE TEACHING SELF-EFFICACY IN NEWLY QUALIFIED PRIMARY TEACHERS WITH EXTANT SCHOOL-BASED WORK EXPERIENCES

Lindsay Lightner; Judith Morrison
 Washington State University

CUEING IN TUTORIAL VIDEOS IN ORGANIC CHEMISTRY: INVESTIGATION OF LEARNING EFFECTIVENESS USING EYE TRACKING

Marc Rodemer¹; Julia Eckhard²; Nicole Graulich²; Sascha Bernholt¹
¹Leibniz Institute for Science and Mathematics Education (IPN) at Kiel University; ²Justus-Liebig-University Gießen

INQUIRING INTO INQUIRY: WHAT CAN WE LEARN ABOUT INQUIRY AS MEANS AND ENDS FROM PISA AND TIMSS STUDY?

Nani Teig
 University of Oslo

MODELING AND DEVELOPMENT OF CONTENT KNOWLEDGE AND ITS IMPORTANCE FOR EXPLAINING PHYSICS

Patrick Enkrott; David Buschhüter; Andreas Borowski
 University of Potsdam

COMPARE THE CORRECTNESS AND CONSISTENCY OF STUDENTS' MENTAL MODELS ON COMBUSTION IN MODELLING-BASED AND REGULAR CURRICULUM

Chihang Chang
 Kang Chiao International School

SCIENCE TEACHERS' PERCEPTIONS AND NEEDS ON INTEGRATING ENGINEERING DESIGN

Jesse Hietala; Risto Leinonen; Pekka E. Hirvonen; Mervi A. Asikainen
 University of Eastern Finland

ON THE EXCHANGEABILITY OF DIFFERENT MEASUREMENT METHODS AND THEIR USE TO ELICIT EVIDENCE ON INSTRUMENT'S COGNITIVE VALIDITY

Livia Murer¹; Susanne Metzger²; Angela Bonetti³; Christoph Gut³
¹Zurich University of Teacher Education and University of Basel; ²University of Applied Sciences and Arts Northwestern Switzerland and University of Basel; ³Zurich University of Teacher Education

ASSESSING EXPERIMENTAL COMPETENCES IN SCIENCE

Angela Bonetti¹; Christoph Gut¹; Maik Walpuski²
¹Zurich University of Teacher Education; ²University of Duisburg-Essen

EVALUATING STUDENT SELF-PERCEPTIONS AND IMPORTANCE OF WORK AND LIFE SKILLS SKILLS AND CORE IDEAS ENABLING PROMOTION OF GREATER INTEREST

Helen Semilariski; Regina Soobard; Miia Rannikmäe
 University of Tartu

STUDENT DIFFICULTIES WITH BOUNDARY CONDITIONS FOR THE DIFFUSION EQUATION

Sofie Van den Eynde¹; Mieke De Cock¹; Johan Deprez¹; Martin Goedhart²
¹KU Leuven; ²University of Groningen

READING EVOLUTIONARY TREES: TESTING AND EVALUATION OF THE SYNTHETIC TREE-READING MODEL (STREAM)

Thilo Schramm; Yvonne Schachtschneider; Philipp Schmiemann
 University Duisburg-Essen

PEER ASSESSMENT IN LOWER SECONDARY SCHOOL SCIENCE

Laura Ketonen; Jouni Viiri; Pasi Nieminen
 University of Jyväskylä

ANALYSING AND SUPPORTING STUDENTS' UNDERSTANDING OF SYMBOLIC-MATHEMATICAL MODELS IN CHEMISTRY

Ines Komor; Helena van Vorst; Elke Sumfleth
 University of Duisburg-Essen

DEVELOPING PROFESSIONAL IDENTITY AMONG LEADING CHEMISTRY TEACHERS

Ruth Waldman¹; Ron Blonder²
¹Weizmann Institute of Science; ²Weizmann institute of science

13:45 - 15:00 SP03 - SUMMER SCHOOL 2018

Room F2

Chairperson(s): Gjalt Prins

STUDENTS' FREEDOM AND EXPERIENCES DURING OUTDOOR SCIENCE LEARNING

Anttoni Kervinen¹; Wolff-Michael Roth²; Kalle Juuti³; Anna Uitto³
¹University of Helsinki, Finland; ²University of Victoria, BC; ³University of Helsinki

ORAL EXPLANATORY COMPETENCE IN SCIENCE EDUCATION AT PRIMARY SCHOOL

Jennifer Krupinski; Sarah Rau-Patschke; Stefan Rumann
 Universität Duisburg-Essen

ENGAGING YOUNG CHILDREN IN OUTDOOR EDUCATION EXPLORATORY SCIENTIFIC DIALOGUES AND THE IMPORTANCE OF CHILDREN'S FINDINGS OF NATURE ELEMENTS

Ingunn Skalstad
 University of Southeast Norway

STUDENTS' PERCEPTION TOWARDS EXTERNAL REPRESENTATIONS OF THE ATOMIC LEVEL

Perihan Akman; Sabine Fechner
 Paderborn University

STUDENTS' REASONING IN THE DOMAIN OF SUSTAINABILITY EDUCATION: THE CASE OF PLASTICS.

Esther de Waard; Wouter van Joolingen; Gjalt Prins
 Freudenthal Institute, Utrecht University

DIPPING INTO THE ART OF WRITING SCIENCE: IS TASK-BASED LANGUAGE TEACHING A KEY TO SUCCESS?

Johanna Taglieber; Corinna Pieber; Suzanne Kapelari; Wolfgang Dür; Barbara Hinger
 University of Innsbruck, Department of subject-specific Education

EMBODIED SIMULATIONS IN BIOLOGY EDUCATION

C.L. Geraedts
 Vrije Universiteit Amsterdam

21ST CENTURY BIOLOGY EDUCATION AND MEASURING BIOLOGICAL LITERACY

Helin Semilariski; Anne Laius
 University of Tartu

DESIGN-BASED RESEARCH ACTIVITY ON WAVES AND MODERN PHYSICS IN SECONDARY SCHOOL

Federica Minozzi; Irene Marzoli
University of Camerino

THE ROLE OF STUDENTS' CONCEPTION ON RANDOMNESS AND PROBABILITY THEORY IN THE CONTEXT OF SCIENCE

Alexandra Jansky¹; Sascha Schmelting²; Martin Hopf¹
¹University of Vienna; ²CERN

AN INTRINSICALLY INTEGRATED EDUCATIONAL GAME ON NEWTONIAN MECHANICS TO PROMOTE CONCEPTUAL DEVELOPMENT

Anne van der Linden; Wouter van Joolingen; Ralph Meulenbroeks
Freudenthal Institute, Utrecht University

INTEGRATING BIOINFORMATICS AT THE INTERDISCIPLINARY INTERSECTION OF ELEMENTARY AND SECONDARY SCHOOL CURRICULA USING A BOTTOM-UP APPROACH

Ana Martins¹; Leonor Lencastre²; Fernando Tavares¹
¹Faculty of Sciences of University of Porto; Research Center in Biodiversity and Genetic Resources (C); ²Faculty of Psychology and Educational Sciences of University of Porto

SYSTEMS THINKING IN BIOLOGY EDUCATION

Melde G.R. Gilissen; Marie-Christine P.J Knippels; Wouter R. van Joolingen
Utrecht University

THE INFLUENCE OF CLOSE INDIVIDUALS IN ADOLESCENTS' EDUCATIONAL AND CAREER CHOICES – GENDERED CHOICES IN STEM AS A SPECIAL INTEREST

Kirsi Ikonen; Risto Leinonen; Pekka E. Hirvonen; Mervi A. Asikainen
University of Eastern Finland

GENDER AND SMALL GROUP STEM ACTIVITIES: A COMPARISON OF STUDENTS' SCIENCE AND ENGINEERING PARTICIPATION

Jeanna Wieselmann¹; Emily Dare²; Elizabeth Ring-Whalen³; Gillian Roehrig¹
¹University of Minnesota; ²Florida International University; ³St. Catherine University

CREATING PEDAGOGIES FOR SUSTAINABILITY IN CHILE THROUGH CHEMISTRY EDUCATION: BENEFITS AND CHALLENGES FROM TEACHERS' PERSPECTIVESÆ

Denise Quiroz Martinez
University College London

STUDENTS' INITIAL UNDERSTANDING OF MODELS OF COMPLEX BIOLOGICAL PROCESSES

Susanne Jansen; Wouter van Joolingen; Marie-Christine Knippels
Utrecht University

STUDENTS' USE OF SCIENCE CAPITAL IN CHEMISTRY

Lilith Rüschenpöhler; Silvija Markic
Ludwigsburg University of Education

INVESTIGATING THE INTERACTION BETWEEN LEARNING ABOUT THE NATURE OF SCIENCE AND QUANTUM PHYSICS IN SECONDARY SCHOOLS

Kirsten Stadermann¹; Martin Goedhart²
¹University of Groningen, NL; ²Institute of Science Education and Communication, University of Groningen, NL

NAVIGATING CLIMATE CHANGE: THE ROLE OF POLITICS IN YOUTH DISCOURSE AND SCIENTIFIC REASONING

Lynne Zummo
Stanford University

TEACHING NATURE OF SCIENCE (NOS) IN GREECE; EVALUATION OF THE CONDITION & STUDY OF EFFECTIVE WAYS TO INCLUDE IT INTO TEACHING IN THE SECONDARY EDUCATION

Anna Koumara
University of Ioannina

TOWARDS A FRAMEWORK OF EQUITABLE DISCIPLINARY RESPONSIVENESS IN SCIENCE EDUCATION

Christa Haverly
Michigan State University

13:45 - 15:00 **Workshop 11 - MODERNISING SCIENCE TEACHING: BRINGING THE VIRTUAL UNIVERSE INTO THE CLASSROOM** **Room G1**

Chairperson(s): Magdalena Kersting

MODERNISING SCIENCE TEACHING: BRINGING THE VIRTUAL UNIVERSE INTO THE CLASSROOM

Magdalena Kersting¹; Jackie Bondell²

¹University of Oslo, Dept. of Physics; ²ARC Centre of Excellence for Gravitational Wave Discovery (OzGrav), Faculty of Science Engineering and Technology, Swinburne Uni

13:45 - 15:00 **Workshop 12 - SUPPORTING STUDENTS' MODELING PRACTICE USING AN ONLINE COMPUTATIONAL MODELING TOOL** **Room G2**

Chairperson(s): Tom Bielik

SUPPORTING STUDENTS' MODELING PRACTICE USING AN ONLINE COMPUTATIONAL MODELING TOOL

Tom Bielik¹; Lynn Stephens²

¹CREATE for STEM at Michigan State University; ²The Concord Consortium

13:45 - 15:00 **Workshop 13 - HOW TO MAKE DIY INSTRUCTIONAL VIDEOS FOR CLASSROOM FLIPPING — IT IS EASIER THAN YOU THINK!** **Room G3**

Chairperson(s): Rachel Ka Wai Lui

HOW TO MAKE DIY INSTRUCTIONAL VIDEOS FOR CLASSROOM FLIPPING — IT IS EASIER THAN YOU THINK!

Rachel Ka Wai Lui

The University of Hong Kong

13:45 - 15:00 **Workshop 14 - INTERDISCIPLINARY ESCAPE ROOM: CONSTRUCTING COMPUTATIONAL MODELS FOR DIFFUSION WITH THE POWERFUL SIMPLIFICATION TOOLS OF PHYSICS** **Room G4**

Chairperson(s): Haim Edri

INTERDISCIPLINARY ESCAPE ROOM: CONSTRUCTING COMPUTATIONAL MODELS FOR DIFFUSION WITH THE POWERFUL SIMPLIFICATION TOOLS OF PHYSICS

Haim Edri; Elon Langbeheim, Samuel Safran; Edit Yerushalmi

Weizmann Institute of Science

TUESDAY 15:00 - 16:30

15:00 - 16:30 **OP25 - STRAND 3 - TEACHING, STUDENT PARTICIPATION, ENGAGEMENT AND EMOTION** **Room A1**

Chairperson(s): Elisa Vilhunen

COMPLEX ISSUES FOR INCREASED STUDENT PARTICIPATION IN CHEMISTRY EDUCATION

Cecilia Dudas; Carl-Johan Rundgren; Iann Lundegård

MND, Stockholm University

SCIENCE TEACHERS' PERCEPTIONS OF STUDENT ENGAGEMENT AND ITS IMPORTANCE FOR TEACHING

Cristian Abrahamsson¹; Claes Malmberg²; Ann-Marie Pendrill¹

¹Lund University; ²Halmstad University

THE EFFECT OF TEACHING PRACTICES ON SITUATIONAL INTEREST TOWARDS SCIENCE AND TECHNOLOGY AMONG MIDDLE SCHOOL STUDENTS

Ousmane Sy¹; Patrice Potvin²; Isabelle Vinatier³

¹Université du Québec à Trois-Rivières; ²Université du Québec à Montréal; ³Université de Nantes

EPISTEMIC EMOTIONS IN SCIENCE CLASSROOM ACTIVITIES

Elisa Vilhunen; Kalle Juuti; Visajaani Salonen; Jari Lavonen; Katariina Salmela-Aro

University of Helsinki

15:00 - 16:30 **OP26 - STRAND 3 - TEACHER COGNITION AND EMOTION** **Room A2**

Chairperson(s): Alberto Bellocchi

TEACHERS' PERSPECTIVES ON LEARNER-GENERATED EXTERNAL VISUAL REPRESENTATIONS

C. Alexander Scherb; Sandra Nitz

University Koblenz-Landau

"IF SCIENCE WAS A ROAD"... SEARCHING FOR TEACHERS' SOCIAL REPRESENTATIONS OF SCIENCE AND SCIENTIFIC CONTROVERSIES

Lynda Dunlop¹; Fernanda Veneu²
¹University of York; ²Oswaldo Cruz Foundation

ACTIVITIES AND LABORATORY WORK OF OUT-OF-FIELD TEACHERS: AN INDICATOR OF PCK

Harleen Singh; Julie Luft; Jessica Napier
 University of Georgia

IMPACT OF A SCIENCE TEACHER'S EMOTION MANAGEMENT ON SOCIAL BONDS

Alberto Bellocchi
 Queensland University of Technology

15:00 - 16:30 **OP27 - STRAND 2 - SCIENCE LEARNING, BILINGUAL CONTEXTS AND LEARNING THROUGH A FOREIGN LANGUAGE** **Room B1**

Chairperson(s): Alain Jameau

HANDS-ON SCIENCE TO PROMOTE LANGUAGE LEARNING IN BILINGUAL CONTEXTS

Marta Marialva
 Instituto Camões

'SAY WHAT?' - 21ST CENTURY SKILLS, ENGLISH LANGUAGE LEARNERS AND STEM OUTREACH

Stephanie Florence-Czuba; Isha DeCoito
 Western University

BILINGUAL MODULES IN BIOLOGY: COMPARISON OF MOTIVATIONAL EFFECTS IN DIFFERENT SCHOOL YEARS

Stephanie Ohlberger; Claas Wegner
 Bielefeld University

LEARNING PHYSICS AND CHEMISTRY IN A FOREIGN LANGUAGE: THE EXAMPLE OF THE RUTHERFORD MODEL AT HIGH SCHOOL

alain jameau¹; carole Le Henaff²
¹University of Western Brittany; ²University of Western Brittany - School of Education (ESPE)

15:00 - 16:30 **OP28 - STRAND 2 - REPRESENTATION AND MATERIALITY IN SCIENCE LEARNING** **Room B2**

THE BODILY PRODUCTION OF PHENOMENA IN THE SCIENCE LABORATORY: RECOGNIZING AN OVERLOOKED CONTENT

Liv Kondrup Hardahl¹; Per-Olof Wickman²; Cecilia Caiman²
¹University College Absalon; ²Stockholm University, Department of Mathematics and Science Education

CHILDREN'S PERCEPTIONS OF REPRESENTATIONAL PRACTICES IN SCIENCE LEARNING

Shingo Uchinokura
 Kagoshima University

STUDENTS' VIEWS OF FORCE DIAGRAMS WHILE SOLVING PHYSICS PROBLEMS

Judyanto Sirait; Janet Ainley
 University of Leicester

GAZE TRANSITIONS IN MULTIPLE CHOICE TASKS WITH GRAPH AND TEXT REPRESENTATIONS

Martina Kekule¹; Jarkko Hautala²; Jasmin Kilpelainen²; Jouni Viiri²
¹Charles University; ²University of Jyväskylä

15:00 - 16:30 **OP29 - STRAND 6 - FRAMEWORKS FOR IMPROVING SCIENCE EDUCATION** **Room B3**

Chairperson(s): Jonathan Osborne

REALISM VERSUS RELATIVISM — REALLY? A CRITICAL REALIST FRAMEWORK FOR SCIENCE EDUCATION

Robyn Yucel
 Deakin University

THE USE OF EPISTEMIC LENSES TO ANALYSE SCIENCE AND ENGINEERING IN STEM EDUCATION PROPOSALS

Cristina Simarro; Digna Couso
 CRECIM, Universitat Autònoma de Barcelona (UAB)

THE PARTICLE-WAVE DUALITY AND OTHER MYTHS IN THE DIDACTICS OF QUANTUM MECHANICS

Nils-Erik Bomark
University of Agder

IN SEARCH OF A COHERENT NARRATIVE FOR THE SCIENCES CURRICULUM: THE AFFORDANCES OF STYLES OF REASONING

Jonathan Osborne; Stephanie Rafanelli
Stanford University

15:00 - 16:30 **OP30 - STRAND 8 - SKILLS FOR IMAGINING FUTURES AND TAKING ACTION** **Room B4**

Chairperson(s): Jenny Hellgren

TOWARD THE RECOGNITION OF FUTURE-SCAFFOLDING SKILLS IN SCIENCE EDUCATION

Eleonora Barelli¹; Giulia Tasquier¹; Laura Branchetti²; Antti Laherto³; Elina Palmgren³; Caitlin Wilson⁴; Olivia Levrini⁴

¹Alma Mater Studiorum - University of Bologna, Department of Physics and Astronomy; ²University of Parma, Department of Mathematics, Physics and Computer Science; ³University of Helsinki, Department of Physics; ⁴Landvernd - The Icelandic Environment Association

BROADENING STUDENTS' FUTURES THINKING: RESULTS FROM A MODULE ON QUANTUM COMPUTERS

Antti Laherto; Elina Palmgren; Tapio Rasa; Pia Erkkö
University of Helsinki

TEACHING FOR AND LEARNING OF ACTION COMPETENCE IN EDUCATION ON SOCIO-SCIENTIFIC ISSUES

Cecilia Eriksson; Eva Lundqvist; Malena Lidar
Department of Education, Uppsala University

I DON'T WANT TO MAKE THEM ACTIVISTS - BUT HELP THEM BECOME RESPONSIBLE CITIZENS

Jenny Hellgren; Katarina Ottander; Christina Ottander
Umeå University

15:00 - 16:30 **OP31 - STRAND 9 - ENGAGING WITH SUSTAINABILITY II** **Room B5**

Chairperson(s): George Malandrakis

DOES CULTURAL BACKGROUND HAVE AN INFLUENCE ON THE CONNECTEDNESS TO NATURE?

Silvia Fränkel; Daniela Sellmann-Risse; Melanie Basten
Bielefeld University

FAMILIARIZING YOUNG CHILDREN WITH THE IDEA OF SUSTAINABILITY

Maria-Christina Kasimati; Marida Ergazaki
University of Patras

INTERDISCIPLINARITY IN EDUCATION FOR SUSTAINABLE DEVELOPMENT

Eldri Scheie; Shelley Stromholt
Norwegian Centre for Science Education, University of Oslo

GREEK STUDENT-TEACHERS' LATENT KNOWLEDGE ABOUT URBAN SUSTAINABILITY: PRELIMINARY FINDINGS

George Malandrakis¹; Constantinos Papadopoulos²; Zisis Kyriakou²; Dimitrios Pnevmatikos²; Penelope Papadopoulou²

¹Aristotle University of Thessaloniki; ²University of Western Macedonia

15:00 - 16:30 **OP32 - STRAND 9 - THE PEDAGOGY OF ENVIRONMENTAL EDUCATION II** **Room B6**

Chairperson(s): Alexandros Amprazis

THE ENJOYABLE USE OF NATURE: APPRECIATION OF NATURE AND THE TWO MAJOR ENVIRONMENTAL VALUE MODEL (2-MEV)

Constantinos Manoli¹; Bruce Johnson¹; Franz Bogner²
¹University of Arizona; ²University of Bayreuth, Z-MNU (Centre of Math & Science Education)

TEACHING ELEMENTARY PUPILS ABOUT ALIEN SPECIES

Toru DOI¹; Toshio Kishimoto²
¹University of Toyama; ²Museum of Natural and Environmental History, Shizuoka

PERCEPTION OF ECOLOGICAL PROBLEMS AND RISKS: DOES ACADEMIC ENVIRONMENTAL EDUCATION MATTER?Nurit Carmi¹; Iris Alkaber²¹Tel-Hai Academic College; ²Kibbutzim College of Education, Technology and the Arts Tel-Aviv, Israel**PLANT BLINDNESS INTENSITY THROUGHOUT THE SCHOOL YEARS: A CROSS-AGE STUDY**Alexandros Amprazis; Penelope Papadopoulou
University of Western Macedonia, Greece

15:00 - 16:30 **OP33 - STRAND 12 - TEACHERS' IDENTITIES, PRACTICES AND TEACHER EDUCATION** **Room B7****Chairperson(s): Willem Rauscher****CRITICAL DISCOURSE ANALYSIS OF SCIENCE TEACHER IDENTITY WORK IN URBAN SCHOOLS**Katherine Wade-Jaimes
University of Memphis**"IT STARTS WITH THINKING ABOUT WHAT YOU CAN DO:" CRITICAL PRAXIS AMONG JUSTICE-ORIENTED SCIENCE TEACHERS**Sara Tolbert¹; Alexa Schindel²¹University of Canterbury; ²University at Buffalo, New York**IDENTIFYING ELEMENTS OF EFFECTIVE PROGRAMS FOR PREPARING AMERICAN INDIAN SECONDARY STEM TEACHERS**Regina Sievert¹; Joan LaFrance²¹Salish Kootenai College; ²Mekinak Consulting**A GENDER COMPARISON OF TECHNOLOGY TEACHERS' DISPOSITION TOWARD CRITICAL THINKING**Willem Rauscher; Sonja van Putten
University of Pretoria

15:00 - 16:30 **Poster Symposium PS02 - UNDERSTANDING OUT-OF-SCHOOL LEARNING PROCESSES IN STEM DISCIPLINES WITHIN THE GRADUATE PROGRAM GINT** **Room C1****Chairperson(s): Michael Komorek; Discussant: Dimitris Psillos****EDUCATIONAL RECONSTRUCTION OF CURRENTS AND STRUCTURE FORMATIONS**Kai Bliesmer; Michael Komorek
Carl von Ossietzky Universität Oldenburg**THE SYSTEM BEHIND CLIMATE. COGNITIVE AND MOTIVATIONAL PROCESSES IN THE DEVELOPMENT OF CLIMATE SYSTEM UNDERSTANDING THROUGHOUT A SEQUENCE LINKING IN-SCHOOL & OUT-OF-SCHOOL-LEARNING**Claudia Gorr¹; Michael Komorek¹; Claus Michelsen²¹Carl-von-Ossietzky-Universität Oldenburg; ²University of Southern Denmark**ADOLESCENTS' REASONING AND JUDGEMENT ABOUT COMPLEX PROBLEMS IN SUSTAINABLE DEVELOPMENT: AN INTERVENTION STUDY**Annegret Jansen; Ulrike-Marie Krause
University of Oldenburg**IMPROVING A SCIENCE OUT-OF-SCHOOL LAB IN A DESIGN BASED RESEARCH APPROACH**Sönke Janssen; Gunnar Friege
Leibniz Universität Hannover**COMPLEMENTARY NETWORKING OF OUT-OF-SCHOOL LEARNING ENVIRONMENTS**Michael Komorek; Christin Sajons
University of Oldenburg**DIVERGENT THINKING OF STUDENTS TAKING PART IN SCIENCE COMPETITIONS**Swantje Müller; Verena Pietzner
University of Oldenburg**CLIMATE CHANGE AND THE PHYSICAL DYNAMICS OF COAST, WADDEN SEA AND OCEAN AS TOPICS FOR EXTRACURRICULAR LEARNING**Annika Roskam; Michael Komorek; Kai Bliesmer
Carl von Ossietzky Universität Oldenburg**UNDERSTANDING PUPILS' LEARNING PROCESSES IN OUT-OF-SCHOOL SCIENCE LABS**Christin Marie Sajons; Michael Komorek
Carl von Ossietzky Universität Oldenburg

AN EMPIRICAL STUDY ON LEARNING PROCESSES AND ACTIONS OF STUDENTS WHILE INTERACTING WITH EXHIBITS AT A SCIENCE CENTRE

Anastasia Striligka¹; Michael Komorek¹; Dimitris Stavrou²
¹Carl von Ossietzky Universität Oldenburg; ²University of Crete

INTEREST STRUCTURED LEARNING PROCESSES IN AN OUT-OF-SCHOOL LAB

Micha Winkelmann; Susanne Wessnigk; Henrike Haverkamp
 Leibniz Universität Hannover - AG Physikdidaktik

15:00 - 16:30 OP34 - STRAND 4 - USING STUDENT-GENERATED VIDEOS AND ANIMATIONS IN SCIENCE TEACHING Room D1

Chairperson(s): Sevil Akaygun

ASSESSMENT OF PRE-SERVICE ELEMENTARY SCIENCE TEACHERS ABOUT A PROGRAMME OF INITIATION TO ACTIVISM THROUGH THE PRODUCTION OF VIDEOS ON LOCAL PROBLEMS

Daniel Cebrián-Robles¹; Enrique España-Ramos²; Pedro Reis³
¹Málaga University; ²Malaga University; ³Universidade de Lisboa, Instituto de Educação

STARTING SMALL: THE ADOPTION OF MOBILE-FILMMAKING IN THE SCIENCE CLASSROOM

Kaitlyn Martin¹; Lloyd Davis¹; Susan Sandretto²
¹Centre for Science Communication, University of Otago; ²College of Education, University of Otago

ESSENTIALS IN THE DESIGN OF WEBQUESTS TO LEVERAGE STUDENTS' LEARNING

María Napal; Isabel Zudaire; Irantzu Uriz
 Universidad Pública de Navarra

ANIMATION CHALLENGE: INVESTIGATING THE EFFECT OF CRITIQUING THE ANIMATIONS IN VARIANCE ON PRESERVICE TEACHERS' UNDERSTANDING OF REDOX REACTIONS

Sevil Akaygun; Emine Adadan
 Bogazici University

15:00 - 16:30 OP35 - STRAND 10 - STEM CURRICULUM STUDIES 1 Room D2

Chairperson(s): Grady Venville

STEM EDUCATION FROM AN AUSTRALIAN PERSPECTIVE

Ann Osman; Jan Van Driel; David Clarke
 University of Melbourne

TRENDS, IMPLICATIONS AND POSSIBILITIES FOR THE INTERDISCIPLINARY SCHOOL STEM CURRICULUM

Victoria Millar
 The University of Melbourne

INVESTIGATING THE NATURE OF STEM: ANALYSIS OF CURRICULUM DOCUMENTS FROM THE U.S., KOREA AND TAIWAN USING THE FAMILY RESEMBLANCE APPROACH

Wonyong Park; Jen-Yi Wu; Sibel Erduran
 University of Oxford

A WORLDLY PERSPECTIVE: USING THEORY TO ANALYSE STEM CURRICULA

Grady Venville¹; Leonie Rennie²; John Wallace³
¹Australian National University; ²Curtin University; ³Toronto University

15:00 - 16:30 OP36 - STRAND 11 - STUDENTS' ASSESSMENT IN CONTEXTUALIZED PROBLEM SOLVING AND INQUIRY-BASED TASKS Room D3

Chairperson(s): Iris Schiff

HOW CAN CONTEXT HELP TO SOLVE A PROBLEM? A PROCEDURAL ANALYSIS OF CONTEXTUALIZED PROBLEM-SOLVING

Patrick Löffler; Alexander Kauertz
 University of Koblenz-Landau

A TAXONOMY FOR EXAMINING EPISTEMIC PROBLEM-SOLVING APPROACHES IN STEM INQUIRY ACTIVITIES

Timothy Tan; Yew-Jin Lee; Peter Lee
 National Institute of Education, Nanyang Technological University, Singapore

WORKING WITH FIRST- OR SECOND-HAND DATA IN SCHOOL LABS: DOES IT MAKE A DIFFERENCE?

Burkhard Priemer; Stephan Pfeiler
Humboldt-Universität zu Berlin

INQUIRY COMPETENCES OF JUNIOR AND SENIOR CLASS BIOLOGY STUDENTS

Iris Schiff; Lisa Virtbauer; Elisabeth Scheicher
University of Salzburg, School of Education

15:00 - 16:30 **OP37 - STRAND 15 - TEACHER EDUCATION AND BELIEFS IN EARLY CHILDHOOD SCIENCE** **Room E2 - Italia**

Chairperson(s): Jesper Sjöström

TEACHERS' PERCEPTIONS OF ENVIRONMENTAL EDUCATION IN EARLY CHILDHOOD SETTINGS

Ann-Catherine Henriksson
Åbo Akademi University

EXPLORING SCIENCE TEACHING CONTINUITY ACROSS ECE SECTORS: HOW DO THE TEACHERS IN DIFFERENT SCHOOL FORMS DEAL WITH THE SAME CONTENT?

Bodil Sundberg¹; Sofie Areljung²; Karin Due¹; Christina Ottander¹; Marianne Skoog³
¹Department of Science and Mathematics Education, Umeå University;; ²Department of Applied Educational Science; ³School of humanities, education and social sciences

PRE-PRIMARY EDUCATION UNIVERSITY STUDENTS' PERSPECTIVES OF DIFFERENT FORMS OF SCIENTIFIC INQUIRY: AN EXPLORATORY STUDY

Kostas Korfiatis; Stella Constantinou; Stella Petrou; Charalambia Lazaridou
University of Cyprus

CHARACTERISTICS OF SCIENCE TEACHING IN PRESCHOOL

Jesper Sjöström; Ann-Christine Vallberg Roth
Malmö University - Faculty of Education and Society

15:00 - 16:30 **OP82 - STRAND 1 - MATHEMATICAL MODELLING IN SCIENCE** **Room F1**

Chairperson(s): Felix Ho

INFLUENCE OF MATHEMATICAL SENSEMAKING AND CONFIDENCE ON PROBLEM SOLVING

Anita Schuchardt
University of Minnesota

THE EXTENDED THEORETICAL FRAMEWORK OF MATHEMATICAL WORKING SPACE (EXTENDED MWS): COMPARISON WITH THE ANTHROPOLOGICAL THEORY OF THE DIDACTIC (ATD) AND USE IN PHYSICS OR CHEMISTRY

Laurent Moutet
LDAR Université Paris 7 UFR de mathématiques

PHYSICS AND NON-PHYSICS STUDENTS' UNDERSTANDING OF GRAPHS: AN EYE-TRACKING STUDY

Ana Susac¹; Andreja Bubic²; Elizabeta Kazotti³; Maja Planinic³; Marijan Palmovic⁴
¹Department of Applied Physics, Faculty of Electrical Engineering and Computing, University of Zagreb; ²Chair for Psychology, Faculty of Humanities and Social Sciences, University of Split; ³Department of Physics, Faculty of Science, University of Zagreb; ⁴Laboratory for Psycholinguistic Research, Department of Speech and Language Pathology, University of Zagreb

DOING MATHS IN CHEMISTRY - THE INTERACTION BETWEEN CHEMISTRY AND MATHEMATICS IN PROBLEM SOLVING

Felix M. Ho¹; Maja Elmgren¹; Jon-Marc G. Rodriguez²; Kinsey Bain³; Marcy H. Towns²
¹Uppsala University; ²Purdue University; ³Michigan State University

15:00 - 16:30 **OP39 - STRAND 1 - UNDERSTANDING CHEMICAL REACTIONS** **Room F2**

Chairperson(s): Emine Adadan

REVISITING THE 'STABLE' OCTET

Ruth Wheeldon
UCL Institute of Education

HOW DO STUDENTS BALANCE A CHEMICAL EQUATION FOR THE FIRST TIME? SPONTANEOUS USES OF DRAWING AND SYMBOLISM

Annie K. L. Chan¹; Maurice M. W. Cheng²
¹The University of Hong Kong; ²University of Waikato

A SPECTRUM-LIKE MODEL FOR STUDENTS' UNDERSTANDING OF SCIENCE: A CASE IN CHEMICAL REACTION

Maurice M.W. Cheng¹; Y.C. Wong²

¹The University of Waikato; ²Shung Tak Catholic English College, Hong Kong

EXAMINING PRESERVICE CHEMISTRY TEACHERS' UNDERSTANDING OF GAS BEHAVIOR: THE CONTRIBUTION OF METACOGNITIVE AWARENESS

Emine Adadan

Bogazici University

15:00 - 16:30

OP40 - STRAND 7 - ARGUMENTATION AND EPISTEMIC COGNITION

Room F3

Chairperson(s): Irene Hadjicosti

EPISTEMIC KNOWLEDGE MOBILIZED BY HIGH SCHOOL STUDENTS DURING A ROLE-PLAY ABOUT FOOD SAFETY

Lucia Casas Quiroga; Beatriz Crujeiras Pérez

Universidade de Santiago de Compostela

CONTEMPLATING THE OPPOSITION: DOES A PERSONAL TOUCH MATTER?

Kalyso Iordanou¹; Deanna Kuhn²

¹University of Central Lancashire Cyprus; ²Columbia University

A QUALITATIVE COMPARATIVE STUDY TO ELICIT FEATURES OF EPISTEMIC KNOWLEDGE WHEN MIDDLE SCHOOL STUDENTS ENGAGED IN DIALOGICAL ARGUMENTATION

Getachew Tarekegn¹; Jonathan Osborne²; Mesfin Tadesse¹

¹Addis Ababa University; ²Graduate School of Education

STUDENTS' FORMS OF DIALOGUE WHEN ENGAGED WITH CONTEMPORARY BIOLOGICAL RESEARCH

Irene Hadjicosti¹; Kostas Korfiatis²; Stephen Price³; Ralph Levinson³

¹university of cyprus; ²universtiy of cyprus; ³University College London

15:00 - 16:30

OP41 - STRAND 13 - LEARNING ENVIRONMENTS IN PRE-SERVICE TEACHER EDUCATION

Room G1

Chairperson(s): Kirsti Marie Jegstad

DEVELOPMENT OF A LEARNING ENVIRONMENT TO ENHANCE TEACHER STUDENTS' DIAGNOSTIC COMPETENCE

Ingrid Krumphals; Claudia Haagen-Schützenhöfer

University of Graz

NOVEL EDUCATIONAL COMPUTATIONAL CHEMISTRY LEARNING ENVIRONMENTS EFFECT ON PRE-SERVICE CHEMISTRY TEACHERS' PERCEPTIONS OF TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE

Jorge Rodriguez-Becerra¹; Lizethly Cáceres-Jensen¹; Tatiana Díaz¹; Victor Bahamonde Padilla¹; Johannes Perna²; Maija Aksela²

¹Universidad Metropolitana de Ciencias de la Educación; ²University of Helsinki

A FRAMEWORK FOR CREATING TOOLS FOR USE IN EDUCATIONAL ENVIRONMENTS: ANALYZING LEARNING AS PROOF OF CONCEPT

Susan Kirch¹; Pooneh Sabouri¹; Moyu Zhang¹; Wanjing Ma²

¹New York University; ²University of Pennsylvania

THE OUTDOORS AS A SETTING FOR LEARNING CHEMISTRY IN TEACHER EDUCATION

Kirsti Marie Jegstad¹; Jan Höper²; Kari Beate Remmen³

¹OsloMet - Oslo Metropolitan University; ²UiT The Arctic University of Norway; ³University of Oslo

15:00 - 16:30

OP42 - STRAND 13 - PEDAGOGICAL CONTENT KNOWLEDGE III

Room G2

Chairperson(s): Jaana Herranen

TEACHER EDUCATION IN QUANTUM PHYSICS — A PROPOSAL FOR IMPROVING PEDAGOGICAL CONTENT KNOWLEDGE

Gesche Pospiech; Matthias Schöne

TU Dresden

EARTH SCIENCE IN PRESERVICE TEACHER: VALIDATING AN INSTRUMENT FOR MEASURING PCK IN ELEMENTARY PST

Claudia Vergara¹; David Santibañez²; Beatriz Becerra³; Sofia Letelier¹; Hernan Cofre⁴

¹Alberto Hurtado University; ²Universidad Católica Silva Henríquez; ³Universidad Católica de Valparaíso; ⁴Universidad Católica de Valparaíso

THE DEVELOPMENT OF PRE-SERVICE TEACHERS' PCK ABOUT TEACHING ELECTROMAGNETISMCoréne Coetzee¹; Estelle Gaigher¹; Marissa Rollnick²¹University of Pretoria; ²WITS University**TOWARDS LEARNER-DRIVEN SCIENCE TEACHER EDUCATION FOR SUSTAINABILITY**Jaana Herranen; Maija Aksela

University of Helsinki

15:00 - 16:30 OP43 - STRAND 13 - PRE-SERVICE TEACHERS IN PRIMARY SCHOOL AND PRESCHOOL Room G3

Chairperson(s): Martina Lavagnini**SCIENCE AND DIGITALIZATION IN PRESCHOOL TEACHER EDUCATION - STUDENT TEACHERS' EXPERIENCES**Per Högström

Högskolan i Halmstad

THE RELEVANCE OF SCIENCE AND TEACHING SCIENCE ACCORDING TO FINNISH PRIMARY TEACHER STUDENTSPia Sjöblom; Ann-Sofi Härmälä-Braskén

Åbo Akademi University

PRIMARY PRESERVICE TEACHERS' ATTITUDES AND INTENTION TOWARDS TEACHING SCIENCEReece Mills¹; Chrystal Whiteford¹; Daniel Brown²¹Queensland University of Technology; ²Griffith University**PROSPECTIVE PRIMARY TEACHERS LEARN ABOUT THE INTERPLAY OF MATHEMATICS AND PHYSICS**Martina Lavagnini¹; Marisa Michelini¹; Gesche Pospiech²¹University of Udine; ²TU Dresden

15:00 - 16:30 OP44 - STRAND 14 - SUSTAINABLE DEVELOPMENT GOALS (SDGS) Room G4

Chairperson(s): Tapashi Chowdhury**IN-SERVICE TEACHERS' PERCEPTIONS REGARDING THE IMPLEMENTATION OF THE GREEN CHEMISTRY IN THE CLASSROOM**Pia José González; Mariona Espinet; Anna Marbà

Universitat Autònoma de Barcelona

SELF-EFFICACY OF IN-SERVICE SECONDARY SCHOOL TEACHERS TOWARD EDUCATION FOR SUSTAINABLE DEVELOPMENT: PRELIMINARY FINDINGSAthanasios Mogias¹; George Malandrakis²; Penelope Papadopoulou³; Costas Gavrilakis⁴¹Democritus University of Thrace; ²Aristotle University of Thessaloniki; ³University of Western Macedonia; ⁴University of Ioannina**VALUE INHERENT PEDAGOGY IN TEACHING SCIENCE**Uri Livne; Uri Livne; Avraham Merzel; Yifat Kolikant

The Hebrew University of Jerusalem

TEACHER OWNERSHIP OF USING SOCIO-SCIENTIFIC ISSUES TO PROMOTE FUTURE CITIZENRYTapashi Chowdhury; Jack Holbrook; Miia Rannikmaa

University of Tartu

15:00 - 16:30 OP45 - STRAND 14 - IMPLEMENTING INQUIRY-BASED SCIENCE EDUCATION I Room G5

Chairperson(s): Ella Yonai**PROFESSIONALISING TEACHERS FOR INQUIRY-BASED SCIENCE EDUCATION - CHALLENGES AND LIMITS**Elisabeth Hofer; Anja Lembens

University of Vienna, AECC Chemistry

SCIENTIFIC INQUIRY FOR SCIENCE TEACHING IN THE EXTREME NORTH OF CHILE: PERCEPTIONS AND CHALLENGES FROM THE SCHOOL COMMUNITY OF A RURAL SCHOOLKATHERINE ACOSTA¹; Marlene Morales²; Carlos Rodríguez²; Juan Jimenez³¹UNIVERSIDAD DE TARAPACÁ; ²University of Tarapacá; ³Illinois Institute of Technology**CHANGES IN ACADEMIC LANGUAGE AND SCIENCE INQUIRY INTERACTIONS IN A 4TH GRADE CHILEAN CLASSROOM AFTER A PRACTICE-BASED PROFESSIONAL DEVELOPMENT**Dominga Miranda; Alejandra Meneses; Maximiliano Montenegro; Andrea Valenzuela

Pontificia Universidad Católica de Chile

PRINCIPLE-BASED DESIGN: A COURSE FOR TEACHERS ON WORKING WITH A SCANNING ELECTRON MICROSCOPE

Ella Yonai; Blonder Ron
The Weizmann Institute of Science

15:00 - 16:30 OP46 - STRAND 16 - SCIENCE, INQUIRY AND MATH SKILLS AT PRIMARY LEVEL Room G6

Chairperson(s): Mario Quintanilla

ONLINE CITIZEN SCIENCE IN PRIMARY CLASSROOMS: DEVELOPING SCIENCE CAPABILITIES FOR CITIZENSHIP

Dayle Anderson; Markus Luczak- Roesch; Cathal Doyle; Yevgeniya Li; Cameron Pierson; Brigitte Glasson
Victoria University Of Wellington

THE EFFECTIVENESS OF A DIGITAL TOOL IN IMPROVING PRIMARY SCIENCE TEACHING AND SCIENCE THINKING SKILLS

Louise Stubberfield¹; Lily Ickowitz-Seidler¹; Sarah Leonardi²
¹Wellcome Trust; ²CFE Research

THE PEDAGOGICAL CHARACTERISTICS OF LEARNING TASKS IN MATHEMATICS AND SCIENCES IN PRIMARY SCHOOLS

Irit Sasson
Tel-Hai Academic College

PERCEPTION OF ELEMENTARY STUDENTS OF CHILE ABOUT THEIR EMOTIONS WHEN THEY CONSULT IN LINE SCIENTIFIC KNOWLEDGE TO RESOLVE THEIR SCHOOL TASKS.

Mario Quintanilla¹; Miguel Manzanilla¹; Eloy Peña¹; Alberto Labarrere²
¹Pontificia Universidad Católica de Chile; ²Universidad Santo Tomas de Chile

15:00 - 16:30 OP47 - STRAND 17 - UNIVERSITY STUDENTS' UNDERSTANDING IN DISCIPLINE-BASED SCIENCE EDUCATION Room G7

Chairperson(s): RAFAELLE DA SILVA SOUZA

HIGH SCHOOL AND UNIVERSITY STUDENTS' UNDERSTANDING OF SOLUBILITY AND SOLUBILITY PRODUCT CONCEPTS. A PHENOMENOGRAPHIC APPROACH.

Daniel Zuazagoitia¹; Oscar Gonzalez²; Consuelo Dominguez-Sales³
¹University Basque Country; ²UNIVERSITY BASQUE COUNTRY; ³University of Valencia

MISCONCEPTIONS OF ENGINEERING AND PHYSICS UNIVERSITY STUDENTS ABOUT SELF-REGULATION IN A SIMPLE DC CIRCUIT

Sergio Rosa-Cintas; Asuncion Menargues; Carolina Nicolás-Castellano; Ruben Limiñana; Alexandra Rey-Cubero; Juan Francisco Álvarez-Herrero; Joaquín Martínez-Torregrosa; Isabel Lujan
University of Alicante

RECONSTRUCTING QUANTUM PHYSICS FOR INSTRUCTION

Elina Palmgren¹; Terhi Mäntylä²
¹University of Helsinki, Department of Physics; ²University of Tampere, Faculty of Education and Culture

A LOOK AT THE CURRICULAR COMPONENT OF QUANTUM MECHANICS IN THE PUBLIC UNIVERSITIES OF BRAZIL

Rafaelle Da Silva Souza¹; Ileana Maria Greca²; Indianara Silva³; Elder Sales Teixeira³
¹Universidade Federal da Bahia; ²Universidade de Burgos; ³Universidade Estadual de Feira de Santana

15:00 - 16:30 OP48 - STRAND 17 - STEM, RRI AND INTERDISCIPLINARITY AT UNIVERSITY LEVEL Room G8

Chairperson(s): Chia-Hui Hung

THE STRATEGIC UNDERGRADUATE STEM TALENT ACCELERATION INITIATIVE (SUSTAIN): IMPACTS ON THE SOCIALIZATION OF LOW-INCOME COLLEGE STUDENTS

Gaye Ceyhan; Alia Thompson; John Tillotson; Jason Wiles
Syracuse University

STARBIOS2 - ENGAGING WITH RESPONSIBLE RESEARCH THROUGH SCIENCE EDUCATION

Doris Elster
University of Bremen

A NOVEL INTERDISCIPLINARY APPROACH TO DIVERSIFY BIOECONOMY PARTICIPATION: A PILOT STUDY

Shana McAlexander; Katherine McCance; Margaret Blanchard; Richard Venditti
North Carolina State University

ART IN MEDICAL EDUCATION: SOCIETY, TECHNOLOGY, ENGINEERING, ART, AND MEDICINE (STEAM) LEARNING TO STRENGTHEN THE PROFESSIONALISMChia-Hui Hung¹; Chi-Sheng Chen²¹Chung-Shan medical university and Chung-Shan medical university hospital; ²Jenteh junior college of medicine, nursing and management**TUESDAY 17:00 - 18:30****17:00 - 18:30 OP92 - STRAND 3 - PROJECT BASED EDUCATION AND SPECIAL PROGRAMMES Room A1****Chairperson(s): Niklas Kramer****GIFTED UPPER SECONDARY STUDENTS' ENGAGEMENT IN LEARNING PHYSICS THROUGH PROJECT BASED LEARNING**Taina Makkonen; Jari Lavonen
University of Helsinki**ENGAGING UPPER SECONDARY STUDENTS LEARNING NEWTONIAN MECHANICS THROUGH PROJECT BASED LEARNING**Jari Lavonen¹; Taina Makkonen¹; Kalle Juuti¹; Visajaani Salonen¹; Janna Inkinen¹; Katariina Salmela-Aro¹; Klinge Condori²; Joseph Krajcik³; Barbara Schneider³
¹University of Helsinki; ²Universidad Nacional de San Agustín; ³Michigan State University**IN- SCHOOL SCIENCE ENRICHMENT PROGRAM FOR GIFTED CHILDREN: EFFECTS ON PSYCHOLOGICAL OUTCOMES AMONG PARTICIPANTS AT THE NOREGIAN TALENT SCIENCE CENTERS**Ella Idsøe¹; Merethe Frøyland²; Thormod Idsøe³
¹Norwegian Centre for Science Education, University of Oslo; ²Norwegian Center for Science Education; ³Norwegian Center for Child Behavioral Development**THE EFFECTS OF AN INTERDISCIPLINARY WEEK-LONG WORKSHOP ABOUT "THE CARDIOVASCULAR SYSTEM"**Niklas Kramer; Claas Wegner
Bielefeld University**17:00 - 18:30 OP93 - STRAND 3 - PRACTICAL WORK AND EXPERIMENTS Room A2****Chairperson(s): Seamus Delaney, Australia****THE IMPACT OF CURRICULUM CHANGE ON PRACTICAL WORK IN SCIENCE FOR 11 – 18S: FINDINGS FROM A THREE-YEAR NATIONAL SURVEY IN ENGLAND AND SCOTLAND**Vanessa Kind¹; Helen Cramman²
¹University of Durham; ²Durham University**PRACTICAL WORK OR SIMULATIONS? VOICES FROM GENERATION Z**Promail K.Y. Leung¹; Maurice M.W. Cheng²
¹The University of Hong Kong; ²The University of Waikato**ANALYSIS OF LEARNING WITH DYNAMIC MODELS AND EXPERIMENTS IN OPTICS**Albert Teichrew; Roger Erb
Department of Physics Education, Goethe University Frankfurt**TEACHER PRACTICES TO LINK MACRO-LEVEL OBSERVATIONS WITH SUB-MICRO REPRESENTATIONS OF CHEMISTRY UNDERSTANDING - AN INTERNATIONAL COMPARATIVE STUDY**Seamus Delaney¹; Katrin Soika²; Luka Vinko³; Connie Cirkony⁴; Liivi Kivimäe²; Iztok Devetak³
¹Deakin University, Australia; ²Tallinn University, Estonia; ³University of Ljubljana, Slovenia; ⁴Monash University, Australia**17:00 - 18:30 OP94 - STRAND 2 - GENDER AND DIVERSITY IN SCIENCE LEARNING Room B1****Chairperson(s): Susanne Walan****DIVERSE STUDENTS, DIVERSE INQUIRY? HANDS-ON INQUIRY LEARNING IN HETEROGENEOUS CHEMISTRY CLASSROOMS**Dennis Kirstein; Sebastian Habig; Maik Walpuski
University of Duisburg-Essen**INFLUENCE OF THE SOCIO-CULTURAL CONTEXT ON STUDENTS' NAÏVE KNOWLEDGE: EXAMPLE OF TANZANIAN STUDENTS' UNDERSTANDING OF VOLCANIC AND SEISMIC PROCESSES AND RISKS**Florence Le Hebel¹; Valérie Fontanieu²
¹Laboratoire ICAR, ENS de Lyon, France; ²IFE, ENS de Lyon, France

HOW CAN WE HELP DISADVANTAGED STUDENTS TO CONTINUE WITH SCIENCE ONCE IT IS NO LONGER COMPULSORY?

Michael Reiss¹; Tamjid Mujtaba¹; Richard Sheldrake²
¹UCL Institute of Education; ²UCL Institute of Education

COMBINING DRAMA AND PROP MAKING IN A MAKERSPACE TO STIMULATE GIRLS' INTEREST IN STEM AND THEIR DEVELOPMENT OF 21ST CENTURY SKILLS.

Susanne Walan
 Karlstad University

17:00 - 18:30 **OP95 - STRAND 6 - TEACHERS' AND SCIENTISTS' PERCEPTIONS** **Room B2**

Chairperson(s): Jen-Yi Wu

SCIENCE TEACHERS' PERCEPTIONS OF THE NATURE OF SCIENCE CONSIDERING THEIR PRE AND IN-SERVICE EDUCATION

Busra Aksoz; Zeynep Kızıltepe; Ebru Kaya
 Bogazici University

EXPLORING PHYSICS TEACHERS' CONCEPTIONS OF THE NATURE OF THE SCIENCES

Dimitrios Schizas¹; Dimitris Psillos²
¹International Hellenic University; ²School of Primary Education, Aristotle University of Thessaloniki,

TEACHERS' VIEWS ON PHYSICS, TECHNOLOGY AND RESPONSIBILITY

Frederik Bub; Thorid Rabe
 Martin Luther University Halle-Wittenberg

SCIENTISTS' PERCEPTIONS OF THE NATURE OF SCIENCE: AN INVESTIGATION BASED ON THE FAMILY RESEMBLANCE APPROACH

Jen-Yi Wu¹; Sibel Erduran²
¹Ministry of Science and Technology; ²University of Oxford

17:00 - 18:30 **OP96 - STRAND 6 - NATURE OF STEM** **Room B3**

Chairperson(s): Katrin Vaino

THE PORTRAYAL OF ENGINEERING OPTIMIZATION IN SECONDARY SCIENCE VERSUS TECHNOLOGY EDUCATION

Allison Antink-Meyer; Ryan Brown
 Illinois State University

A LITERATURE REVIEW ON THE USE OF THE TERMS 'TECHNOLOGY' AND 'ENGINEERING': THE NATURE OF TECHNOLOGY IN SCIENCE EDUCATION

Sejung Kim; Jinwoong Song
 Seoul National University

EXPLORING THE NATURE OF STEM BEYOND THE ACRONYM

Terry Lyons
 Queensland University of Technology

DEVELOPING A QUESTIONNAIRE TO MEASURE STUDENTS' CONCEPTIONS OF THE NATURE OF TECHNOLOGY

Katrin Vaino; Toomas Vaino; Miia Rannikmäe
 University of Tartu

17:00 - 18:30 **OP97 - STRAND 8 - EVERYDAY SITUATIONS AND DECISIONS** **Room B4**

Chairperson(s): Durdane Bayram Jacobs

IDENTIFYING EVERYDAY DECISION SITUATIONS OF LEARNERS IN SCIENCE EDUCATION

Laurence Schmitz; Christiane S. Reiners
 University of Cologne

ADULT SCIENCE LITERACY IN ACTION: ENGAGING WITH A REAL LIFE SOCIO-SCIENTIFIC ISSUE

Keren Dalyot; Ayelet Baram-Tsabari
 Technion Israel Institute of Technology

FINDING CONSENSUS IN CONFLICTS: IMPLEMENTATION OF PLACE-BASED SOCIO-SCIENTIFIC TEACHING & LEARNING

Hui-Chuan Chang; Hui Lee
 Curriculum Design and Human Potentials Development, National Dong Hwa University

A CITIZENSHIP CHEMISTRY LESSON: STUDENTS' INFORMED DECISION-MAKING BY USING DIFFERENT PERSPECTIVES ABOUT USE AND SALE OF LAUGHING GAS AMONG YOUTHS

Durdane Bayram Jacobs¹; Ineke Henze²; Godfried Wieske³
¹Radboud University; ²Delft University of Technology; ³Stanislas College Pijnacker

17:00 - 18:30 **OP98 - STRAND 9 - LEARNING OUTSIDE THE CLASSROOM I** **Room B5**

Chairperson(s): Youngjin Choi

A COMPARATIVE CASE STUDY OF TEACHER-COACHES WHO LEAD AFTER-SCHOOL STEM CLUBS AT TWO RURAL, LOW WEALTH MIDDLE SCHOOLS

Kylie Swanson Hoyle¹; Margaret Blanchard²
¹University of Colorado Colorado Springs; ²North Carolina State University

FACTORS INFLUENCING STUDENT LEARNING IN RURAL U.S. AFTER-SCHOOL STEM CLUBS

Margaret Blanchard¹; Kristie Gutierrez²; Kylie Swanson Hoyle³; Christopher Allred⁴; Jason Painter¹; N. Scott Ragan¹
¹North Carolina State University; ²Old Dominion University; ³University of Colorado Colorado Springs

LIFELONG LEARNING WITH GIRAFFES: BIOINSPIRATION AT THE ZOO

Michal Topaz; Tali Tal
 Technion - Israel Institute of Technology

CHARACTERISTICS OF SPATIAL ABILITY IN EARTH SCIENCE ACTIVITY USING ORIENTEERING

Youngjin Choi; Donghee Shin
 Ewha Womans University

17:00 - 18:30 **OP99 - STRAND 9 - STUDENTS' KNOWLEDGE AND UNDERSTANDING OF ENVIRONMENTAL TOPICS AND ISSUES** **Room B6**

Chairperson(s): Jonathan Hense

BIODIVERSITY AND CULTURAL DIVERSITY: STUDENTS' CONCEPTIONS AND VALUES RELATED TO BIODIVERSITY AND INTERCULTURALITY — CASE OF LEBANON

Fadi El Hage¹; Taghrid Diab¹; Arnaud Martin²; Carla Khater³
¹Universite Saint-Joseph; ²Université de Montpellier; ³CNRS Libanais

EVALUATION OF STUDENTS' SELF-REPORTED KNOWLEDGE AND FACTUAL IDENTIFICATION SKILLS OF NATIVE BIRD SPECIES IN [CITY]

Ulrike Sturm; Kim G. Mortega; Silke L. Voigt-Heucke; Alexandra Moormann
 Museum für Naturkunde Berlin - Leibniz Institute for Evolution and Biodiversity Science

USING MOBILE GAZE TRACKING TO STUDY STUDENTS' OBSERVATIONS DURING AN OUTDOOR ECOLOGY LESSON

Anna Uitto; Anttoni Kervinen
 University of Helsinki

THE 5-MIN-BIOLOGY - A SHORT AND POWERFUL METHOD TO DEVELOP SPECIES KNOWLEDGE IN BIOLOGY LESSONS

Jonathan Hense; Annette Scheersoi
 Biology Education, University Bonn

17:00 - 18:30 **OP100 - STRAND 12 - TEACHING AND STEM EXPERIENCES** **Room B7**

Chairperson(s): Ainur Almukhambetova

GENDERED SCIENCE TEACHING: TO BOYS OR NOT TO BOYS? THAT IS THE QUESTION

Ruth Amos; Avital Shirazi
 UCL Institute of Education

RELATIONSHIP OF STUDENTS' ATTITUDE TOWARDS SCIENCE WITH THEIR LEARNING APPROACH: A GENDER BASE STUDY

Muhammad Anwer; Michael Reiss
 UCL Institute of Education

AFFIRMING TEACHING AND LEARNING SCIENCE EXPERIENCES FOR RACIAL, CULTURAL, AND LINGUISTICALLY DIVERSE STUDENTS IN A STEM-INCLUSIVE HIGH SCHOOL

Noemi Waight; Jennifer Tripp; Lorenda Chisolm
 University at Buffalo

WHY THE PIPELINE LEAKS? UNDERSTANDING FEMALE HIGHER EDUCATION STUDENTS' EXPERIENCES IN STEM IN KAZAKHSTAN

Ainur Almukhambetova; Aliya Kuzhabekova; Daniel Hernandez Torrano
Nazarbayev University Graduate school of education

17:00 - 18:30 **OP101 - STRAND 7 - ASSESSING ARGUMENTATION** **Room C1**

Chairperson(s): Yann Shiou Ong

ADDRESSING THE PRACTICE OF ARGUING FROM EVIDENCE IN SCIENCE USING FORCED-CHOICE ITEM FORMATS

Sara Dozier¹; Linda Morell²; Weeraphat Suksiri²; Jonathan Osborne¹; Mark Wilson²
¹Stanford University; ²University of California, Berkeley

TOWARD DEVELOPING AUTHENTIC MEASURES OF TEACHER EPISTEMOLOGIES AND STUDENT ATTITUDES TO ARGUMENT

Nicole Zillmer; April Holton; J. Bryan Henderson
Arizona State University

ARTICULATED REASONING IN SPOKEN STUDENT ARGUMENTS

Kaisa Jokiranta; Markus Hähkiöniemi; Jenna Hiltunen; Sami Lehesvuori; Pasi Nieminen; Jouni Viiri
University of Jyväskylä

CLUSTER SIZE MEASUREMENT: A STUDY OF SECONDARY STUDENTS PROBLEMATISING DATA

Yann Shiou Ong¹; Richard Duschl²
¹National Institute of Education, Nanyang Technological University; ²Pennsylvania State University

17:00 - 18:30 **OP102 - STRAND 4 - USING DIGITAL GAMES FOR LEARNING BIOLOGY** **Room D1**

Chairperson(s): Georgia Hodges

PLAYING MOLECULAR BIOLOGY — COMBINING A GAME-BASED VIRTUAL LABORATORY AND HANDS-ON EXPERIMENTS IN A BLENDED-LEARNING COURSE FOR PRE-SERVICE TEACHERS

Steffen Schaal¹; Christian König²; Max Mannsperger¹
¹University of Education Ludwigsburg; ²University of Hohenheim

CHARACTERISING THE EDUCATIONAL POTENTIALS OF MOBILE APPLICATIONS RELATED TO ECOLOGY

María Zoe Maldonado Vélez¹; Romina Cecilia Torres²; Leticia Garcia Romano³
¹Science and Technology Teaching Department, National University of Córdoba, Córdoba, Argentina; ²National Scientific and Technical Research Council, Córdoba, Argentina; ³Science and Technology Teaching Department, CONICET, National University of Córdoba, Córdoba, Argent

ASSESSING CONCEPTUAL UNDERSTANDING OF HIGH SCHOOL STUDENTS WITH A DIGITAL EDUCATIONAL GENETICS GAME

Cody Smith¹; Arif Rachmatullah¹; Eric Wiebe¹; Trudi Lord²; Frieda Reichsman²; Chad Dorsey²; Bradford Mott¹; James Lester¹; Danielle Boulden¹
¹North Carolina State University; ²Concord Consortium

A MIXED METHODS STUDY COMPARING LEARNING GAINS ASSOCIATED WITH SERIOUS GAMEPLAY AND HANDS-ON SCIENCE IN ELEMENTARY CLASSROOMS

Georgia Hodges; Kayla Flanagan
University of Georgia

17:00 - 18:30 **OP103 - STRAND 10 - STEM CURRICULUM STUDIES 2** **Room D2**

Chairperson(s): Nina Waaddegaard

ELEMENTARY STUDENT CONCEPTIONS OF STEM: DOES ATTENDING A STEM SCHOOL MAKE A DIFFERENCE?

Elizabeth Ring-Whalen¹; Jeanna Wieselmann²; Gillian Roehrig²
¹St. Catherine University; ²University of Minnesota

EVALUATING THE QUALITY OF A K-12 INTEGRATED STEM CURRICULUM

Gillian Roehrig¹; Emily Dare²; Elisabeth Ring-Whalen³; Jeanna Wieselmann¹
¹University of Minnesota; ²Florida International University; ³St Catherine University

TEACHERS' NEGOTIATION OF USABILITY OF INDUSTRIAL SCIENCE AND TECHNOLOGY TEACHING RESOURCES

Maria Andrée¹; Lena Hansson²
¹Departement of Mathematics and Science Education; ²University of Kristianstad

TEACHER DILEMMAS OF STEM EDUCATION IN DENMARK

Nina Waaddegaard

Department of Science Education, University of Copenhagen

17:00 - 18:30 **OP104 - STRAND 11 - STUDENTS' ASSESSMENT IN COMPUTER-BASED AND DIGITAL ENVIRONMENTS** **Room D3**

Chairperson(s): Mats Kieserling**COMPUTER-AUTOMATED SCORING OF RESPONSES TO ITEMS IN OPEN FORMAT ABOUT ASPECTS OF META-MODELLING KNOWLEDGE**

Dirk Krüger; Moritz Krell

Freie Universität Berlin

ASSESSMENT OF ARGUMENTATION — CONSIDERATIONS FOR AUTOMATED ANALYSIS AND ENGLISH LANGUAGE LEARNERSChristopher Wilson¹; Jonathan Osborne²; Kevin Haudek³; Molly Stuhlsatz¹; Tina Cheuk²; Brian Donovan¹; Zoe Buck Bracey¹; Marisol Mercado Santiago³¹BSCS Science Learning; ²Stanford University; ³Michigan State University**TO QUIT OR NOT TO QUIT: USING LOG FILE DATA TO UNDERSTAND PROFILES OF STUDENTS' PERFORMANCE ON SIMULATED INQUIRY TASKS**

Nani Teig

University of Oslo

DIGITISATION IN CHEMISTRY LESSONS - DEVELOPMENT AND EVALUATION OF AN EXPERIMENTAL DIGITAL LEARNING ENVIRONMENT WITH UNIVERSAL ACCESSIBILITY

Mats Kieserling; Insa Melle

TU Dortmund University

17:00 - 18:30 **OP105 - STRAND 5 - TEACHING AND LEARNING ABOUT ENERGY AND HEAT** **Room E2 - Italia**

Chairperson(s): Massimiliano Malgieri**RESEARCH-BASED DESIGN OF A TEACHING AND LEARNING SEQUENCE FOR THE FIRST LAW OF THERMODYNAMICS**

Kalliopi Meli; Dimitrios Koliopoulos

University of Patras

USING INFRARED CAMERAS TO SUPPORT TEACHERS' AND PUPILS SCIENTIFIC COMMUNICATION IN LEARNING ABOUT CHALLENGING THERMAL PHENOMENANiclas Åhman¹; Fredrik Jeppsson²¹Linnaeus University, Department of Physics and Electrical Engineering; ²Linköping University, Norrköping, Sweden**ADAPTATIONS TO PROJECT-BASED LEARNING OF AN ENERGY MODEL-BASED TEACHING SEQUENCE**Caterina Solé¹; María Isabel Hernández²; Conxita Márquez²¹CRECIM (Autonomous University of Barcelona); ²Autonomous University of Barcelona**REDESIGNING A TEACHING-LEARNING SEQUENCE ABOUT THE PHYSICAL BASIS OF GREENHOUSE EFFECT AND GLOBAL WARMING**Pasquale Onorato¹; Massimiliano Malgieri²; Alessandro Salmoiraghi¹; Stefano Oss¹; Anna De Ambrosis²¹University of Trento; ²University of Pavia

17:00 - 18:30 **OP106 - STRAND 1 - DEVELOPING STUDENTS' UNDERSTANDING OF THE CONCEPT OF ENERGY** **Room F1**

Chairperson(s): Daniel Gysin**SYSTEMS, TRANSFER, AND FIELDS: EVALUATING A NEW APPROACH TO ENERGY INSTRUCTION**David Fortus¹; Marcus Kubsch²; Tom Bielik³; Joseph Krajcik³; Yaron Lehavi⁴; Knut Neumann²; Jeffrey Nordine²; Sebastian Opitz²; Israel Touitou³¹Weizmann Institute of Science; ²Leibniz Institute for Science and Mathematics Education (IPN); ³Michigan State University; ⁴David Yellin College**INVESTIGATING A SYSTEMS TRANSFER APPROACH TO TEACHING ENERGY IN MIDDLE SCHOOL**Marcus Kubsch¹; Sebastian Opitz¹; Jeffrey Nordine¹; Knut Neumann¹; David Fortus²; Joseph Krajcik³¹IPN; ²Weizmann Institute of Science; ³CREATE for STEM Institute

WHAT CONCEPTUAL FRONTIERS MUST SECONDARY SCHOOL STUDENTS OVERCOME IN ORDER TO UNDERSTAND THE CONCEPT OF ENERGY TRANSFER THROUGH HEAT?

Camilo Vergara; Víctor López; Digna Couso
CRECIM

KNOWLEDGE COORDINATION AND THE USE OF CONTEXT DURING THE TRANSFER PROCESS IN PHYSICS

Daniel Gysin¹; Markus Rehm²; Dorothee Brovelli¹
¹University of Teacher Education Lucerne; ²University of Education, Heidelberg

17:00 - 18:30 **OP107 - STRAND 1 - UNDERSTANDING PHYSICS CONCEPTS: QUANTUM MECHANICS AND COSMOLOGY** **Room F2**

Chairperson(s): Kristina Zuza

"BUT THE ELECTRON IS NOT ALIVE?" - STUDENTS' CHALLENGES WITH THE CONCEPT OF OBSERVATION IN QUANTUM PHYSICS

Anders Huseby; Berit Bungum
The Norwegian University of Science and Technology

UNDERSTANDING THE MEANING OF THE QUANTUM OF ACTION: ABSOLUTE ENTROPY OF THE IDEAL MONOATOMIC GAS

Francesca Monti
Department of Computer Science, University of Verona

AN INVESTIGATION OF STUDENT'S CONCEPTUAL UNDERSTANDING ABOUT COSMOLOGY THROUGH CLUSTER ANALYSIS

Arturo Colantonio¹; Italo Testa²; Irene Marzoli¹; Silvio Leccia³; Emanuella Puddu³; Silvia Galano²
¹University of Camerino; ²University "Federico II"; ³INAF - Astronomical Observatory of Campodimonte

ANALYZING THE UPPER SECONDARY SCHOOL STUDENTS' UNDERSTANDING OF THE UNIVERSE

Kristina Zuza; Joanes Lizarraga
UPV/EHU

17:00 - 18:30 **OP108 - STRAND 18 - EXPLORING SCIENTIFIC PRACTICES AND AFFECT** **Room F3**

Chairperson(s): Joni Lämsä

EXPLORING THE QUALITY OF INQUIRY-BASED SCIENCE - DEVELOPING A FRAMEWORK FOR VIDEO ANALYSIS

Marianne Odegaard¹; Solveig Karlsen²; Marit Kjærnsli¹; Mai Lill Suhr Lunde¹; Eva Kristin Narvhus¹; Magne Olufsen²; Johannes Sæleset²
¹University of Oslo; ²University of Tromsø

A VIDEO-BASED GROUNDED THEORY STUDY OF CLASSROOM PEDAGOGY: COMBINING PUPIL, TEACHER AND RESEARCHER PERSPECTIVES

John-Paul Riordan¹; Mark Hardman²
¹Canterbury Christ Church University; ²UCL Institute of Education

CONNECTIONS BETWEEN SCIENTIFIC PRACTICES IN ONE TASK ABOUT ENZYMES

Paloma Blanco-Anaya; Peregrina Varela-Caamiña; Joaquín Díaz de Bustamante
Universidade de Santiago de Compostela

AUTOMATIC CONTENT ANALYSIS IN COLLABORATIVE INQUIRY-BASED LEARNING

Joni Lämsä¹; Catalina Espinoza²; Roberto Araya²; Jouni Viiri¹; Abelino Jiménez G.²; Raul Gormaz²; Raija Hämäläinen¹
¹University of Jyväskylä; ²University of Chile

17:00 - 18:30 **OP109 - STRAND 13 - REFLECTIVE PRACTICES IN PRE-SERVICE TEACHER EDUCATION** **Room G1**

Chairperson(s): Alexander Koch

SELF-REFLECTION OF A CHEMISTRY TEACHER

Jarmila Kmetova; Marek Skorsepa
Matej Bel University

DEVELOPMENT OF REFLECTION SKILLS OF PRE-SERVICE PHYSICS TEACHERS

Maren Kempin; Christoph Kulgemeyer
University of Bremen

FOSTERING REFLEXIVE SKILLS IN PRACTICAL TRAINING USING TASKS AND PROMPTS - COMPETENCIES AND ATTITUDES OF BIOLOGY TEACHER STUDENTS

Stephanie Grünbauer; Dörte Ostersehl
University of Bremen

AN EMPIRICAL PILOT IN ASSESSING STUDENT TEACHERS' BIOGRAPHY AND INSTRUCTIONAL BELIEFS

Alexander Koch
University of Missouri

17:00 - 18:30 **OP110 - STRAND 13 - NATURE OF SCIENCE AND SCIENTIFIC INQUIRY** **Room G2**

Chairperson(s): Sila Kaya

CHANGE IN BELIEFS ABOUT SCIENCE WORKSHOPS: AN INTERNATIONAL PROJECT DURING INITIAL TEACHER TRAINING

Iñigo Rodríguez-Arteche¹; María del Carmen Barreto-Pérez²; Maite Sardiña-Baña³; María Mercedes Martínez-Aznar³

¹Universidad Rey Juan Carlos; ²Universidad de Piura; ³Universidad Complutense de Madrid

PRESERVICE PHYSICS AND CHEMISTRY TEACHERS' LEARNING ABOUT INQUIRY DURING A LESSON STUDY

Mónica Baptista; Teresa Conceição; João Pedro Ponte
Instituto de Educação da Universidade de Lisboa

PRESCHOOL TEACHER STUDENTS VIEW'S INFLUENCE ON THEIR INTENTION TO USE TAUGHT INQUIRY METHODS

Anastasios Zoupidis¹; Vasileios Tselfes²; Petros Kariotoglou¹

¹University of Western Macedonia, Greece; ²National and Kapodistrian University of Athens

ENGAGING PRE-SERVICE SCIENCE TEACHERS IN CONTEMPORARY SOCIAL ASPECTS OF NOS: IMPROVING ENTREPRENEURIAL UNDERSTANDING

Sila Kaya¹; Naomi Birdthistle²; Orla McCormack¹; Sibel Erduran³

¹University of Limerick; ²Swinburne University of Technology; ³University of Oxford

17:00 - 18:30 **OP111 - STRAND 13 - CONNECTING PRE-SERVICE TEACHER EDUCATION TO PRACTICE** **Room G3**

Chairperson(s): Merryn Dawborn-Gundlach

FUTURE CHEMISTRY TEACHER'S PERCEPTIONS OF VOCATIONALLY RELEVANT LEARNING ACTIVITIES

Johannes Pernaä; Maija Aksela

University of Helsinki, Department of Chemistry

THE DEVELOPMENT AND IMPLEMENTATION OF AN INSTRUCTIONAL FRAMEWORK FOR SCIENCE TEACHER PREPARATION BASED ON CORE PRACTICES

Ron Gray

Northern Arizona University

PRE-SERVICE SCIENCE TEACHERS' PERCEPTIONS OF HOW THEY LEARN TO FACILITATE INQUIRY-BASED PRACTICAL WORK

Maria Tsakeni

University of the Free State

TEACHER RETENTION: SUPPORTING EARLY-CAREER SCIENCE TEACHERS TO STAY IN THE TEACHING PROFESSION

Merryn Dawborn-Gundlach; Merryn Dawborn-Gundlach

University of Melbourne

17:00 - 18:30 **OP112 - STRAND 14 - TEACHERS AND STEM REFORM** **Room G4**

Chairperson(s): Heba EL-Deghaidy

TEACHER PRAXIS IN PROMOTING INQUIRY FOCUSED QUESTIONING IN STEM: REFOCUSING THE 'LEARNING PIT'

YVONNE ZEEGERS¹; Katrina Elliott²; Marianne Nicholas²

¹University of South Australia; ²South Australian Department for Education

A CROSS CULTURAL ANALYSIS OF PRIMARY TEACHERS' CURRENT UNDERSTANDINGS AND PERCEPTIONS OF STEM EDUCATION

Jennifer Mansfield; Kathy Smith; Sindu George

Monash University

ZERO TO STEM: THE JOURNEY OF A U.S. ELEMENTARY SCHOOL BECOMING A STEM SCHOOL AND IMPLICATIONS FOR PROFESSIONAL DEVELOPMENT

[Julianne Wenner](#); Sara Hagenah
Boise State University

SCIENCE TEACHERS PERCEPTIONS OF STEM INTEGRATION

[Heba EL-Deghaidy](#)¹; Nasser Mansour²
¹The American University In Cairo; ²Exeter University

17:00 - 18:30 **OP113 - STRAND 14 - IMPLEMENTING INQUIRY-BASED SCIENCE EDUCATION II** **Room G5**

Chairperson(s): Smadar Levy

THE IMPACT OF A PHYSICS-BASED INQUIRY WORKSHOP ON HIGH SCHOOL AND MIDDLE SCHOOL SCIENCE TEACHERS

[Elon Langbeheim](#); Edit Yerushalmi
The Weizmann Institute of Science

DEVELOPING SCIENCE TEACHERS' TPACK AND ITS IMPACT ON DESIGNING TECHNOLOGY-BASED INQUIRY ACTIVITIES

[Mohamed Mustafa](#)
University of Ottawa

THE MULTIPLIER ROLE IN TEACHER PROFESSIONAL DEVELOPMENT - A QUALITATIVE STUDY OF IMPLEMENTATION OF INQUIRY-BASED LEARNING

[Ragnhild Lyngved Staberg](#)¹; Rune Ratdal²
¹The Norwegian University of Science and Technology; ²Trondheim Municipality, Sunnland school

TEACHER-LEADERS' LEARNING WHILE LEADING A PLC OF PHYSICS TEACHERS — THE CASE OF THE INQUIRY-BASED LABORATORY

[Smadar Levy](#); Esther Bagno; Hana Berger; Bat-Sheva Eylon
Weizmann Institute of Science

17:00 - 18:30 **OP114 - STRAND 16 - SCIENCES IN PRIMARY SCHOOL/HEALTH-BIOLOGY EDUCATION** **Room G6**

Chairperson(s): Xana Sá-Pinto

USING PHILOSOPHY-INSPIRED CATEGORIZATION STRATEGIES TO DESIGN A LEARNING ENVIRONMENT ABOUT BIOLOGICAL CLASSIFICATION: A CASE STUDY WITH 4TH GRADERS

[Eftychia Valanidou](#); Marida Ergazaki; Renia Gasparatou
University of Patras

COLLABORATION BETWEEN TEACHERS AND SCHOOL NURSES CONCERNING SEX EDUCATION IN UPPER PRIMARY SCHOOL

[Mats Lundström](#); Ann-Cathrine Bramhagen
Malmö University

THE PROJECT-BASED LEARNING: IMPACT ON LEARNING OF GEOLOGY BY SYRIAN REFUGEE GRADE 6 STUDENTS

[ASSAAD YAMMINE](#)¹; Pauline Abdouche²
¹LEBANESE UNIVERSITY; ²UL

THE IMPACT OF EXPLORING SEXUAL SELECTION IN ELEMENTARY SCHOOL STUDENTS UNDERSTANDING OF EVOLUTION

[Xana Sá-Pinto](#)¹; Alexandre Pinto²; Patrícia Pessoa²; Pedro Cardia²; Joaquim Bernardino Lopes³
¹CIDTFF.UA; ²P.Porto: ESE; ³UTAD

17:00 - 18:30 **OP115 - STRAND 17 - CROSSING STAGES IN THE HIGHER EDUCATIONAL SYSTEM AND PROFESSIONAL EXPERTISE** **Room G7**

Chairperson(s): Trevor Anderson

IMAGINING THE FUTURE - POSSIBLE SELVES IN HIGHER EDUCATION

[Katia Kromann Nielsen](#); Lars Ulriksen
Department of Science Education, University of Copenhagen

DISCIPLINARY CULTURE CARRIERS AND THE INTER-RELATED-NESS BETWEEN VARIOUS STAGES IN THE EDUCATIONAL SYSTEM

[Maja Elmgren](#); Anita Hussénius
Uppsala University

ANALYSIS OF LEARNING ASSISTANTS' PHYSICS IDENTITY DEVELOPMENT AND RECONCILIATION OF MULTIMEMBERSHIP THROUGH THE LENS OF COMMUNITIES OF PRACTICE

Eleanor Close; Jessica Conn; Shahrzad Hesaaraki; Austin McCauley; Xandria Quichocho
Texas State University

USING EXPERT RESEARCH KNOWLEDGE TO INFORM UNDERGRADUATE BIOCHEMISTRY INSTRUCTION

Trevor Anderson¹; Nancy Pelaez¹; Kathleen Jeffery¹; Stefan Irby¹; Caleb Trujillo²
¹Purdue University; ²Michigan State University

17:00 - 18:30 **OP116 - STRAND 17 - PRE-SERVICE TEACHER EDUCATION AND TEACHER TRAINING** **Room G8**

Chairperson(s): Arpana Dhar

AN EDUCATIONAL FRAMEWORK TO SUPPORT TEACHERS IN DEVELOPING AND IMPLEMENTING INQUIRY-BASED AND PROJECT-BASED ASSIGNMENTS IN ACADEMIC SCIENCE & ENGINEERING COURSES

Ria Dolfing; Peter Wolfs
University of Groningen

MIGHT TEXTBOOKS MINIMISE THE MISSING LINK BETWEEN THEORY AND PRACTICE IN TEACHER TRAINING?

Katrin Bölsterli Bardy¹; Maja Brückmann²
¹University of Teacher Education Lucerne PHLU; ²University of Oldenburg

BEYOND BIOLOGY — WHAT IS FOREFRONTED WHEN BIOLOGISTS ARE SHADOWED?

Kristina Andersson¹; Annica Gullberg²
¹Uppsala University; ²Uppsala University, Centre for Gender Research

PEARLS AND PERILS OF COLLABORATION: A REFLECTIVE JOURNEY

Arpana dhar
Curtin University

WEDNESDAY 9:00 - 11:00

09:00 - 11:00 **Symposium 21 - DIALOGICAL PERSPECTIVES IN SCIENCE EDUCATION: APPROACHING DIALOGUE IN CONTEMPORARY SCIENCE CLASSROOMS** **Room A1**

Chairperson(s): [Miranda Rocksén](#), [Anne Solli](#); **Discussant:** [Eduardo Mortimer](#)

A BAKHTINIAN APPROACH TO ISSUES OF PUBLIC DEBATE

[Anne Solli](#); Thomas Hillman; Åsa Mäkitalo
University of Gothenburg

TEACHER ORCHESTRATION OF WHOLE-CLASS DISCUSSIONS IN SCIENCE: EXPLORING DIALOGIC AND AUTHORITATIVE PASSAGES

[Sami Lehesvuori](#); Markus Hahkiöniemi; Jouni Viiri; Pasi Nieminen; Kaisa Jokiranta; Jenna Hiltunen
University of Jyväskylä

SENSEMAKING AT THE INTERSECTION OF AUTHORITATIVE AND STUDENT-GENERATED REPRESENTATIONS

[Line Ingulfsen](#); Anniken Furberg; Erik Knain
University of Oslo

APPROACHING DIALOGUE IN A SEQUENCE OF LESSONS ABOUT EVOLUTION: SCIENCE CLASSROOM COMMUNICATION ON MULTIPLE-SCALES

[Miranda Rocksén](#)
University of Gothenburg

09:00 - 11:00 **Symposium 29 - STUDENTS AWARENESS AND OPPORTUNITIES FOR STEM CAREER** **Room A2**

Chairperson(s): [Silvija Markic](#), [Sarah Hayes](#); **Discussant:** [Rachel Mamlok-Naaman](#)

STUDENTS LOOKING SCIENCE-RELATED CAREERS FROM DIFFERENT PERSPECTIVES

[Anssi Salonen](#); Ilpo Jäppinen; Tuula Keinonen
University of Eastern Finland

CULTURE AND GENDER DIFFERENCES IN VOCATIONAL ORIENTATION IN SCIENCE

[Marina Hönic](#); Lilith Rüschenpöhler; Julian Küsel; Silvija Markic
Ludwigsburg University of Education

DEVELOPMENT AND EVALUATION OF TOOLS FOR GENDER- AND DIVERSITY-SENSITIVE CAREER ORIENTATION IN CHEMISTRY

[Ute Brinkmann](#); Tatjana Jesserich; Markus Precht
Technische Universität Darmstadt

CHANGING THE PERCEPTIONS THAT POST-PRIMARY SCHOOL STUDENTS' HOLD ABOUT SCIENTISTS AND THEIR WORK THROUGH A CAREER ORIENTATION PROGRAMME

[Sarah Hayes](#); Aimee Stapleton; Martin McHugh
University of Limerick

09:00 - 11:00 **Symposium 22 - COLLABORATIVE CONSTRUCTION OF KNOWLEDGE IN SCIENCE CLASSROOMS ENACTS RELATIONSHIPS OF DEMOCRACY** **Room B1**

Chairperson(s): [Elizabeth Cavicchi](#), [Maria Cristina Trevissoi](#); **Discussant:** [Edvin Ostergaard](#)

PRODUCTIVE DISCUSSIONS: NURTURING SCIENCE LITERATE STUDENTS AND ACTIVE CITIZENS

[Carlo Berton](#)
Liceo scientifico Copernico

TECHNOLOGY PROJECTS: A SCHOOL SUBJECT TO INTRODUCE DEMOCRATIC VALUES

[Alicia Lopez Jornet](#)
CIC Batxillerats

COLLABORATIVE EXPLORING IN SKY AND SPACE: LEARNERS AND TEACHER CONSTRUCT KNOWLEDGE AND DEMOCRATIC RELATIONSHIPS

[Elizabeth Cavicchi](#)
Edgerton Center, MIT

BRING THE DREAM TO LIGHT: HOW COLLABORATIVE CONSTRUCTION OF KNOWLEDGE IN HIGH SCHOOL PHYSICS/SCIENCE DEVELOPS DEMOCRATIC VALUES AND EXPERIENCES

[Maria Cristina Trevissoi](#)
"A. Roiti" high school

09:00 - 11:00 **Symposium 23 - FACTORS INFLUENCING TEACHING, LEARNING, AND ACCEPTING EVOLUTION** **Room B2**

Chairperson(s): Daniela Fiedler; Discussant: Marcus Hammann

READING THE TREE OF LIFE: FACTORS INFLUENCING THE ABILITY TO READ EVOLUTIONARY TREES
 Thilo Schramm; Yvonne Schachtschneider; Philipp Schmiemann
 University Duisburg-Essen

QUANTITATIVE STUDY OF LOWER-SECONDARY SCHOOL STUDENTS' ACCEPTANCE OF EVOLUTION IN FRANCE
 Magali Coupaud; Jérémy Castéra; Corinne Jégou; Julie Gobert; Pascale Brandt-Pomares; Alice DELSERIEYS-PEDREGOSA
 Aix Marseille Université

"EVOLUTION? I DON'T BELIEVE IN IT": THEOLOGICAL TENSIONS AROUND THE TEACHING AND LEARNING OF EVOLUTION IN THE ISRAELI SOCIETY
 Merav Siani¹; Anat Yarden²
¹Herzog Academic College Israel; ²Weizmann Institute of Science

THE EFFECTIVENESS OF SECONDARY EDUCATION IN PROMOTING UNDERSTANDING OF NATURAL SELECTION: A COMPARISON BETWEEN FLANDERS AND THE NETHERLANDS.
 Rianne Pinxten; Ellen Vandervieren; Marcel Eens
 University of Antwerp

09:00 - 11:00 **Symposium 24 - CRITICAL PERSPECTIVES IN COMPUTER SCIENCE EDUCATION** **Room B3**

Chairperson(s): Anne-Kathrin Peters, Billy Wong; Discussant: Michael Reiss

COMPUTER SCIENCE EDUCATION AS BILDUNG AND IDENTITY DEVELOPMENT
 Lea Budde; Carsten Schulte
 Paderborn University

COMPUTER SCIENCE VS ICT: THE GENDER IMPACT OF CURRICULUM CHANGE IN ENGLAND
 Peter Kemp¹; Billy Wong²
¹University of Roehampton; ²University of Reading

BECOMING A COMPUTER SCIENCE STUDENT: FIRST YEAR HIGHER EDUCATION STUDENTS' IDENTITY WORK AND ACADEMIC INTEGRATION PROCESS
 Katia Kromann Nielsen; Andrea F. M. Gregersen; Henriette Tolstrup Holmegaard
 Department of Science Education, University of Copenhagen

UNDERSTANDING AND DEVELOPING DESIRABLE COMPUTING IDENTITIES IN A DIALOGUE WITH STUDENTS AND TEACHERS

UNDERSTANDING AND DEVELOPING DESIRABLE COMPUTING IDENTITIES IN A DIALOGUE WITH STUDENTS AND TEACHERS
 Anne-Kathrin Peters
 Uppsala University

09:00 - 11:00 **Symposium 25 - NEW FRAMEWORKS FOR STUDYING EQUITY IN INFORMAL SCIENCE EDUCATION: CROSS-CULTURAL PERSPECTIVES** **Room B4**

Chairperson(s): Angela Calabrese Barton; Discussant: Edna Tan

CHARACTERISING YOUTH PARTICIPATION IN NATURAL HISTORY MUSEUM-LED CITIZEN SCIENCE: DESIGNING FOR THE DEVELOPMENT OF AGENCY FOR MORE EQUITABLE PARTICIPATION IN ENVIRONMENTAL SCIENCE
 Heidi L. Ballard¹; Julia Lorke²; Rebecca D. Swanson³; Maryam Ghadiri Khanaposhtani¹; Lucy D. Robinson²
¹University of California, Davis, CA, USA; ²Natural History Museum; ³Tufts University, Boston, MA, USA

HIGH LEVERAGE PRACTICES IN SUPPORT OF EQUITABLE AND TRANSFORMATIVE PATHWAYS TOWARDS STEM-AGENTIC LIVES
 Won Jung Kim; Angela Calabrese Barton; Sinead Brien; ReAnna Roby
 Michigan State University

THE "PRACTICE TURN" IN INFORMAL LEARNING STEAM PEDAGOGIES
 Bronwyn Bevan¹; Joseph Roche²; Sam Mejias³
¹University of Washington; ²Trinity College; ³London School of Economics

WHO IS BEING SERVED? EQUITY AND THE PATTERNS OF PARTICIPATION IN INFORMAL STEM LEARNING SETTINGS

Spela Godec¹; Louise Archer¹; Emily Dawson²
¹UCL Institute of Education; ²University College London

09:00 - 11:00 **Symposium 26 - CITIZEN SCIENCE AND SCIENCE EDUCATION: OPPORTUNITIES TO LEARN, LEARNING OUTCOMES TO ACHIEVE** **Room B5**

Chairperson(s): Till Bruckermann; **Discussant:** Miriam Brandt

AGREEMENT IS NEEDED! — IDENTIFICATION OF COMMON GOALS FOR AN URBAN ECOLOGY CITIZEN SCIENCE PROJECT THROUGH A DELPHI STUDY

Till Bruckermann; Ute Harms
 Leibniz Institute for Science and Mathematics Education (IPN)

RESEARCH ON LEARNING OUTCOMES IN A BIODIVERSITY CITIZEN SCIENCE PROJECT WITH SCHOOLS

Martin Scheuch¹; Manfred Bardy-Durchhalter²; Julia Kelemen-Finan³; Silvia Winter⁴
¹University College for Agricultural and Environmental Education; ²Austrian Educational Competence Centre for Biology, University of Vienna; ³naturgeschutzakademie.at [Austrian Academy for Nature Conservation], Stockerau, Austria; ⁴Institute for Nature Conservation & Division of Plant Protection, University of Natural Resources an

DESIGN FOR PARTICIPATION IN SCIENTIFIC RESEARCH ENHANCES PUPILS' ENGAGEMENT WITH LEARNING OPPORTUNITIES

Susanne Rafolt; Suzanne Kapelari; Elisabeth Carli
 University of Innsbruck

"DON'T STEP ON THE VOLCANOES!" - DEVELOPING ENVIRONMENTAL SCIENCE AGENCY THROUGH PARTICIPATION IN MUSEUM-LED CITIZEN SCIENCE PROJECTS

Julia Lorke¹; Heidi L. Ballard²; Maria Aristeidou³; Christothea Herodotou³; Rebecca D. Swanson⁴; Lucy D. Robinson¹
¹Natural History Museum, London, UK; ²University of California, Davis, CA, USA; ³Open University, Milton Keynes, UK; ⁴Tufts University, Boston, MA, USA

09:00 - 11:00 **Symposium 27 - ARTICULATING DIFFERENT CONCEPTUALIZATIONS AND METHODOLOGICAL APPROACHES FOR STUDYING YOUTH'S STEM IDENTITIES DEVELOPMENT** **Room B6**

Chairperson(s): Hosun Kang; **Discussant:** Jrene Rahm

MATERIALITY IN STEM IDENTITY RESEARCH: ENTANGLEMENTS WITH DIGITAL AND PHYSICAL MATTER

Emily Dawson
 UCL

SCIENCE IDENTITIES - STABLE, CHANGING AND IN PLURAL

Lars Ulriksen; Henriette T. Holmegaard
 Department of Science Education, University of Copenhagen

PERFORMING, CLAIMING, AND ENVISIONING POSSIBLE SELVES IN STEM IN THE FLOW OF LIFE: THE ROLE OF INSIDE-NESS AND PLACEMAKING

Jrene Rahm¹; Jrene Rahm¹; Allison Gonsalves²; Audrey Lachaine²
¹Université de Montréal; ²McGill University

EXPLORING PEDAGOGIES THAT SUPPORT YOUTH STEM IDENTITIES DEVELOPMENT IN MIDDLE SCHOOL SCIENCE CLASSROOMS

Hosun Kang¹; Angela Calabrese-Barton²; Edna Tan³
¹University of California Irvine; ²Michigan State University; ³The University of North Carolina at Greensboro

09:00 - 11:00 **Invited Symposium 06 - AESTHETICS IN SCIENCE EDUCATION** **Room C1**

Chairperson(s): Per-Olof Wickman, Leslie Atkins Elliott **Discussant:** Leslie Atkins Elliott

THE ROLE OF AESTHETICS IN LEARNING SCIENCE: EXAMINING AN INTEGRATED ART-SCIENCE LESSON

Per-Olof Wickman¹; Shelley Hannigan²; Joseph Ferguson²; Vaughan Prain²; Russell Tytler²
¹Stockholm University; ²Deakin University

THE ROLE OF AESTHETICS IN THE TEACHING AND LEARNING OF DATA MODELLING

Joseph Ferguson; Russell Tytler; Peta White
 Deakin University

THE ROLE OF ART PRACTICE IN ELEMENTARY SCHOOL SCIENCE

[Cecilia Caiman](#); Britt Jakobson
Stockholm University

THE ROLE OF AESTHETICS IN KOREAN STEAM CURRICULUM

[Kongju Mun](#)¹; Yohan Hwang²
¹Seoul National University; ²Chungnam National University

09:00 - 11:00 **Symposium 35 - DEVELOPING TEACHING PRACTICES IN EARLY YEARS STEM EDUCATION: OPPORTUNITIES AND CHALLENGES** **Room D1**

Chairperson(s): [Esme Glauert](#), [Fani Stylianidou](#); **Discussant:** [Costas Constantinou](#)

TEACHER'S PERSPECTIVES IN RELATION TO TEACHING STEM IN SWEDISH PRESCHOOLS

[Kerstin Bäckman](#)
University of Gävle

TEACHING NATURE OF SCIENCE IN PRESCHOOL WITH A STARTING POINT IN CHILDREN'S PICTURE BOOKS

[Lena Hansson](#); [Lotta Leden](#); [Susanne Thulin](#)
Kristianstad University

TEACHER PEDAGOGY WHEN USING TANGIBLE ROBOTS SUCH AS BEE-BOTS.

[Coral Campbell](#); Christopher Speldewinde
Deakin University

FOSTERING CREATIVITY AND INQUIRY IN EARLY YEARS SCIENCE: DEVELOPING A RESEARCH BASED APPROACH TO PROFESSIONAL DEVELOPMENT

[Esme Glauert](#)¹; [Fani Stylianidou](#)²
¹University College London Institute of Education; ²IKY / Erasmus+ Hellenic National Agency Higher Education Sector

09:00 - 11:00 **Invited Symposium 13 - BRIDGING THE GAP BETWEEN SCIENCE EDUCATION RESEARCH, EDUCATIONAL PRACTICES, SOCIETY AND CITIZENS: INQUIRY BASED LEARNING AND RESPONSIBLE RESEARCH AND INNOVATION** **Room D2**

Chairperson(s): [Claudio Fazio](#); **Discussant:** [Marisa Michelini](#)

RETENTION OF LEARNING THROUGH INQUIRY

[Dagmara Sokotowska](#)
Smoluchowski Institute of Physics, Jagiellonian University, Kraków, Poland

INTRODUCTION OF NEW FINDINGS IN SCIENCE TO PRE-UNIVERSITY EDUCATION USING INQUIRY BASED LEARNING

[Mojca Čepič](#); [Jerneja Pavlin](#)
Faculty of Education, University of Ljubljana, Slovenia

CHALLENGES AND OPPORTUNITIES FOR RETHINKING INQUIRY BASED SCIENCE EDUCATION

[Eilish McLoughlin](#)¹; [Odilla Finlayson](#)²
¹CASTeL, School of Physical Sciences, Dublin City University, Ireland; ²CASTeL, School of Chemical Sciences, Dublin City University, Ireland

INQUIRY IN HIGHER EDUCATION: AN EXAMPLE OF CROSSING DISCIPLINARY KNOWLEDGE BOUNDARIES

[Cecília Galvão](#)¹; [Cláudia Faria](#)¹; [Wanda Viegas](#)²; [Luís F. Goulão](#)²; [Amélia Branco](#)³
¹Instituto de Educação, Universidade de Lisboa, Portugal; ²Leaf/Instituto Superior de Agronomia, Universidade de Lisboa, Portugal; ³Instituto Superior de Economia e Gestão, Universidade de Lisboa, Portugal

09:00 - 11:00 **Symposium 36 - SCIENCE EDUCATION CHALLENGES TO HEGEMONIC POWER STRUCTURES** **Room D3**

Chairperson(s): [John Bencze](#); **Discussant:** [Steve Alsop](#)

TURBULENT TIMES: NEOLIBERALISM AND SCIENCE EDUCATION

[Lyn Carter](#)
Australian Catholic University, Melbourne

COMMUNICATING CURRICULUM REFORM TO THE GENERAL PUBLIC: CHALLENGES AND LIMITATIONS

[Isabel Martins](#)
Federal University of Rio de Janeiro

SCIENCE AND SOCIAL JUSTICE: THE CASE FOR CRITICAL REALISM

Ralph Levinson¹; Matthew Weinstein²

¹University College, London, Institute of Education; ²University of Washington, Tacoma

MOBILIZING CRITICAL & ALTRUISTIC SCIENCE EDUCATION

John Bencze¹; Dave Del Gobbo²; Sarah El Halwany¹; Mirjan Krstovic²; Minja Milanovic¹; Zoya Padamsi¹; Chantal Pouliot³; Nadia Qureshi¹; Majd Zouda¹

¹OISE, University of Toronto; ²Peel District School Board; ³Laval University

09:00 - 11:00 **Invited Symposium 07 - POLICY AND PEDAGOGY: INTERNATIONAL REFORM AND DESIGN CHALLENGES OF SCIENCE AND STEM EDUCATION.** **Room E2 - Italia**
Sponsored by NARST-International Committee

Chairperson(s): Richard Duschl; Discussant: Lucy Avraamidou

Richard Duschl
 Caruth Institute for Engineering Education Southern Methodist University, Germany

Costas Constantinou
 University of Cyprus

Doris Jorde
 BioCEED University Of Oslo, Norway

Jonathan Osborne,
 Stanford University, United States

Eilish McLoughlin
 Dublin City University, Ireland

Audrey Msimanga
 Sol Plaatje University, South Africa

Fang-Ying Yang
 National Taiwan Normal University, Taiwan

09:00 - 11:00 **Symposium 18 - MECHANISTIC REASONING: A MULTI-DISCIPLINARY PERSPECTIVE** **Room F1**

Chairperson(s): Michal Haskel-Ittah, Anat Yarden; Discussant: Kapon Shulamit

STUDENTS' MECHANISTIC REASONING RELATED TO TRACING MATTER AND ENERGY IN THE CONTEXT OF THE CARBON CYCLE

Marcus Hammann; Marcus Hammann; Roman Asshoff; Katharina Düsing; Daniel Hüsken
 University of Münster

REASONING ABOUT GENETIC MECHANISMS: THE CRITICAL ROLE OF FUNCTIONS

Michal Haskel-Ittah¹; Ravit Golan Duncan²; Anat Yarden¹

¹Weizmann Institute of Science; ²Rutgers

A MECHANISTIC PERSPECTIVE ON ORGANIC CHEMISTRY

Ira Caspari¹; Nicole Graulich²

¹University of Massachusetts Boston; ²Justus-Liebig-University Giessen

STUDENTS-GENERATED DRAWINGS FOR PROMOTING MECHANISTIC REASONING IN EXPLAINING CHEMICAL REACTIONS.

Vanessa de Andrade¹; Yael Schwartz²; Mónica Baptista¹; Sofia Freire¹

¹University of Lisbon, Institute of Education; ²Department of Science Teaching, Weizmann Institute of Science

09:00 - 11:00 **Symposium 19 - PHILOSOPHICAL AND CONCEPTUAL CHALLENGES IN QUANTUM PHYSICS EDUCATION** **Room F2**

Chairperson(s): Ellen Karoline Henriksen; Discussant: Alexander Kauertz

UNDERSTANDING ENERGY DIAGRAMS AS A PREREQUISITE FOR UNDERSTANDING QUANTUM MECHANICS

Kim Krijtenburg-Lewerissa¹; Henk Pol¹; Wouter van Joolingen²

¹ELAN Institute for Teacher Training; ²Freudenthal Institute for Science and Mathematics Education

"YOU HAVE TO SORT OUT WHAT YOU THINK!" - STUDENTS' VIEWS OF NATURE OF SCIENCE IN QUANTUM PHYSICS

Kirsten Stadermann; Martin Goedhart

Institute for Science Education and Communication, University of Groningen

MODES OF DISCOURSE IN QUANTUM PHYSICS: A THEORETICAL PROPOSAL FOR AN ANALYTICAL FRAMEWORK

Alexandro Pereira

Instituto de Física da UFRGS

NORWEGIAN UPPER SECONDARY STUDENTS' IDEAS ABOUT THE WAVE NATURE OF MATTER

Maria Vetlesen Boe¹; Susanne Viefers¹; Berit Bungum²; Ellen Karoline Henriksen¹

¹University of Oslo, Dept. of Physics; ²Norwegian University of Science and Technology

09:00 - 11:00 **Symposium 20 - NEW MATERIALISM AND ITS IMPLICATIONS FOR SCIENCE EDUCATION RESEARCH METHODOLOGY - II** **Room F3**

Chairperson(s): Mark Hardman; Discussant: Lindsay Hetherington

TAKEN-FOR-GRANTED LABORATORY MATERIAL PRACTICES AND ITS CONSEQUENCES FOR STUDENTS

Anita Hussénius
Uppsala University

DANCING WITH ROBOTS: AN ETHNOGRAPHIC LOOK AT EMBODIED PERFORMANCE OF HUMAN-ROBOT ASSEMBLAGES

Marcella Fioroni¹; Steve Alsop²
¹Crescent School; ²York University

MATERIAL, MODELS AND MULTIPLICITIES IN THE SCIENCE CLASSROOM

Mark Hardman¹; John-Paul Riordan²
¹UCL Institute of Education; ²Canterbury Christ Church University

NEW MATERIALISM AND NEW METHODOLOGIES IN SCIENCE EDUCATION RESEARCH

Mark Hardman¹; Jill Noakes²; Lindsay Hetherington²
¹UCL Institute of Education; ²University of Exeter

09:00 - 11:00 **Symposium 04 - WHAT'S THE PROBLEM? IDENTIFICATION OF STUDENTS' CHARACTERISTICS HINDERING LEARNING ABOUT EVOLUTION** **Room G1**

Chairperson(s): Ute Harms; Discussant: Kostas Kampourakis

UPPER SECONDARY SCHOOL STUDENTS' IMPLICIT ASSOCIATIONS OF GENETICS AND TELEOLOGICAL CONCEPTIONS

Florian Stern; Kostas Kampourakis; Marine Delaval; Andreas Müller
University of Geneva

CONTEXT DEPENDENCE OF THRESHOLD CONCEPTS IN STUDENTS' NATURAL SELECTION EXPLANATIONS

Andreas Göransson¹; Daniela Fiedler²; Daniel Orraryd³; Lena Tibell¹
¹Department of science and technology, Linköping University; ²Department of Biology Education, Leibniz Institute for Science and Mathematics Education (IPN) at Ki; ³Department of Social and Welfare studies, Linköping University, Norrköping, Sweden

TO ZOOM INTO EVOLUTIONARY TIME: INTERACTING WITH A DYNAMIC TREE OF LIFE

Jörgen Stenlund¹; Lena Tibell²; Konrad Konrad Schönborn³
¹School of Science and Technology, Örebro University; ²Linköping university Department of Science and Technology; ³Linköping University Department of Science and Technology

FOCUSING PRE-SERVICE TEACHERS: MEASURING DIAGNOSTIC KNOWLEDGE ABOUT EVOLUTION WITH THE SIMULATED CLASSROOM BIOLOGY (SCR BIO).

Julian Fischer¹; Nils Machts²; Jens Möller²; Ute Harms¹
¹IPN Leibniz-Institute for Science and Mathematics Education at the University of Kiel; ²Institute for Educational Psychological Teaching and Learning Research (IPL) at the University of Kiel

09:00 - 11:00 **Symposium 31 - ACTION RESEARCH FOR INNOVATION AND PROFESSIONAL DEVELOPMENT IN SCIENCE EDUCATION** **Room G2**

Chairperson(s): Ingo Eilks; Discussant: Sylvija Markic

TEACHER-DRIVEN PARTICIPATORY ACTION RESEARCH FOR INNOVATING THE HIGH SCHOOL CHEMISTRY CURRICULUM THROUGH GREEN CHEMISTRY

Ingo Eilks¹; Michael Linkwitz²
¹University of Bremen; ²Otto-Hahn-Gymnasium, Bergisch-Gladbach, Germany

FROM THE SCHOOL LABORATORY TO CHEESE FACTORY

Marika Kapanadze¹; Natela Bagatrishvili²
¹Iliia State University, Georgia; ²State School N7, Telavi, Georgia

WHAT KIND OF A TEACHER AM I? MY SELF-STUDY ON MY SCIENCE, TECHNOLOGY, ENGINEERING, MATHEMATICS (STEM) LESSON

Ismail Dönmez¹; Mehmet Fatih TASAR²
¹Mus Alparslan University; ²Gazi University

RESEARCHING THE IMPACT OF A TEACHER PROFESSIONAL DEVELOPMENT PROGRAMME IN SCIENCE EDUCATION BASED ON ACTION RESEARCH

Franz Rauch; Angela Schuster
Alpen-Adria-University Klagenfurt

09:00 - 11:00 **Symposium 32 - RECONSIDERING, REFINING AND REIMAGINING PCK FOR SCIENCE EDUCATION** **Room G3**

Chairperson(s): Rebecca Cooper, Andreas Borowski; Discussant: Oliver Tepner

BUILDING CONSENSUS TO ADVANCE PCK RESEARCH

Janet Carlson¹; Kirsten Daehler²; Andreas Borowski³; Kennedy Chan⁴; Rebecca Cooper⁵; Jan van Driel⁶
¹Graduate School of Science Education, Stanford University; ²WestEd; ³Universität Potsdam; ⁴Hong Kong University; ⁵Monash University; ⁶University of Melbourne

REIMAGING THE EXISTING: INTERPRETING MULTIPLE STUDIES IN THE LIGHT OF THE NEW PCK MODEL

Sophie Kirschner¹; Elizabeth Mavhunga²; Stefan Sorge³; Anita Stender⁴; Chris Wilson⁵
¹JLU Giessen; ²Wits School of Education; ³IPN Kiel; ⁴University of Duisburg-Essen; ⁵BSCS Science Learning

EPCK: DIVING INTO THE INNER CIRCLE

Alicia Alonzo¹; Amanda Berry²; Pernilla Nilsson³
¹Michigan State University; ²Monash University; ³Halmstad University

ASSESSING PCK USING A GRAND RUBRIC

Marissa Rollnick¹; Kennedy Kam Ho CHAN²
¹University of the Witwatersrand; ²The University of Hong Kong

09:00 - 11:00 **Symposium 33 - DIGITALLY SUPPORTED TEACHING AND LEARNING FORMATS - DEVELOPMENT AND EVALUATION** **Room G4**

Chairperson(s): Insa Melle, Germany; Discussant: Felix Ho

DEVELOPMENT OF AN INCLUSIVE, DIGITAL MEDIA SUPPORTED LEARNING ENVIRONMENT FOR INQUIRY-BASED LEARNING

Sandra Puddu¹; Brigitte Koliander²; Philipp Spitzer³
¹PH Vienna; ²PH Niederösterreich; ³University of Vienna, AECC Chemistry

SCIENCE PRE-SERVICE TEACHERS TPACK AND BELIEFS ABOUT LEARNING WITH DIGITAL MEDIA

Julian Kuesel; Silvija Markic
Ludwigsburg University of Education

A BLENDED LEARNING APPROACH FOR IN-SERVICE TEACHERS TRAINING BASED ON ONLINE MOODLE PLATFORM

Chiara Schettini; Rossana Galassi; Daniela Amendola
University of Camerino

PROFESSIONALISATION OF PROSPECTIVE TEACHERS FOR DIGITISATION IN CHEMISTRY EDUCATION — DEVELOPMENT AND EVALUATION OF A UNIVERSITY SEMINAR

Franziska Zimmermann; Insa Melle
TU Dortmund University

09:00 - 11:00 **Symposium 34 - AFFORDANCES OF AUGMENTED REALITY FOR LEARNING SCIENCE** **Room G5**

Chairperson(s): Seamus Delaney; Discussant: Eleni Kyza

TEACHERS' PERSPECTIVES ON LOCATION-BASED LEARNING VIA AUGMENTED-WORLD

Miri Barak; Shadi Asakle
Technion, Israel Institute of Technology

AUGMENTED REALITY IN LOWER SECONDARY SCIENCE TEACHING: TEACHERS AND STUDENTS AS PRODUCERS

Birgitte Lund Nielsen; Harald Brandt
VIA University College

COMBINING ESTABLISHED TEACHING MEDIA WITH AUGMENTED REALITY (AR) — INVESTIGATION OF THE EFFECTS ON LEARNING RESULTS AND OF TEACHERS' AND STUDENTS' VIEWS ON AR

Christoph Thyssen; Carsten Hoffmann
TU Kaiserslautern

TEACHER PERCEPTIONS OF THEIR ROLE AND DUTY TO IMPLEMENT AUGMENTED REALITY INTO SCIENCE TEACHING

Seamus Delaney; Caitlyn Pryse; George Aranda
Deakin University, Australia

09:00 - 11:00 **Symposium 30 - SCIENCE EDUCATION FOR SUSTAINABLE DEVELOPMENT: COMPARING THE CHALLENGES OF THE ANTHROPOCENE** **Room G7**

Chairperson(s): **Elaosi Vhurumuku; Discussant: Washington Takawira Dudu**

TEACHER EDUCATION AND ANTHROPOCENE

Nina Christenson¹ ; Kassahun Weldemariam²
¹Karlstad University; ²University of Gothenburg

INITIAL SCIENCE TEACHER EDUCATION FOR SUSTAINABLE DEVELOPMENT: ANALYSIS OF CURRICULA FOR A SOUTH AFRICAN UNIVERSITY

Elaosi Vhurumuku¹; Washington Dudu²
¹University of Witwatersrand; ²University of Northwest

INITIAL SCIENCE TEACHER EDUCATION FOR SUSTAINABLE DEVELOPMENT: A CASE STUDY OF BINDURA UNIVERSITY, ZIMBABWE

Nicholas Zezekwa¹; Elaosi Vhurumuku²
¹Bindura University; ²University of Witwatersrand

THE INTEGRATION OF SUSTAINABLE DEVELOPMENT IN LIFE SCIENCES CLASSROOM PRACTICES: A CASE STUDY OF THE UNIVERSITY OF THE WITWATERSRAND, SOUTH AFRICA

Portia Kawai
 University of Witwatersrand

WEDNESDAY 13:45 - 15:00

13:45 - 15:00 **Interactive Poster P01 - STRAND 1 - UNDERSTANDING WITHIN CHEMISTRY, BIOLOGY AND ENVIRONMENTAL CONTEXT** **Room A1**

Chairperson(s): **Julia Sprung**

STUDENTS' CONCEPTUAL PROGRESSION OF CHEMICAL REACTIONS

Merve Nur Yavuzkaya; Emine Adadan
 Boğaziçi University

STUDENTS INTERPRETATION OF GRAPH SLOPE IN KINEMATICS INVESTIGATED BY THE EYE-TRACKING METHOD

Martina Kekule
 Charles University

THE INTERPLAY BETWEEN INDIVIDUAL REFLECTION AND COLLABORATIVE LEARNING - USING THE PEER-INTERACTION-METHOD TO DIAGNOSE AND FOSTER STUDENTS' CONCEPTIONS ABOUT COMBUSTION

Julian Heeg; Sarah Hundertmark; Sascha Schanze
 Leibniz Universität Hannover - Institute for Science Education

STUDENTS' MODEL-BASED REASONING ABOUT THE RELATIONSHIPS BETWEEN THE GAS LAW AND A REAL-WORLD EVENT

Claus Auning
 University of Southern Denmark

STUDENTS' MENTAL MODELS OF THE MARINE ENVIRONMENT: IMPLICATIONS FOR ENVIRONMENTAL SCIENCE EDUCATION

Shu-Chiu Liu¹; Miao-Hsuan Yen²
¹Center for General Education, National Sun Yat-sen University, Kaohsiung, Taiwan; ²Graduate Institute of Science Education, National Taiwan Normal University, Taipei, Taiwan

INFLUENCE OF EXPERIENCE ON TREE READING PERFORMANCE

Inga Ubben¹; Sandra Nitz²; Annette Upmeier zu Belzen¹
¹Humboldt-Universitaet zu Berlin; ²Universitaet Koblenz-Landau

PUPILS' SCIENTIFIC CONCEPT FORMATION OF METALS IN PRIMARY SCIENCE IN JAPAN

Yukinori Utsumi
 Gifu University

SEED DIVERSITY: HOW DO PRIMARY SCHOOL CHILDREN EXPLAIN IT?

Bernat Esquiús; Isabel Jiménez
 UVIC

THE FITS MODEL: LEARNING SCIENCE BY DESIGN CHALLENGES

Dave van breukelen; Maurice Smeets
 Fontys University of Applied Sciences

QUESTIONING STRATEGIES TO PROMOTE AND ASSESS, COGNITION METACOGNITION AND CONCEPTUAL UNDERSTANDING IN CHEMISTRY: AN ANALYSIS

James Trimble¹; James Lovatt²; Odilla E. Finlayson¹

¹CASTeL, School of Chemical Sciences, Dublin City University; ²CASTeL, DCU Institute of Education, Dublin City University

SMALL-GROUP DISCUSSIONS — A TOOL TO SUPPORT PROSPECTIVE PRIMARY TEACHERS CONCEPTUAL UNDERSTANDING?

Ann-Sofi Härmälä-Braskén

Åbo Akademi University

INSTRUCTING SECONDARY SCHOOL STUDENTS IN 'TRIPLET' CONCEPT MAPPING FOR CHEMISTRY — A PILOT STUDY

Ylva Pamment

Department of Educational Sciences, Lund Universitet

SCIENTIFIC PERSPECTIVISM FOR A-LEVEL CHEMISTRY EDUCATION

Ilse Landa¹; Hanna Westbroek¹; Jacqueline van Muijlwijk-Koezen¹; Fred Janssen²; Martijn Meeter¹

¹Vrije Universiteit Amsterdam; ²ICLON Universiteit Leiden

EXPERIMENTATION PERSPECTIVES AS POTENTIAL SCAFFOLDS FOR LEARNING TO DESIGN CHEMICAL EXPERIMENTS

Ria Kraakman-van der Zwet¹; Fred Janssen²; Hanna Westbroek¹; Jacqueline van Muijlwijk-Koezen³

¹VU University Amsterdam, Faculty of Behavioural and Movement Sciences; ²ICLON, Leiden University Graduate School of Teaching; ³VU University, Amsterdam Institute for Molecules, Medicines and Systems, Amsterdam Institute of Mole

LINKING THE DEVELOPMENT OF INQUIRY COMPETENCES TO THE UNDERSTANDING OF THE STRUCTURE AND COMPOSITION OF MATTER IN CHEMISTRY — A MODEL-BASED APPROACH

Julia Sprung; Benjamin Bollmann; Theresa Goetz; Andreas Nehring

Leibniz Universität Hannover - Institute for Science Education

13:45 - 15:00

Interactive Poster P02 - STRAND 1 - UNDERSTANDING WITHIN PHYSICS AND MATHEMATICS CONTEXT

Room A2

Chairperson(s): Jenny Magnes

EXPLANATIONS AND AWARENESS ABOUT COMPUTER SIMULATIONS OF COMPLEX SYSTEMS: A STUDY TO UNDERSTAND THE GAP BETWEEN EXPERTS AND NOVICES

Eleonora Barelli

DIFA - University of Bologna

THOUGHTS ABOUT QUANTUM PHYSICS EDUCATION

Marco Giliberti¹; Giovanni Organtini²

¹Physics Department University of Milan; ²Physics Department La Sapienza università di Roma

UNDERSTANDING DENSITY THROUGH ITS MICROSCOPIC CAUSES IN SECONDARY EDUCATION

Irantzu Uriz; María Napal; María Isabel Zudaire

Universidad Pública de Navarra

FRAMEWORK FOR TEACHING AND LEARNING MATHEMATIZATION IN PHYSICS

Gesche Pospiech

TU Dresden

THE LEVEL OF UNDERSTANDING OF SELECTED CONCEPTS IN PHYSICS OF STUDENTS FROM DIFFERENT COUNTRIES

Tünde Kiss; Klára Velmovská

Comenius University, Faculty of Mathematics, Physics and Informatics

STUDENTS LEARNING ABOUT KINEMATICS THROUGH MULTIPLE REPRESENTATIONS

André Martins Silva; Mónica Baptista

Instituto de Educação da Universidade de Lisboa

TEACHING QUANTUM PHYSICS IN HIGH-SCHOOL

Efraim Y Weissman; Avi Merzel; Nadav Katz; Igal Galili

The Hebrew University of Jerusalem

NAVIGATING FOUR DIMENSIONS — UPPER SECONDARY STUDENTS' UNDERSTANDING OF MOVEMENT IN SPACETIME

Magdalena Kersting

University of Oslo, Dept. of Physics

DELPHI-STUDY TO DEFINE THE TERM "STUDENTS' CONCEPTIONS"

Ingrid Krumphals¹; Thomas Plotz²; Claudia Haagen-Schützenhöfer¹

¹University of Graz; ²University of Vienna

GESTALT AND FUNCTIONALITY AS INDEPENDENT DIMENSIONS OF MENTAL MODELS

Malte Ubben; Stefan Heusler
Westfälische Wilhelms-Universität Münster

UNDERSTANDING FOURIER TRANSFORMS THROUGH INTUITION BUILDING

Jenny Magnes; Kathleen Raley-Susman
Vassar College

13:45 - 15:00 **Interactive Poster P19 - STRAND 12 - CULTURAL SOCIAL AND GENDER ISSUES IN SCIENCE AND TECHNOLOGY EDUCATION** **Room B1**

Chairperson(s): Guillaume Cyr

EXPLORING PRE-SERVICE PHYSICS TEACHERS' DEVELOPMENT OF PHYSICS IDENTITY THROUGH THE USE OF MULTIPLE REPRESENTATIONS (MR)

Nuril Munfaridah; Lucy Avraamidou; Martin Goedhart
Institute for Science Education and Communication, University of Groningen

STEREOTYPES SEEM TO BE UNSTOPPABLE. STEREOTYPES, SUPPORT IN SCHOOL AND THE FAMILY AND THEIR CONTRIBUTION TO ACADEMIC SELF-CONCEPT IN STEM

Silke Luttenberger¹; Manuela Paechter²; Bernhard Ertl³
¹University of Teacher Education Styria; ²University of Graz; ³Universität der Bundeswehr München

STUDENTS COPING WITH AUTHORITATIVE DIMENSIONS OF SCIENCE LESSONS

Anttoni Kervinen¹; Wolff-Michael Roth²; Kalle Juuti¹; Anna Uitto¹
¹University of Helsinki, Finland; ²University of Victoria, BC, Canada

AN INVESTIGATION OF THE IMPACT OF AN INDUSTRY-FOCUSED GENDER INTERVENTION ON THE SELF-PERCEPTIONS AND CAREER ASPIRATIONS OF FEMALE UNDERGRADUATE STUDENTS IN THE STEM DISCIPLINES

Tracey O'Connell
University of Limerick

GENDER AND SCIENCE: MEN AND WOMEN IN GREEK GYMNASIUM SCIENCE TEXTBOOKS

Georgios Ampatzidis; Anastasia Armeni
University of Patras

"YOU'RE RUINING IT": POSITIONING AND IDENTITY IN A 6TH GRADE PLACE-BASED LEARNING CONTEXT

Lynne Zummo
Stanford University

BRIDGING QUESTIONS OF 'WHO' AND 'WHAT' IN SCIENCE EDUCATION RESEARCH

Anne-Sofie Nyström; Anna Danielsson
Uppsala University, Dept. of Education

A FRAMEWORK FOR STUDYING THE INTEGRATION OF SEXUAL DIVERSITY IN SECONDARY SCHOOL SCIENCE TEACHING

Guillaume Cyr; Martin Riopel; Janik Bastien-Charlebois
Université du Québec à Montréal (UQAM)

13:45 - 15:00 **Interactive Poster P15 - STRAND 8 - SCIENTIFIC LITERACY AND SOCIO-SCIENTIFIC ISSUES** **Room B2**

Chairperson(s): Torill Høyby

CARTOGRAPHY AS A TOOL TO ADDRESS ACTIVISM WITH PRE-SERVICE SCIENCE TEACHERS ON A SOCIALLY ACUTE QUESTION: MEAT PRODUCTION AND CONSUMPTION

Aurelio Cabello-Garrido; Daniel Cebrián-Robles; Enrique España-Ramos;
Francisco José González-García; Antonio Joaquín Franco-Mariscal; Ángel Blanco-López
Málaga University

HOW DO STUDENTS USE FACTS AND VALUES IN A WRITTEN TASK ABOUT RISK ASSESSMENT OF IRRADIATED STRAWBERRIES?

Linda Schenk¹; Margareta Enghag²; Karin Haglund³
¹KTH - Royal Institute of Technology; ²Stockholm University; ³Tumba gymnasium

COMPARING SYNTHETIC AND GREEN PESTICIDES IN CHEMISTRY TEACHING FROM A SUSTAINABILITY PERSPECTIVE

Christian Zowada¹; Nadja Belova¹; Vania Zuin²; Ingo Eilks¹
¹University of Bremen; ²Universidade Federal de Sao Carlos

MAPPING THE DIMENSIONS OF BIODIVERSITY AND CITIZENSHIP IN A DISCUSSION ON SOCIOSCIENTIFIC ISSUES

Anne Freitas¹; Rafael Castro¹; Marcelo Motokane²
¹Postgraduate Program in Science Teaching, University of São Paulo; ²University of São Paulo

ANIMAL TESTING IN BIOMEDICAL RESEARCH - A SOCIOSCIENTIFIC ISSUE AT SCHOOL

Elena Kinz; Julia Auer; Simone Schumann; Brigitte Gschmeidler
 Open Science - Lebenswissenschaften im Dialog

RELATIONSHIPS AMONG FAMILIARITY OF SCIENCE TERMS, TEXT COMPREHENSION AND READING TIME IN SCIENCE TEXT READING

Donghyuk Yang; Eunjung Yun; Yunebae Park
 Kyungpook National University

CITIZENSHIP EDUCATION, RRI AND THE POWER OF COLS

Paola Ambrogi¹; Giulia Tasquier²; Margherita Venturi²
¹IIS Nobili; ²University of Bologna

USING SCIENCE-BASED NEWS REPORTS TO BRIDGE A LANGUAGE GAP: A LANGUAGE AND LITERACY PERSPECTIVE ON LEARNING SECONDARY SCIENCE

Billy McClune
 Queen's University Belfast

INVESTIGATING PERSPECTIVE-TAKING ON SOCIOSCIENTIFIC ISSUES AMONG JAPANESE PRIMARY SCHOOL STUDENTS

Sayuri Tokura¹; Etsuji Yamaguchi¹; Miki Sakamoto¹; Tomokazu Yamamoto²; Shigenori Inagaki¹; Kazuya Wakabayashi¹; Motoaki Matano³
¹Kobe University; ²Hyogo University of Teacher Education; ³Elementary School Attached to Kobe University

THE EFFECTS OF SCIENCE CLASSES EXPERIENCE IN CONCEPTIONS ABOUT S&T AND ENVIRONMENTAL CHALLENGES

Raquel Bertoldo¹; Marcelo Giordan¹; Helena Carvalho²
¹University of São Paulo; ²University Institute of Lisbon - ISCTE-IUL

STEM CLUBS: DEVELOPING AN EVIDENCE-BASED EVALUATIVE FRAMEWORK

Angela Fitzgerald¹; Tania Leach¹; Kate Davis¹; Margie Power¹; Neil Martin¹; Stephanie Piper¹; Rena Singh²
¹University of Southern Queensland; ²Inspiring Australia Queensland

CITIZENSHIP EDUCATION AND SUSTAINABILITY ISSUES IN LOWER SECONDARY SCIENCE EDUCATION

Michiel Van Harskamp; Marie-Christine Knippels; Wouter Van Joolingen
 Freudenthal Institute, Utrecht University

GENE-ETICS. AN INTERDISCIPLINARY LEARNING RESOURCE INTRODUCING CRISPR TECHNOLOGY IN AN ETHICAL DEBATE

Torill Høiby¹; Caroline Aakerøy Moe²; Tine Weise Håland³; Linda Smedbakken¹; Øyvind Rundtom¹
¹Skedsmo STEM center, Municipality of Skedsmo; ²Kjeller school; ³Skedsmo STEM centre

13:45 - 15:00 **Interactive Poster P14 - STRAND 6 - NATURE OF SCIENCE: HISTORY PHILOSOPHY AND SOCIOLOGY OF SCIENCE** **Room B3**

Chairperson(s): Mehmet Fatih Tasar

EXPLORING PRESERVICE TEACHERS' COLLABORATIVE DEVELOPMENT OF HISTORY OF SCIENCE BASED LESSONS

Wonyong Park¹; Sibel Erduran¹; Jinwoong Song²
¹University of Oxford; ²Seoul National University

THE ROLE OF AN EXPLICIT AND REFLECTIVE APPROACH TO IMPROVE TEACHING AND NOS CONCEPTIONS OF PRESERVICE BIOLOGY TEACHERS IN BRAZIL

Nathália Helena Azevedo; Daniela Scarpa; Maria Elice Prestes; Filipe Berçot
 University of São Paulo

INTEGRATING INQUIRY, HISTORY AND REFLECTIVE LEARNING TO IMPROVE VIEWS OF SCIENCE: DESIGN AND EVALUATION OF AN INTERVENTION

Cristina Cobo Huesa; Ana María Abril Gallego; Marta Romero Ariza
 University of Jaén

TEACHING THE NATURE OF SCIENCE IN INDIGENOUS MEXICAN COMMUNITIES USING SITUATED LEARNING

Paulina Guerrero-Gutiérrez
 King's College London (Waterloo Campus)

DO SCIENTIFIC INQUIRY ACTIVITIES AT SUPER SCIENCE SCHOOLS IN JAPAN CONTRIBUTE TO STUDENTS' UNDERSTANDING OF THE NATURE OF SCIENCE?

Kenji Matsubara; Yasuhito Hagiwara; Yuji Saruta
National Institute for Educational Policy Research

EPISTEMOLOGICAL REPRESENTATIONS ABOUT THE COMPETENCES OF SCIENTIFIC THOUGHT IN EDUCATORS OF INFANT IN FORMATION. A STUDY IN CHILE.

Mario Quintanilla; Miguel Manzanilla; Eloy Peña
Pontificia Universidad Católica de Chile

ADVANCED SPANISH SCIENCE STUDENTS' UNDERSTANDING ABOUT SOME ASPECTS ON NATURE OF SCIENCE

Isabel María Cruz-Lorite¹; Antonio Joaquín Franco-Mariscal²; Ángel Blanco-López²
¹University of Malaga; ²University of Málaga

THE SUBSTANTIALITY IN THE ORGANIZATION THEORETICAL OF HEAT

Marina Garzón Barrios¹; Marina Castells²
¹UNIVERSIDAD PEDAGÓGICA NACIONAL; ²UNIVERSIDAD DE BARCELONA

"NATURE OF SCIENCE (NOS) KNOWLEDGE IS NOT TESTED IN HIGH STAKES EXAMINATIONS" – GRADE 10 TEACHERS' PERSPECTIVES ABOUT THE TEACHING OF NOS IN SOUTH AFRICA

Remeredzayi Gudyanga; Loyiso Jita
University of the Free State

SCIENTIFIC AND RELIGIOUS PERSPECTIVES ON EVOLUTION: AN APPROACH BASED ON PEDAGOGY OF DIFFERENCE

David Owens¹; Rachel Pear²; Hanan Alexander²; Michael Reiss³
¹Georgia Southern University; ²University of Haifa; ³University College London

CREATIVITY IN DATA ANALYSIS THROUGH CONFRONTATION WITH ANOMALOUS DATA

Pascal Pollmeier; Sabine Fechner
Paderborn University

STEREOCHEMISTRY IN HIGH SCHOOL: HISTORICITY IN BRAZILIAN TEXTBOOKS OF ORGANIC CHEMISTRY

José Cláudio Del Pino¹; Daniele Raupp¹; Tania Renata Prochnow²
¹UFRGS; ²ULBRA

THE NATURE OF STEM? OR "IS STEM A THING?" DISCUSSING THE IMPLICATIONS OF STEM FOR SCIENCE EDUCATION

Valarie Akerson; Valarie Akerson; Angela Burgess; Alex Gerber; Meize Guo; Taukir Khan; Steven Newman
Indiana University

TEACHING SERENDIPITY IN SCIENCE THROUGH VIGNETTE

Yasemin Doygun¹; Hasan Özcan¹; Mehmet Fatih Taşar²
¹Aksaray University; ²Gazi University

13:45 - 15:00 **Interactive Poster P13 - STRAND 2 - LEARNING SCIENCE: COGNITIVE AFFECTIVE AND SOCIAL ASPECTS** **Room B4**

Chairperson(s): CARLOS Garcia

SMART SPACES - A TRIAL OF SPACED LEARNING IN CHEMISTRY REVISION

Mark Hardman
UCL Institute of Education

A STUDENT-ACTIVE APPROACH TO SCIENCE MODELS AND REPRESENTATION - A WAY TO IMPROVE SCIENTIFIC LANGUAGE OF SECOND LANGUAGE LEARNERS?

Lizette Widing¹; Pernilla Nilsson²; Pernilla Granklint Enochson²
¹School of Education, Halmstad University; ²Humanities and Social Science, Halmstad University

MEASURING OVERCONFIDENCE IN SCIENCE CLASSROOM: A SET OF CONCEPT TEST AND CONFIDENCE SCALE

Ai Nurlaelasari Rusmana¹; Yustika Syabandari¹; Rahmi Qurota Aini¹; Minsu Ha¹; Arif Rachmatullah²; Eni Nuraeni³
¹Kangwon National University; ²North Carolina State University; ³Universitas Pendidikan Indonesia

THE EARTHQUAKE AMONG SCIENCE, POETRY, TECHNOLOGY AND MUSIC: AN INTEGRATED LEARNING ACTIVITY

Lucia Stacchiotti; Alessandra Beccaceci; Alessandro Acqua; Eleonora Paris
University of Camerino

VISUAL LITERACY IN BIOLOGY EDUCATION

Elisabeth Scheicher; Iris Schiffel
Paris Lodron University

ASSESSING NINTH GRADE STUDENTS' UNDERSTANDING OF FORCE AND MOTION MODELS AND INVESTIGATING ITS RELATIONSHIP TO THE CONCEPTION OF LEARNING SCIENCE

Silvia Wen-Yu Lee; Silvia Wen-Yu Lee
National Changhua University of Education

CHEMISTRY TEACHERS' DEVELOPMENT OF RELEVANT AND INTERESTING CONTEXT-BASED OPEN-ENDED PROBLEMS

Karolina Broman
Umeå University

STUDENTS' APPROACHES TO LEARNING ENVIRONMENTAL SCIENCE IN A DISTANCE-LEARNING COURSE

David Gonzalez Gomez¹; Jin Su Jeong¹; Alejandrina Gallego²; Florentina Cañada¹
¹University of Extremadura; ²National University of Distance Education

CURIOUSER AND CURIOUSER: EVALUATING THE IMPACT OF A PROFESSIONAL DEVELOPMENT INITIATIVE IN SUPPORTING PRIMARY TEACHERS TO DEVELOP PUPILS' EPISTEMIC REASONING AND SELF-CONCEPT AS SCIENTIST.

Deborah Myers
Northumbria University

EVOLUTION, AFFECT AND ACCEPTANCE: A PSYCHOANALYTICAL EXAMINATION OF THE CONTROVERSY

Emma Newall
UCL Institute of Education

CHILDREN'S MOTIVATION AND INTEREST DEVELOPMENT IN SCIENCE FROM DAYCARE TO UPPER SECONDARY SCHOOL

Morten Rask Petersen
UCL University College

WORKING ON WHAT THE STUDENTS THINK ABOUT CHEMICAL REACTIONS. A DIDACTIC INTERVENTION ON MISCONCEPTIONS AT PRIMARY SCHOOL LEVEL

Florentina Canada; Miriam Hernandez; Maria Antonia Davila; Jesus Sanchez-Martin
University of Extremadura

HOW TO SPEAK ABOUT SCIENCE EMOTIONS. THE USE OF BOARD GAMES AS A COLLECTING METHOD FOR EMOTIONAL EVALUATION OF UNIVERSITY SCIENCE STUDENTS.

JESÚS SÁNCHEZ-MARTÍN¹; Florentina Cañada-Cañada¹; MARÍA ANTONIA DÁVILA-ACEDO²; MIRIAM HERNÁNDEZ DEL BARCO¹
¹University of Extremadura; ²UNIVERSITY OF EXTREMADURA

THE SKEPTICS - EXPERIENCES OF BILDUNG IN UNIVERSITY LEVEL PHYSIC

Ronny Kjelsberg
NTNU - Norwegian University of Science and Technology

KEY VARIABLES FOR THE MOTIVATION OF WOMEN IN DIFFERENT STEM FIELDS

Manuela Paechter¹; Silke Luttenberger²; Bernhard Ertl³
¹University of Graz; ²University of Teacher Education Styria; ³Universität der Bundeswehr München

CLIMATE CHANGE IMAGES AS EMOTIONAL EXPERIENCE. A WORK IN PROGRESS

CARLOS Garcia; CARLOS Garcia; Carlos Garcia
Universidad de Guadalajara

13:45 - 15:00 Interactive Poster P16 - STRAND 9 - HEALTH AND THE OUTDOORS

Room B5

Chairperson(s): Graça S. Carvalho

LEARNING AND TEACHING SCIENCE OUTSIDE THE CLASSROOM: EXPERIENCES WITH PRE SERVICE TEACHERS IN CHILE AND BRAZIL

Natália Candido Vendrasco¹; Adriana Pugliese²
¹Pontificia Universidad Católica de Chile; ²Universidade Federal do ABC - UFABC

THE SCIENCE TEACHER'S PREPARATIONS FOR THE OUT-OF-SCHOOL LEARNING

Mona Kvivesen
UiT The Arctic University of Norway

THE IMPACT OF A SCIENCE CAMP ON PUPILS MOTIVATING TO LEARN NATURAL SCIENCES

Petra Ivánková¹; Martin Lindner²
¹Comenius University in Bratislava; ²Martin Luther Universität Halle Wittenberg

LONG-TERM EFFECTS OF SCIENCE SUMMER CAMPS

Martin Lindner
Martin-Luther-University

AN ETHIC OF CARE IN SCIENCE EDUCATION THROUGH OUTDOOR LEARNING

Joan Whelan; Orla Kelly
DCU

EDUCATIONAL KITCHEN-GARDEN PROJECTS: STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS

Stella Petrou; Konstantinos Korfiatis
University of Cyprus

EATING DISORDER AND RISK OF SUICIDAL BEHAVIOR IN SECONDARY SCHOOL STUDENTS

Olga Mayoral¹; Marta Talavera²; David Martín²; Raissa Arbona¹
¹Universitat de València; ²Conselleria de Sanitat. Generalitat Valenciana

DEVELOPMENT OF STANDARDS OF PRACTICE FOR HEALTH PROMOTION IN COLLEGES OF EDUCATION

Irit Hof-Nahor¹; Nurit Bar-Yossef²; Irit Livne³
¹Oranim College of Education; ²Kibbutzim College of Education, Technology and Arts, Tel-Aviv, Israel; ³Ministry of Education

THE ROLE-PLAYING GAME AS AN INNOVATIVE ACTIVITY IN THE TEACHING OF SCIENCE TO PROMOTE ATTITUDES AND HEALTHY NUTRITIONAL HABITS IN STUDENTS OF SECONDARY SCHOOL

Erika Gonzalez-Sanchez; Vito Brero; Maria del Carmen Acebal
University of Malaga

EXPLORING HOW A CARD-TYPE GAME FOR TERMINAL CARE CAN PROMOTE THE HEALTH AND WELL-BEING AWARENESS OF NON-SCIENCE STUDENTS

Shiho Miyake¹; Asami Ohnuki²
¹Kobe College; ²Shirayuri University

SUBJECT-SPECIFIC HUMOUR AS A CREATIVE METHOD FOR TEACHING HEALTH LITERACY

Marisa Alena Holzapfel; Karin Stachelscheid; Maik Walpuski
University of Duisburg-Essen

CO-CREATION (COC) PROCESS IN A SITUATION OF STUDY (SOS) ON HEALTH EDUCATION

Graça S. Carvalho¹; Eva T.O. Boff²; Maria Cristina P. Araújo²
¹CIEC, University of Minho, Braga, Portugal; ²UNIJUL, Ijuí, RS, Brazil

13:45 - 15:00 **Interactive Poster P17 - STRAND 9 - NATURE, ECOLOGY & ENVIRONMENT** **Room B6**

Chairperson(s): Mariana Tambellini Faustino

ANIMALPOCKY: AN OBSERVATION LEARNING SUPPORT APPLICATION USING AUGMENTED REALITY FOR ZOOS

Arisa Emoto¹; Arata Hisano²; Itsuki Kawabata²; Fusako Kusunoki²; Kumiko Hanaki³; Noriko Atake³; Shigenori Inagaki¹; Tomoyuki Nogami¹
¹Kobe University; ²Tama Art University; ³Kobe Municipal Oji Zoo

THE TASTE OF BIODIVERSITY: EXPLORING DOMESTIC PLANT BREEDS INTRASPECIFIC DIVERSITY TO FOSTER SCIENTIFIC LITERACY

Sara Aboim¹; Lisa Afonso²; Xana Sá-Pinto³
¹Politécnico do Porto; ²Faculdade de Psicologia e Ciências da Educação da Universidade do Porto; ³CIDTFF.UA

RE-COUPLING NATURE AND CULTURE: HOW CAN PRIMARY TEACHER EDUCATORS ENABLE PRE-SERVICE TEACHERS AND THEIR PUPILS TO BREATHE LIFE BACK INTO HUMANITY'S TIN FORESTS?

Deborah Myers
Northumbria University

TEACHING NATURE — A CASE STUDY OF 5-7-YEAR-OLD CHILDREN ENGAGED IN OUTDOOR LEARNING ACTIVITIES, FROM AN ESD PERSPECTIVE

Christiana Glettler
KPH Graz

THE NEW ECOLOGICAL PARADIGM SCALE FOR USE WITH CHILDREN IN SLOVENIA

Gregor Torkar¹; Vanja Debevec²; Constantinos Manoli³; Bruce Johnson³
¹University of Ljubljana Faculty of Education; ²Skocjan Caves Public Service Agency; ³University of Arizona, College of Education

STORYTELLING-DRIVEN PERSPECTIVE-TAKING IN SUPPORT OF ENVIRONMENTAL IDENTITY

Florian Rietz; Nicolas Robin; Arvid Nagel
University of Teacher Education St.Gallen

EVALUATION OF LEARNING SUPPORT FUNCTION OF SIMULATION GAME FOR FOREST MANAGEMENT

Shota Asahina¹; Shuya Kawaguchi²; Yoshiaki Takeda¹; Hideo Funaoi³; Etsuji Yamaguchi¹; Fusako Kusunoki⁴; Masanori Sugimoto⁵; Hiroshi Mizoguchi²; Shigenori Inagaki¹

¹Kobe University; ²Tokyo University of Science; ³Soka University; ⁴Tama Art University; ⁵Hokkaido University

DEVELOPMENT OF A SCALE TO TEST ENVIRONMENTAL LITERACY AND TO PREDICT ENVIRONMENTAL RESPONSIBLE BEHAVIOUR OF PRE-SERVICE TEACHERS

Lidia Caño; Oihana Barrutia

University of the Basque Country

USING MEDIA IN ENVIRONMENTAL EDUCATION PRACTICES: THE CHALLENGE OF PROMOTING MEDIA LITERACY

Mariana Tambellini Faustino; Rosana Louro Ferreira Silva

Universidade de São Paulo

13:45 - 15:00 **Interactive Poster P18 - STRAND 9 - CLIMATE & SUSTAINABILITY**

Room B7

Chairperson(s): Benjamin J. Tempel

EXPLORING THE ENVIRONMENTAL CAPITAL OF THAI VISITORS REGARDING FLOODING AND CLIMATE CHANGE ISSUES: A CASE STUDY AT A LARGE SCIENCE MUSEUM IN THAILAND

Supa Tanprasertkun

University College London Institute of Education

UPPER-SECONDARY SCHOOL PHYSICS STUDENTS' UNDERSTANDING OF THE GREENHOUSE EFFECT

Terhi Mäntylä; Leena Partanen; Viivi Nousiainen

Tampere University

MAKING THE CHANGE POSSIBLE. INCLUSION OF ESD IN THE TRAINING OF SECONDARY SCHOOL TEACHERS

Olga Mayoral; María Calero; M. Pilar Martínez-Agut; M. Àngels Ull; Victoria Vázquez; Amparo Vilches

Universitat de València

A HOLISTIC MODEL FOR CLIMATE CHANGE EDUCATION

Sakari Tolppanen¹; Hannele Cantell²; Essi Aarnio-linnanvuori³; Anna Lehtonen²

¹University of Eastern Finland; ²University of Helsinki; ³WWF

EXAMINING CHANGES OF UNIVERSITY STUDENTS' PERCEPTIONS ON CLIMATE CHANGE AFTER ATTENDING INTERNATIONAL CLIMATE CHANGE EDUCATION PROGRAM

Jun Yang; Chan-Jong Kim; Seung-Urn Choe

Seoul National University

INTERGENERATIONAL STEM EDUCATION FOR ADOLESCENTS TOWARDS LIVEABLE FUTURES: CAN YOU LOOK AN EARTHWORM IN THE EYE AND SAY, "I DID MY BEST FOR YOU"?

Kathy Paige; David LLOYD; Richard Smith

University of South Australia

MOVING BEYOND A KNOWLEDGE DEFICIT PERSPECTIVE & TOWARDS A MODEL FOR YOUTH CLIMATE CHANGE BEHAVIOR

K.C. Busch¹; Daniel Gruehn¹; Nicole Ardoin²; Kathryn Stevenson¹

¹North Carolina State University; ²Stanford University

DEVELOPMENT OF AN UNIVERSAL INDICATOR FOR EDUCATION FOR SUSTAINABLE DEVELOPMENT BY A SYSTEMATIC LITERATURE REVIEW

Benjamin J. Tempel; Sonja Schaal; Steffen Schaal

University of Education Ludwigsburg

13:45 - 15:00 **Interactive Poster P23 - STRAND 10 - SCIENCE CURRICULUM AND EDUCATIONAL POLICY / STRAND 11 - EVALUATION AND ASSESSMENT OF STUDENT LEARNING AND DEVELOPMENT**

Room C1

Chairperson(s): Triin Rosin

THE USE OF A MIXED METHODOLOGICAL APPROACH TO ANALYSE THE SPECIFIC CODING ORIENTATION

Larissa Nascimento; Rafael Castro; Marcelo Motokane

Universidade de São Paulo

DEVELOPMENT OF A TEST INSTRUMENT TO MEASURE TEACHER STUDENTS' CONTENT KNOWLEDGE AND PEDAGOGICAL CONTENT KNOWLEDGE

Lisa Mosele; Oliver Kraft; Inga Gryl; Stefan Rumann

University of Duisburg Essen

ASSESSMENT OF TEAM COMMUNICATION SKILLS IN STEM OUT-OF-SCHOOL TIME SETTINGS

Frances Lawrenz¹; Amy Grack Nelson²
¹U of Minnesota; ²Science Museum of Minnesota

HAVE STUDENTS ATTENDING ALSO INFORMAL LECTURES A BETTER ASTRONOMICAL KNOWLEDGE ? EXPLORING THE 10-13 AGE COMPARING SCHOOL AND INFORMAL LECTURES

Sandro Bardelli¹; Elena Zucca²; Angelo Adamo¹
¹INAF-Astrophysical and Space Science Observatory; ²INAF-Astrophysical and Space Science Observatory Bologna

SELF-EFFICACY AND SCIENTIFIC LITERACY TO MEASURE LEARNING

Daniel Solis¹; Nancy Longnecker²; David A. W. Hutchinson³
¹Centre for Science Communication, University of Otago; The Dodd-Walls Centre for Photonic and Quantum; ²Centre for Science Communication, University of Otago; ³The Dodd-Walls Centre for Photonic and Quantum Technologies, Department of Physics, University of Otago

MAXIMIZING INTRINSIC INTEREST & POTENTIAL OF SCIENCE GIFTED STUDENTS THROUGH 'STRUCTURED SCHOOL-BASED SCIENCE GIFTED EDUCATION FRAMEWORK' IN A THOROUGH-TRAIN SCHOOL IN HONG KONG

Man Ho Li; Ka Chun Suen; Mei Yu Lin; Wing Kwong Chan
 Po Leung Kuk Laws Foundation College

PROPOSAL OF THE USE OF SCIENTIFIC LITERACY INDICATORS TO ANALYSE A WRITTEN EVALUATION

Larissa Nascimento; Heloísa Flores; Marcelo Motokane; Gabriela Zanarotti
 Universidade de São Paulo

DEVELOPMENT OF THE WEB-BASED AUTOMATED COMPUTER SCORING SYSTEM USING ARTIFICIAL INTELLIGENCE IN KOREA

Jisun Park¹; Minsu Ha²; Jun-ki Lee³; Sein Shin⁴; Gyeong-geon Lee⁵
¹Ewha Womans University; ²Kangwon National University; ³Chonbuk National University; ⁴Chungbuk National University; ⁵Seoul National University

EXPLORING HOW COLLEGE STUDENTS SOLVE PHYSICS PROBLEMS: AN EYE-MOVEMENT ANALYSIS

Guo-Li Chiou; Fang-Ying Yang
 National Taiwan Normal University

DEVELOPMENT OF A TEST INSTRUMENT FOR A CONCEPTUAL UNDERSTANDING OF ELECTROMAGNETIC RADIATION

Thomas Plotz
 University of Vienna

RELATIONSHIP OF EMOTIONS WITH ASSOCIATED VARIABLES TO THE SCIENCE LEARNING IN SECONDARY STUDENTS

Pedro Membiela; Miguel Angel Yebra; Manuel Vidal; Antonio González
 University of Vigo

INFLUENCE OF CONTEXTUAL VARIABLES IN THE PERCEPTION OF SCIENCE LEARNING IN SECONDARY STUDENTS

Pedro Membiela; Miguel Angel Yebra; Manuel Vidal; Antonio González
 University of Vigo

ASSESSMENT OF K-12 STUDENTS' SCIENCE AND LITERACY KNOWLEDGE

Claire Cesljarjev¹; Valarie Akerson²
¹Indiana University; ²Indiana University

DEVELOPMENT AND VALIDATION OF A LEARNING PROGRESSION MODEL FOR CHEMICAL KINETICS

JOAQUIM FERNANDO MENDES DA SILVA; ANTONIO CARLOS OLIVEIRA GUERRA; LUCIANA GONDIM MONTEIRO
 Federal University of Rio de Janeiro

A MODEL FOR TRANSFER OF INTELLECTUAL RESOURCES BETWEEN SCIENCE AND MATHEMATICS: AN EMPIRICAL STUDY

Kyungwoon Seo¹; Brian Hand²; Kyong Mi Choi³
¹Seoul National University; ²University of Iowa; ³University of Virginia

WHAT WE CAN (AND CANNOT) LEARN FROM INTERNATIONAL TESTING: AN EXAMPLE FROM AUSTRALIA

Helen Georgiou
 University of Wollongong

DEVELOPMENT OF STUDENTS' CHEMISTRY COMPETENCES AT THE TRANSITION BETWEEN PRIMARY AND SECONDARY SCHOOL

Alina Behrendt; Vanessa Fischer; Maik Walpuski
 University of Duisburg-Essen

PUTTING SCIENCE CAPITAL TO THE TEST: VALIDATION OF AN ASSESSMENT OF CAREER ASPIRATION FACTORS

M. Gail Jones¹; Megan Ennes¹; Katherine Chesnutt¹; Emily Cayton²; Drew Weedfall¹; Emma Refvem¹; Kathryn Rende¹; Pamela Huff¹
¹NC State University; ²Campbell University

DISCIPLINARY EXPERTS IN PRIMARY SCIENCE AND MATHEMATICS EDUCATION: INFLUENCES ON TEACHING AND LEARNING

Reece Mills; Theresa Bourke; Erin Siostrom
 Queensland University of Technology

ANALYSIS OF IMPLEMENTED SCIENCE CURRICULA: AN APPROACH FROM TEACHERS' PEDAGOGICAL PERSPECTIVES

Susumu Nozoe¹; Tetsuo Isozaki²
¹University of Miyazaki; ²Hiroshima University

US AND JAPANESE SCIENCE TEACHERS DEFINITION AND ENACTMENT OF INQUIRY-BASED TEACHING AND LEARNING PRACTICES

Noemi Waight¹; Koichi Furuya²; Melinda Whitford¹
¹University at Buffalo; ²Joetsu University of Education

FUNDING FOR INSTRUCTIONAL MATERIALS IN SECONDARY SCIENCE CLASSROOMS

Emily Cayton¹; M. Gail Jones²; Megan Ennes²; Katherine Chesnutt²
¹Campbell University; ²North Carolina State University

OUTCOMES OF AN INTEGRATED STEM HIGH SCHOOL - ENABLING ACCESS AND ACHIEVEMENT FOR ALL STUDENTS

Carla Johnson¹; Toni Sondergeld²; Virginia Bolshakova¹
¹Purdue University; ²Drexel University

DETERMINING THE EFFECTIVENESS OF AN E-TESTING MODEL IN ENABLING TEACHERS TO PROVIDE FEEDBACK TO STUDENTS FOR PROMOTING COMPONENTS OF SCIENTIFIC LITERACY IN THE CLASSROOM

Triin Rosin; Katrin Vaino; Regina Soobard; Miia Rannikmäe
 University of Tartu

13:45 - 15:00 **Interactive Poster P20 - STRAND 4 - USE OF MOBILE DEVICES IN SCIENCE EDUCATION (AND ONLINE LEARNING ENVIRONMENT)** **Room D1**

Chairperson(s): Athanasios Velentzas

A FEEDBACK LOOP TO IMPROVE STUDENTS' PERSISTENCE IN A STEM ONLINE LEARNING ENVIRONMENT SETTING

Yannick Skelling-Desmeules¹; Patrick Charland²
¹Université du Québec à Montréal; ²Université du Québec à Montréal (UQAM)

BLENDED LEARNING: USE OF DIGITAL APPS BEFORE AND DURING A MULTIDISCIPLINARY FIELD TRIP WITH INTERNATIONAL STUDENTS

Jardar K. Cyvin; John Magne Grindeland
 NTNU - Norwegian University of Science and Technology

SCHOOL-WORK EXPERIENCE WITH SMARTPHONE APPS ON WAVES

Daniele Buongiorno¹; Marisa Michelini¹; Sergej Faletic²
¹University of Udine; ²University of Ljubljana

IMPACT OF EDUCATIONAL ROBOTICS ON STUDENTS' INTEREST AND PERFORMANCE IN CHEMISTRY

Hugo Lapierre; Patrick Charland; Yannick Skelling-Desmeules
 Université du Québec à Montréal

MOBILE RECORDING DATA, AN AID FOR FORMULATING AND TESTING HYPOTHESIS, THE CASE OF PHOTOSYNTHESIS.

Charalambia Lazaridou; Zacharias Zacharia; Konstantinos Korfiatis
 University of Cyprus

IMPLEMENTING MOBILE LEARNING IN PLANT BIOLOGY, THE CASE OF FOURTH GRADERS.

Charalambia Lazaridou; Zacharias Zacharia
 University of Cyprus

EFFECTS OF DIGITAL MEDIA IN HETEROGENEOUS CHEMISTRY LESSONS

Lars Greitemann; Insa Melle
 TU Dortmund University

EXPLORING INSTRUCTIONAL CONTEXTS THAT FACILITATE THE SOPHISTICATION OF CONCEPTIONS REPRESENTED IN MODELLING ACTIVITIES WITH SMART TECHNOLOGY

Heesoo Ha; Heui-Baik Kim
Seoul National University

THE POTENTIAL OF GENETICS MOBILE APPS TO BE USED IN SECONDARY SCHOOLS IN ARGENTINA

Alejandra Malbrán Barros¹; Carolina Rodriguez¹; Leticia Garcia Romano²
¹Science and Technology Teaching Department, National University of Córdoba, Córdoba, Argentina; ²Science and Technology Teaching Department, National University of Córdoba - National Scientific and

EXPLORING DIFFICULTIES IN THE USE OF MOBILE DEVICE SENSORS IN THE SCIENCE CLASSROOM: THE CASE OF ACCELEROMETERS

Alexandros Kateris¹; Panagiotis Lazos²; Serafeim Tsoukos³; Pavlos Tzamalís⁴; Athanasios Velentzas⁵
¹2nd Experimental Lyceum of Athens; ²National and Kapodistrian University of Athens; ³2nd Experimental Junior High School of Athens; ⁴Agricultural University of Athens; ⁵National Technical University of Athens

13:45 - 15:00**Interactive Poster P21 - STRAND 4 - ICT AND OTHER RESOURCES FOR TEACHING/LEARNING SCIENCE****Room D2****Chairperson(s): Jin Su Jeong****USING FLIPPED CLASSROOM WITH DIGITAL MEDIA FOR PRE-SERVICE PRIMARY SCIENCE TEACHER EDUCATION**

Julian Kuesel; Marina Hoenig
Ludwigsburg University of Education

DIAGNOSTIC OF THE VIRTUAL LEARNING ENVIRONMENT IN THE GRADUATION COURSE IN PHYSICS IN DISTANCE EDUCATION IN BRAZIL

Maria Sônia Veloso¹; Agostinho Serrano²; Ney David Veloso³
¹Universidade Federal de Roraima; ²ULBRA; ³Universidade Estácio de Sá

IMPROVING LEARNER KNOWLEDGE AND EXPERIENCE BY EMPLOYING NEWTON PROJECT SERIOUS GAMES IN PROGRAMMING COURSES

Radoslav Vargic¹; Gregor Rozinaj¹; Dan Zhao²; Gabriel Muntean²
¹FEI STUBA; ²DCU

EYE MOVEMENTS DURING DETERMINATION OF BUTTERFLIES WITH IDENTIFICATION KEY

Tanja Gnidovec; Anna Vamberova; Mojca Zemlja; Gregor Torkar
University of Ljubljana, Faculty of Education

A SIMULATION TO SUPPORT AUTHENTIC OBSERVATION

Chang Youn Lee; Hun-Gi Hong
Seoul National University

THE EFFECTS OF GAME SCAFFOLDING ON PLAYERS' VISUAL BEHAVIORS

Guo-Li Chiou¹; Chung-Yuan Hsu²; Meng-Jung Tsai¹; Po-Fen Hsu¹
¹National Taiwan Normal University; ²National Pingtung University of Science and Technology

DO EYE-MOVEMENTS RELATE TO STRATEGY USE? A NEW APPROACH TO CAPTURE DYNAMIC SELF-REGULATION DURING A COMPLEX SCIENCE TASK

Chia-Yu Wang¹; Ke-Wei Lee²
¹National Taiwan University of Science and Technology, Taiwan; ²National Chiao Tung University, Taiwan

CONCEPTUAL AND PEDAGOGICAL FRAMEWORK FOR AN INTERACTIVE ECOSYSTEM SERIOUS GAME

Martin Riopel¹; Jean-Philippe Ayotte-Beauder²; Alexandre Ayotte³
¹Université du Québec a Montréal; ²Université de Sherbrooke; ³Cyberlude

HOW STUDENTS COMBINE REPRESENTATIONS FROM DIFFERENT MEDIATIONS TO UNDERSTAND THE ELECTRIC FIELD CONCEPT IN ELECTROSTATICS.

Agostinho Serrano; Graciela Paz Meggiolaro
Universidade Luterana do Brasil

ASSESSING E-LEARNING FACTORS IN SCIENCE EDUCATION WITH MULTI-CRITERIA DECISION-MAKING AND F-DEMATEL METHOD

Jin Su Jeong; David González-Gómez
University of Extremadura

13:45 - 15:00 **Poster Symposium PS01 - THINKING TO WRITE AND WRITING TO THINK: SUPPORTING STUDENT WRITING IN SCIENCE AND ENGINEERING IN U.S. PUBLIC SCHOOLS** **Room D3**

Chairperson(s): Gabriel Della Vecchia

ALIGNING WRITTEN EXPLANATIONS WITH DESIGN REASONING IN ELEMENTARY ENGINEERING CLASSROOMS

Patricia Paugh¹; Kristen Wendell²
¹University of Massachusetts Boston; ²Tufts University

SUPPORTING MULTIPLE GENRES OF SCIENTIFIC WRITING IN GRADE 5 PROJECT-BASED LEARNING

Gabriel Della Vecchia; Annemarie Palincsar
 University of Michigan

SOCIALIZING WRITTEN SCIENCE EXPLANATIONS WITH ACADEMIC CONVERSATIONS THAT SUPPORT ELS' REASONING ABOUT EVIDENCE

Zenaida Aguirre-Munoz
 University of Houston

USING CADE TO DECONSTRUCT STUDENTS' EVIDENTIARY REASONING IN SECONDARY BIOLOGY LABORATORY TASKS

Ala Samarapungavan; Kari Clase; Chandrani Mishra; Nancy Pelaez; Stephanie Gardner; Nesibe Karakis; Shuangting Li; Jamison Wills; Kari Clase; Nancy Pelaez
 Purdue University

ASSESSING STUDENTS' SCIENCE INQUIRY PRACTICES AND DUSTING OFF THE MESSY MIDDLE

Haiying Li, Janice Gobert, Rachel Dickler
 Rutgers University

13:45 - 15:00 **Interactive Poster P22 - STRAND 5 - TEACHING-LEARNING SEQUENCES AS INNOVATIONS FOR SCIENCE TEACHING AND LEARNING** **Room F1**

Chairperson(s): David Di Fuccia

EFFECTS OF DIFFERENTLY IMPLEMENTED FLIPPED-LEARNING ON ACADEMIC ACHIEVEMENT AND LEARNING MOTIVATION IN HIGHSCHOOL SCIENCE LESSONS

Gyeong-Geon Lee; Young-Eun Jeon; Hun-Gi Hong
 Seoul National University

DESIGN OF TLS WITH AUGMENTED REALITY TO PROMOTE VISUALIZATION IN UNIVERSITY TEACHING WITH A STEM APPROACH

Cristian Merino¹; Waldo Quiroz²; Ainoa Marzàbal²; Sonia Pino¹; Alexis González¹; Patricio Leyton¹; Ximena Carrasco¹; Agustín Adúriz Bravo³
¹Pontificia Universidad Católica de Valparaíso; ²Pontificia Universidad Católica de Chile; ³Universidad de Buenos Aires

WHY AND HOW LOW-COST PRACTICAL ACTIVITIES CAN BE USED

Marian Mulcahy
 UCL Institute of Education

DESCRIBING, JUSTIFYING AND EXPLAINING: HOW TO SUPPORT WRITING LAB REPORTS IN PHYSICS CLASSES

Philip Timmerman; Heiko Krabbe
 Ruhr-University Bochum, Physics Education Department

SEQUENCE EVALUATION OF HIGH SCHOOL STEM PROJECTS: A RUBRIC CONSTRUCTION AND VALIDATION

Miquel Pérez-Torres; Digna Couso; Conxita Márquez
 Autonomous University of Barcelona

A CASE OF STUDY FOR THE UNDERSTANDING OF GENETICS USING THE CRISPR SCIENTIFIC ADVANCE IN A TEACHING LEARNING SEQUENCE

Maria Paz Beltran Salvo; Cristian Merino Rubilar
 Pontificia Universidad Católica de Valparaíso

EFFECTS OF TEACHING THE CONCEPT OF NEUROPLASTICITY TO INDUCE A GROWTH MINDSET ON MOTIVATION AND ACHIEVEMENT: A META-ANALYSIS

Jérémie Blanchette Sarrasin; Lucian Nenciovici; Lorie-Marlene Brault Foisy; Geneviève Allaire-Duquette; Martin Riopel; Steve Masson
 Université du Québec à Montréal

DEVELOPMENT OF ART-SCIENCE CONVERGENCE EDUCATION CONTENTS ON BIODIVERSITY: FOCUSING ON DESIGN ELEMENTS AND SCENARIOS

Chanmi Jung
 Ewha Womans University

IMPACT OF A ROLE-PLAYING GAME ABOUT NUCLEAR ENERGY ON THE SCIENTIFIC KNOWLEDGE OF PRE-SERVICE ELEMENTARY TEACHERS

Isabel María Cruz-Lorite¹; Daniel Cebrián-Robles¹; Antonio Joaquín Franco-Mariscal²; Enrique España-Ramos²

¹University of Malaga; ²University of Málaga

AN INTERVENTION STUDY ON STUDENT'S DECISION-MAKING USING TRADE-OFFS TO RESOLVE SOCIO-SCIENTIFIC ISSUES

Miki Sakamoto¹; Etsuji Yamaguchi¹; Tomokazu Yamamoto²; Shigenori Inagaki¹; Kazuya Wakabayashi¹; Sayuri Tokura¹

¹Graduate School of Human Development and Environment Kobe University; ²Hyogo University of Teacher Education, Japan

"ESCAPE THIS!" - EVALUATING NEW CHEMICAL ESCAPE ROOM ACTIVITY FOR HIGH-SCHOOL STUDENTS

Shelley Rap¹; Malka Yayon¹; Dvora Katchevich¹; Ran Peleg²; Ron Blonder¹

¹Weizmann Institute of Science; ²EDQuest

MEMORIZING ECOLOGICAL CONCEPTS: ALTERNATIVE FOR TEACHING ECOLOGICAL CONCEPTS TO HIGH SCHOOL STUDENTS

Juliana Nascimento Silva¹; Cirlande Cabral Silva²; Hileia Monteiro Maciel-Cabral¹; Luiz Caldeira Brant Tolentino Neto³; Patricia Macêdo de Castro⁴; Daniel Morin Ocampo³; Elizane da Silva Davila⁵

¹Universidade do Estado do Amazonas; ²INSTITUTO FEDERAL DO AMAZONAS; ³Universidade Federal de Santa Maria; ⁴Universidade Estadual de Roraima; ⁵Instituto Federal Farroupilha

THE BEAUTY TO LEARN ABOUT BRAZILIAN MEGA-BIODIVERSITY: PRODUCTION, VALIDATION AND USES OF INQUIRY DIDACTIC SEQUENCES

Marcelo Tadeu Motokane¹; Caio de Castro Freire²; Rafael Gil Castro²; Mariana Guelero Valle³; Anne Caroline Freitas²; Ana Elisa Montebelli Motta²; Suzana Ursi²

¹University of São Paulo; ²Univ. of São Paulo; ³Univ. Federal do Maranhão

AN INVESTIGATIVE LEARNING FROM AN INCLINED PLANE EXPERIMENT

Michele Ueno Guimaraes; João Felipe Viana de Araújo

Universidade Federal de Ouro Preto

AIMING FOR AN INTEGRATED PERSPECTIVE ON MODELS OF LIGHT IN THE SECONDARY SCHOOL

Massimiliano Malgieri¹; Claudio Suttrini²; Anna De Ambrosis¹

¹University of Pavia, Department of Physics; ²ISS Taramelli-Foscolo, Pavia

A TEACHING-LEARNING SEQUENCE TO BRIDGE THE GAP FROM MICRO TO MACRO IN THERMODYNAMICS

Massimiliano Malgieri¹; Pasquale Onorato²; Monica Di Savino¹; Anna De Ambrosis¹

¹University of Pavia, Department of Physics; ²University of Trento, Department of Physics

PROMOTING THE UNDERSTANDING OF QUANTUM MECHANICS AND THE EXPLORATION OF THEORETICAL INQUIRY PRACTICES IN SECONDARY SCHOOL

Giacomo Zuccarini; Marisa Michelin

University of Udine

ELECTRONIC WASTE AS A CONTEXT FOR TEACHING CHEMISTRY

David Di Fuccia

University of Kassel

13:45 - 15:00

Interactive Poster P03 - STRAND 7 - DISCOURSE AND ARGUMENTATION IN SCIENCE EDUCATION

Room F2

Chairperson(s): Gonzalo Miguel Angel Bermudez

TEACHING PLANNING AND MULTIMODALITY IN THE INITIAL EDUCATION OF CHEMISTRY TEACHERS

Evelin Sgarbosa; Marcelo Giordan

University of São Paulo

THE ROLE OF GESTURES IN THE TRANSITION BETWEEN REPRESENTATIONS

Marcelo Giordan¹; Andrée Tiberghien²; Eduardo Fleury Mortimer³; Ana Luiza Quadros⁴

¹Faculty of Education - University of Sao Paulo; ²Université Lyon 2; ³Faculty of Education - Federal University of Minas Gerais; ⁴Chesmistry Institute - Federal University of Minas Gerais

IMPLICATIONS OF NON-VERBAL MODES OF REPRESENTATION FOR LANGUAGE LEARNERS

Melanie Williams¹; Kok-Sing Tang²

¹Edith Cowan University; ²Curtin University

ARGUMENTATION IN THE CHEMISTRY TEACHING: ANALYSIS OF DISCURSIVE INTERACTIONS AND VERBAL ACTIONS

Wellington Francisco¹; Lôany G. Silva²; Wilmo E. Francisco Junior³

¹Universidade Federal da Integração Latino-Americana; ²Universidade Federal do Tocantins; ³Universidade Federal de Alagoas

PRE-SERVICE TEACHER'S DISCURSIVE MOVES GUIDING WORK WITH EVIDENCE

Ana Elisa Montebelli Motta¹; Marcelo Tadeu Motokane²

¹Postgraduate Program in Science Teaching, University of São Paulo; ²Faculty of Philosophy, Sciences and Letters of Ribeirão Preto, University of São Paulo

ROLES OF NOS VIEWS IN ARGUMENTATIVE REASONING EXPRESSED IN A SOCIO-SCIENTIFIC DEBATE

Rosária Justi; Marina Martins

Universidade Federal de Minas Gerais

SCAFFOLDING EVIDENCE-BASED REASONING IN A TECHNOLOGY SUPPORTED ENGINEERING DESIGN ACTIVITY

Carina Rebello¹; Yuri Piedrahita Uruena¹; Alejandra Magana Deleon¹; Chandan Dasgupta²

¹Purdue University; ²Indian Institute of Technology Bombay

EVALUATING STUDENTS' ARGUMENTATION ON ANTIMICROBIAL RESISTANCE: A PILOT STUDY IN AN AUSTRIAN UPPER SECONDARY SCHOOL

Konstantin J. Sagmeister¹; Pamela Vrabl²; Christoph W. Schinagl²; Suzanne Kapelari¹

¹University of Innsbruck, Department of Subject-Specific Education; ²University of Innsbruck, Department of Microbiology

EXAMINING SCIENCE AND NON-SCIENCE TEACHERS' SKILLS FOR CONSTRUCTING ARGUMENTS, EVALUATING ARGUMENTS AND THEIR PERCEIVED SELF-EFFICACY OF TEACHING ARGUMENTATION

Kalypso Iordanou¹; Evangelia Lytzerinou²

¹University of Central Lancashire Cyprus; ²Open University Cyprus

IDENTIFICATION OF EVIDENCE BY ENGINEERING UNDERGRADUATES AND PRE-SERVICE SCIENCE TEACHERS IN AN ARGUMENTATION ACTIVITY

Maria-José Cano-Iglesias¹; Antonio-Joaquín Franco-Mariscal²; Ángel Blanco-López¹

¹University of Málaga; ²University of Malaga

THE DEVELOPMENT AND CHARACTERIZATION OF A SEQUENCE OF TEACHING ON SCIENTIFIC ARGUMENTATION IN THE IMMUNOLOGY CLASSES FOR HIGH SCHOOL STUDENTS IN HEALTH

Daniel Manzoni-de-Almeida; Terezinha Gennari, D.; Sérgio Lopes, M

Escola de Ciências Biológicas e da Saúde, Centro Universitário das Faculdades Metropolitanas Unidas

THINKING, DOING, TALKING STEM

Jan Sermeus; Christel Balck; Annelies Pil; Wim Temmerman; Jelle De Schrijver

Odissee

CASE STUDY OF COLLECTIVE THINKING EMERGED IN GROUP BASED SCIENTIFIC PROBLEM SOLVING PROCESSS

Chuiim Choi; Sun-Kyung Lee

Seoul National University

ANALYSIS OF EPISTEMIC THINKING IN MIDDLE SCHOOL STUDENTS IN AN ARGUMENT-BASED INQUIRY (ABI) SCIENCE CLASS

Jeonghee Nam¹; Jiyoun Park¹; Heehwa Kim¹; Jongseok Park²; Jeongwoo Son³; Eugene Kang¹

¹Pusan National University; ²Kyungpook National University; ³Gyeongsang National University

EPISTEMIC GOALS FOR PROMOTING ARGUMENTATION IN INQUIRY BASED CLASSES

Lucia Sasseron; Arthur Ferraz

University of São Paulo

THE CONTROVERSIAL ASPECT OF THE SOCIO-SCIENTIFIC ISSUE AS A DISCURSIVE CONSTRUCTION OF THE TEACHER

Gabriel Saraiva Gomes; Marcelo Giordan

School of Education, University of São Paulo

SOCIOSCIENTIFIC ARGUMENTATION IN THE CONTEXT OF BIODIVERSITY-RELATED ISSUES: APPLICATION OF TOULMIN'S ARGUMENT PATTERN FOR TEACHING TO JUSTIFY CLAIMS

Gonzalo Miguel Angel Bermudez¹; María Emilia Ottogalli²; Lia Patricia García²; Ana Lía De Longhi³

¹Universidad Nacional de Córdoba - National Scientific and Technical Research Council

(CONICET); ²Universidad Nacional de Córdoba (FCEfyN). IPEM, Ministerio de Educación de la Provincia de Córdoba; ³Universidad Nacional de Córdoba, Facultad de Ciencias Exactas, Físicas y Naturales

13:45 - 15:00 **Interactive Poster P04 - STRAND 15 - EARLY YEARS SCIENCE EDUCATION / STRAND 18 - METHODOLOGICAL ISSUES IN SCIENCE EDUCATION RESEARCH** **Room F3**

Chairperson(s): Deniz Saribas

QUALITATIVE PERFORMANCE EVALUATION OF WORD EMBEDDING MODEL BY LEARNING SCIENCE TEXTBOOK CORPUS

Eunjeong Yun; Yunebae Park; Donghyuk Yang
Kyungpook National University

WHAT ARE WE WRITING ABOUT? USING BOTTOM-UP TEXT MINING TECHNIQUES TO UNCOVER RESEARCH TRENDS IN ABSTRACTS OF SCIENCE EDUCATION ARTICLES

Alexander Buessing
Didactics of Biology, Osnabrück University

DEMONSTRATION EXPERIMENTS IN COGNITIVE PSYCHOLOGY RESEARCH FOCUS

Claus Bolte
Freie Universitaet Berlin

LEARNING TO BE A SCIENCE TEACHER EDUCATOR: THINKING ABOUT POSITIONALITY IN MY PHD STUDY

maletsau mphahlele
university of the Witwatersrand

CURIOUS CHILDREN AND KNOWLEDGABLE ADULTS - EARLY CHILDHOOD STUDENT TEACHERS' SPECIES IDENTIFICATION SKILLS AND THEIR VIEWS ON THE IMPORTANCE OF SPECIES KNOWLEDGE

Tuula H. Skarstein; Frode Skarstein
University of Stavanger

GREEK PARENTS PERCEPTIONS REGARDING MOBILE DEVICES USAGE BY PRESCHOOL-AGED LEARNERS

Michail Kalogiannakis; Stamatios Papadakis
University of Crete - Faculty of Education - Department of Preschool Education

ENHANCEMENT AND IMPLEMENTATION OF SCIENCE AND MATHEMATICS IN PRE-SCHOOL TEACHERS PRACTICES IN NORTHERN-NORWAY

Saeed Manshadi; Jo Espen Tau Strand; Mona Kvivesen
UiT, The Arctic University of Norway

LITTLE SCIENTISTS: THE IMPACT OF STEM PROFESSIONAL LEARNING ON EARLY CHILDHOOD EDUCATORS

Lena Danaia; Amy MacDonald; Shukla Sikder; Carmen Huser
Charles Sturt University

EARLY-YEARS STEM EDUCATION AND ROBOTICS — THE BOTSTEM FRAMEWORK, TOOLKIT, AND IMPLEMENTED ACTIVITIES IN SPAIN

Ileana Greca; Eva Garcia Terceño; Jairo Ortiz-Revilla
Universidad de Burgos

ROBOTICS AND EARLY-YEARS STEM EDUCATION — BOTSTEM FRAMEWORK, TOOLKIT, AND IMPLEMENTED ACTIVITIES IN SWEDEN

Björn Cronquist; Marie Fridberg; Andreas Redfors
Kristianstad University

PRE-SCHOOL STUDENTS DRAW AN ENGINEER

Emine Sahin- Topalcengiz¹; Bekir Yildirim²; Funda Savasci-Acikalın³
¹Mus Alparslan University/Istanbul University-Cerrahpasa; ²Mus Alparslan University; ³Istanbul University-Cerrahpasa

KINDERGARTEN STUDENTS' CONCEPTIONS ABOUT EARTHQUAKES

S.Lizette Ramos¹; Claudia Huerta²
¹Universidad de Guadalajara; ²Instituto Superior de Investigación y Docencia para el Magisterio

DINOSAUR FOOTPRINTS IN THE PLAYGROUND: THE USE OF EVIDENCE TO CONSTRUCT EXPLANATIONS IN EARLY CHILDHOOD EDUCATION

Esther Cascarosa; Ester Mateo González; Beatriz Mazas Gil
University of Zaragoza

A PROPOSAL FOR LEARNING HEALTHY NUTRITION WITH FOUR-YEARS-OLD SCHOOLCHILDREN

Belén Guardiola Haro; Luisa López Banet; Isabel Banos-González
University of Murcia

FOREST SCHOOL: A PLACE FOR PLAY AND ENJOYMENT OF NATURE, AND A PLACE FOR SCIENCE LEARNING AND PROMOTION OF ENVIRONMENTAL ATTITUDES

Josu Sanz¹; Pello Urkidi¹; Maialen Sistiaga²; Irati Andoño²; Kakun Orbegozo²
¹University of the Basque Country (UPV/EHU); ²Kutxa Ekogunea

PRE-SCHOOL SCIENCE AND MATHEMATICS: DEVELOPING A CULTURE OF CREATIVE LEARNING AND PLAY

Loucas Louca; Chrystalla Papademetri-Kachrimani
 European University Cyprus

PRESCHOOL TEACHERS' ACTIVITY DESIGNS ABOUT NUTRITION TO ENHANCE THEIR STUDENTS CRITICAL THINKING SKILLS

Deniz Saribas¹; Zeynep Gonca Akdemir²
¹Istanbul Aydin University; ²Purdue University

13:45 - 15:00 Workshop 15 - AGORA: A GAMIFIED INTERACTIVE EDUCATIONAL MOBILE APPLICATION Room G1

Chairperson(s): Mohammed Rizkallah

AGORA: A GAMIFIED INTERACTIVE EDUCATIONAL MOBILE APPLICATION

Mohammed Rizkallah¹; Engin Karahan²; Alaa Hassan¹; Dima Sorri¹; Hoor Away¹; Hossam Serag¹
¹American University in Cairo; ²Eskisehir Osmangazi University

13:45 - 15:00 Interactive Poster P12 - STRAND 17 - SCIENCE TEACHING AT THE UNIVERSITY LEVEL Area H1

Chairperson(s): Susanne Engström

ANALYSIS OF LEARNING OF THE TOPIC OF NUCLEAR MAGNETIC RESONANCE IN A PHYSICS COURSE FOR STUDENTS OF LIFE SCIENCES

Sergej Faletic
 University of Ljubljana Faculty of Mathematics and Physics

CRITERIA-BASED ASSESSMENT OF KNOWLEDGE IN BIOLOGY IN HIGHER EDUCATION

Veronica Flodin¹; Jessica Slove Davidsson²
¹MND, Stockholm University; ²Stockholm University, Biology Education Dpt

TECHNOLOGY-ENHANCED LEARNING SUPPORTING ENGAGEMENT, ASSESSMENT, AND REFLECTION IN HIGHER EDUCATION SCIENCE

Joseph Roche
 Trinity College Dublin

DEVELOPMENT AND EVALUATION OF A CHEMISTRY TEST FOR HIGHER EDUCATION

Bianca Paczulla; Vanessa Fischer; Elke Sumfleth; Maik Walpuski
 University of Duisburg-Essen

SPECIES DIVERSITY AS A FACTOR IN THE DESIGN OF FOOD CHAINS

Luka Praprotnik; Gregor Torkar
 University of Ljubljana, Faculty of Education

ASSESSMENT OF AN EDUCATIONAL RECONSTRUCTION PROPOSAL OF PHYSICS AT THE UNIVERSITY

Liliana Ortigoza¹; Juan José Llovera-González²; Héctor Santiago Odetti³
¹Departamento de Física. Facultad de Bioquímica y Ciencias Biológicas. Universidad Nacional del Litoral; ²Instituto de Ciencias Básicas. Universidad Tecnológica de La Habana "José Antonio Echeverría", Cuba.; ³Facultad de Bioquímica y Ciencias Biológicas, Universidad Nacional del Litoral, Santa Fe, Argentina

HOW CAN A PROGRESSION IN TEACHING FOR SUSTAINABLE DEVELOPMENT BE ACHIEVED IN ENGINEERING EDUCATION?

Helena Lennholm
 Learning in engineering sciences

TEACHING THE TREE OF LIFE TO UNDERGRADUATE STUDENTS.

Kristy Daniel¹; E. Austin Leone²
¹Texas State University; ²Oklahoma State University

SERIAL DILUTIONS: STILL A NIGHTMARE FOR SCIENCE UNDERGRADUATE STUDENTS.

Ángel-Luis García-Ponce¹; Ana R Quesada²; Miguel Ángel Medina³; Ángel Blanco-López⁴
¹Facultad de Ciencias de la Educación. Universidad de Málaga; ²Facultad de Ciencias. Universidad de Málaga; ³Facultad de Ciencias. Universidad de Málaga.; ⁴Facultad de Ciencias de la Educación. Universidad de Málaga.

BUILDING ACADEMIC TENACITY IN SCIENCE STUDENTS TO FOSTER WELLBEING AND ACADEMIC SUCCESS

Gulnur Birol; Karen Smith; Daisy Li; Jocelyn Micallef; Patty Hamblen
UBC

STUDENTS' EPISTEMOLOGICAL THINKING ABOUT SOURCES OF KNOWLEDGE FOR CONTROVERSIAL ISSUES

Kathryn Green¹; Lisa Borgerding²
¹North Carolina State University; ²Kent State University

STUDENT HORMONAL STRESS RESPONSES IN TWO LEARNING ENVIRONMENTS

Kristy Daniel; Antonia Mac Crossan; Mar Huertas Pau
Texas State University

INTEGRATING STUDENTS INTO THE TEACHING TEAM: HOW PEER TUTORING CAN ENHANCE SCIENCE EDUCATION

William Man Yin Cheung
The University of Hong Kong

PRACTICAL PERFORMANCE ASSESSMENT OF EXPERIMENTAL COMPETENCE IN SCIENCE TEACHER EDUCATION LABORATORY CLASSES

Fabian Poensgen; Christiane Reiners
University of Cologne

EXPLORING THE RELATIONSHIPS BETWEEN UNDERGRADUATES' SCIENTIFIC EPISTEMIC VIEWS AND PERCEIVED SELF-EFFICACY FOR SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) KNOWLEDGE

Elaosi Vhurumuku
University of Witwatersrand, School of Education, South Africa

PRE-SERVICE CHEMISTRY TEACHERS' ATTITUDES TOWARDS INFORMATION AND COMMUNICATION TECHNOLOGIES: A CASE STUDY OF A SOUTH AFRICAN UNIVERSITY

Sayuri Tokura¹; Etsuji Yamaguchi¹; Miki Sakamoto¹; Tomokazu Yamamoto²; Shigenori Inagaki¹; Kazuya Wakabayashi¹; Motoaki Matano³

¹Kobe University; ²Hyogo University of Teacher Education; ³Elementary School Attached to Kobe University

PHYSICS HIGHER EDUCATION AND BOURDIEU'S SYMBOLIC CAPITAL IN TEACHER EDUCATION

Susanne Engström; Per Norström
KTH/ITM

13:45 - 15:00

Interactive Poster P11 - STRAND 16 - SCIENCE TEACHING-LEARNING AT PRIMARY SCHOOL LEVEL AND EARLY CHILDHOOD

Area H2

Chairperson(s): **Granada Muñoz Franco**

SIGNIFICANCE OF FISH DISSECTION FOR UNDERSTANDING VIEW OF LIFE AND BIODIVERSITY

Junko Iwama¹; Shizuo Matsubara²
¹Aoyama Gakuin University; ²Toin University of Yokohama

IMPROVEMENT OF THE DRAWING EXPRESSION OF SCIENTIFIC MODELS IN STUDENTS OF PRIMARY EDUCATION

Teresa Zamalloa¹; Aritz Uskola¹; Miren Begoñe Burgoa Etxaburu²; Gurutze Maguregui¹
¹University of the Basque Country; ²Instituto de Evaluación e Investigación Educativa ISEI-IVEI (Gobierno Vasco)

THE INTEGRATION OF EXPERIMENT DURING IMPLEMENTATION OF INQUIRY-BASED TEACHING

Ioanna Stavrou; Constantina Stefanidou; Kiriakos Kiriakou; Violetta Galanopoulou; Constantine Skordoulis
National & Kapodistrian University of Athens

WHAT LEARNING RESULTS REGARDING TEACHING OF SCIENCES ARE ACHIEVED FOR FUTURE TEACHERS OF EARLY CHILDHOOD EDUCATION?

José Cantó¹; Jordi Solbes²; Antonio de Pro³
¹Universitat de València; ²University of Valencia (Spain); ³University of Murcia (Spain)

IMPROVING PRE-SERVICE TEACHERS' SCIENCE PROCESS SKILLS AND VIEWS ON SCIENCE INQUIRY

Zeynep Koyunlu Ünlü
Yozgat Bozok University

PRE-SERVICE ELEMENTARY SCIENCE TEACHERS' VIEWS ABOUT SCIENTIFIC INQUIRY. A PILOT STUDY

M^a Marta Alarcón-Orozco; Isabel M^a Cruz-Lorite; Antonio-Joaquín Franco-Mariscal; Ángel Blanco-López
Universidad de Málaga

REINFORCEMENT OF KNOWLEDGE ABOUT GERMINATION AND PLANT GROWTH: A CASE STUDY OF A LEARNING SUPPORT SYSTEM BASED ON FULL-BODY INTERACTION AND COLLABORATION

Naoki Komiya¹; Minami Yano²; Kazuki Yamamoto¹; Ryohei Egusa³; Shigenori Inagaki⁴; Hiroshi Mizoguchi¹; Miki Namatame⁵; Fusako Kusunoki²

¹Tokyo University of Science; ²Tama Art University; ³Meiji Gakuin University; ⁴Kobe University; ⁵Tsukuba University of Technology

SCIENCE COMPETENCES IN THE FIFTH GRADE OF ELEMENTARY SCHOOL

Matija Purkat; Iztok Devetak

University of Ljubljana, Faculty of Education, Slovenia

PRIMARY STUDENTS INFORMATION PROBLEM SOLVING (IPS) IN SCIENCE LEARNING

Qingna Jin; Mijung Kim; Suzanna Wong

University of Alberta

HOW CHILDREN EXPRESS SCIENTIFIC SKILLS IN WRITTEN TEXTS

Marcelo Tadeu Motokane¹; Luciana Sedano Souza²; Adriana S. Tavares Ferreira³; Marcelo Pereira³

¹University of São Paulo; ²Univ. Estadual de Santa Cruz; ³Univ. of São Paulo

SCIENTIFIC COMPETENCY AND HUMAN NUTRITION IN PRIMARY SCHOOL TEXTBOOK IN SPAIN AND PORTUGAL

Juan-Carlos Rivadulla-López; Susana García-Barros; María-Jesús Fuentes-Silveira; Cristina Martínez-Losada

Universidade da Coruña

SCIENTIFIC COMPETENCIES IN PRIMARY AND SECONDARY SCHOOL TEXTBOOKS

Susana García-Barros; Juan Carlos Rivadulla-López; Cristina Martínez-Losada; María Jesús Fuentes-Silveira

Universidade da Coruña

VIRGINIA APGAR: FROM UNIVERSITY TO PRIMARY SCHOOL

Granada Muñoz Franco; Mireia Illescas-Navarro; Hortensia Morón-Monge

Universidad de Sevilla

13:45 - 15:00

Interactive Poster P07 - STRAND 13 - PRE-SERVICE SCIENCE TEACHER EDUCATION (II)

Area H3

Chairperson(s): Federico Plazzi

DEVELOPING CLIL SCIENCE TEACHING COMPETENCIES: INTEGRATING SCIENCE TEACHING EXPERTISE IN HONG KONG

Michael Tsang¹; Angel Lin²; Maurice Cheng³; ¹Yuen Long Merchants' Association Secondary School, ²Simon Fraser University, ³Waikato University

CONTEXTS AND PROCESSES IN SELECTING MIDDLE AND HIGH SCHOOL SCIENCE TEACHERS IN JAPAN

Yoshisuke Kumano Shizuoka University

INCLUSIVE EDUCATION IN SCIENCE — THE NEED FOR MULTIPROFESSIONAL COOPERATION

Robin Schildknecht¹; Sarah Hundertmark²; Vanessa Schad¹; Xiaokang Sun²; Alexander Kauertz¹; Bettina Lindmeier²; Christian Lindmeier¹; Sandra Nitz¹; Andreas Nehring²

¹University of Koblenz-Landau; ²Leibniz Universität Hannover

CONSTRUCTIVISM IN STEM TEACHER PREPARATION

Christina Lunsman¹; Jori Beck²; Kristie Gutierrez²

¹Young Harris College; ²Old Dominion University

MOMENTARY EXPERIENCES OF STUDENT TEACHERS CONDUCTING SCIENCE EXPERIMENTS IN SECONDARY TEACHER EDUCATION

Robbert Smit; Nicolas Robin; Florian Rietz

University of Teacher Education St. Gallen

VISUAL EXPRESSION OF THE GEOLOGICAL CHANGE MODEL DURING A HYDROGEOLOGY TEACHING SEQUENCE WHICH INCLUDES FIELDWORK

Araitz Uskola; Nahia Seijas

University of the Basque Country UPV/EHU

PRE-SERVICE TEACHERS' SOCIAL REPRESENTATION ON SCIENTIST AND SCIENCE TEACHER: BETWEEN TWO DISTANT WORLDS

Guilherme Brockington¹; Ernani Vassoler Rodrigues²; Carlos Alberto Magalhaes Junior³; Camila Contrucci⁴; Lucas Mesquita⁵; Guilherme Bruneri⁵; Pamela Aline de Almeida⁵; Leonardo André Testoni⁵; Camilo Lellis-Santos⁵

¹Federal University of ABC; ²University of Sao Paulo; ³State University of Maringa; ⁴Federal Univesrity of Sao Paulo; ⁵Federal University of Sao Paulo

BECOMING A CHEMISTRY TEACHER- EXPECTATIONS AND REALITY IN CHEMISTRY EDUCATION COURSES

Sabine Streller; Claus Bolte
Freie Universitaet Berlin

THE CASE OF MOTIVATED REASONING IN PRE-SERVICE SCIENCE TEACHER AND YOUNG SCIENCE RESEARCHER

Rahmi Qurota Ainj¹; Ai Nurlaelasari Rusmana¹; Yustika Syabandari¹; Minsu Ha¹; Sein Shin²; Jun-ki Lee³
¹Kangwon National University; ²Chungbuk National University, South Korea; ³Chonbuk National University, South Korea

EMOTIONS AND INTERACTION RITUALS IN CLASSES OF PRE-SERVICE PHYSICS TEACHERS

Maurício Pietrocola; Edison Amaro
University of São Paulo

IMPROVING PHYSICS TEACHING THROUGH ACTION RESEARCH

Marika Kapanadze
Iliia State University, Georgia

THE ROLE OF REPRESENTATIONS: AN EXPERIENCE WITH TEACHERS IN TRAINING

Ana Luiza Quadros¹; Daniela Martins B. Pena²; Maria Luiza S. T. Botelho³
¹Federal University of Minas Gerais, Brazil; ²Federal University o Minas Gerais; ³Federal University of Minas Gerais

UNDERGRADUATE STUDENTS PARTICIPATING IN THE INSTITUTIONAL PROGRAM OF SCHOLARSHIPS OF INITIATION TO TEACHING (PIBID) DEVELOP MORE PROCEDURAL AND ATTITUDINAL CONTENTS IN THEIR INITIAL TEACHER EDUCATION

Luiz Fonseca dos Santos Jr.; Magda Medhat Pechliye
Universidade Presbiteriana Mackenzie

THE DESIGN OF AN INNOVATIVE SCIENTIFIC INTERDISCIPLINARY LAB FOR PRE-SERVICE PRIMARY TEACHERS

Federico Plazzi; Cecilia Bulgarelli; Barbara Mantovani; Marianna Marchini; Barbara Pecori; Fiorella Prada; Giulia Tasquier; Ira Vannini; Margherita Venturi
Alma Mater Studiorum - University of Bologna

13:45 - 15:00 **Interactive Poster P06 - STRAND 13 - PRE-SERVICE SCIENCE TEACHER EDUCATION (I)** **Area H4**

Chairperson(s): Saiqa Azam

ANALYSIS OF AN ARGUMENTATION ACTIVITY ON INVASIVE PLANTS IN PRE-SERVICE SCIENCE TEACHERS

Jose Manuel Hierrezuelo-Osorio; Pedro Juárez-González; Daniel Cebrián-Robles; Antonio Joaquín Franco-Mariscal
Department of Science Education, University of Málaga, Campus de Teatinos s/n, 29071 Málaga, Spain

ARE WE PREPARING TEACHERS FOR INTERDISCIPLINARY PRACTICE? A LOOK TO THE PRESERVICE CHEMISTRY TEACHER EDUCATION IN BRAZIL

FABIANA OCAMPOS; Gildo Giroto Jr.
Universidade Estadual de Campinas

TEACHER COMPETENCIES FOR THE SUCCESS OF INCLUSIVE SCIENCE EDUCATION

Daniela Egger
Institute of Sustainable and Environmental Chemistry (ISEC)

FROM EDUCATING SCIENCE TEACHERS TOWARDS EDUCATING STEM TEACHERS

Morten Rask Petersen; Linda Ahrenkiel; Tom Nauerby
UCL University College

PRE-SERVICE TEACHERS WORKING WITH RESEARCHERS AND ENGINEERS TO INTEGRATE RESEARCH-ORIENTED INSTRUCTION IN SCIENCE AND MATH CLASSROOM

Aviva Klieger; Moriya Mor; Tami Yaron; Aehsan Haj-Yahya
Beit Berl College

PRESERVICE TEACHERS ENGAGING IN STEM EDUCATION RESEARCH

Jennifer Wilhelm; Molly Fisher
University of Kentucky

HELPING STUDENTS TO UNDERSTAND BIOLOGY TERMINOLOGY: INSIGHTS FROM EXPERIENCED TEACHER EDUCATORS

Hlologelo Climant Khoza; Audrey Msimanga; Eunice Nyamupangedengu
University of the Witwatersrand

INITIAL SKILLS IN DRAWING OF THE PRE-SERVICE BIOLOGY TEACHERS

Jan Petr¹; Lukas Rokos²

¹University of South Bohemia in Ceske Budejovice, Faculty of Education; ²University of South Bohemia in Ceske Budejovice; Faculty of Education

CELL BIOLOGY ANALOGIES IN BRAZILIAN BIOLOGY TEXTBOOKS: A TEACHER GUIDE BASED ON FAR MODEL

Carla Araujo; Iago Taveira Oliveira; Zara Guimarães

Universidade de Brasília

BIOLOGY STUDENTS' COMPETENCES IN THE COURSE OF PRACTICAL TRAINING EXPERIENCES

Iris Schiffl; Cornelia Schadler; Natalie Baumgartner-Hirscher

University of Salzburg, School of Education

THE TWO-SIDED COIN OF EFFECTIVE EVOLUTION EDUCATION: TEACHERS' COMPETENCIES AND STUDENTS' RECEPTIVITY

Elizabeth Watts; Clemens Hoffmann

Friedrich-Schiller-Universität Jena

VALUATIONS OF INNOVATIVE ICT ACTIVITIES IN ENVIRONMENTAL EDUCATION BY TRAINING TEACHERS

Vito Brero; María del Carmen Acebal; Jose Antonio Rueda; Erika González

Málaga University

AN ASSESSMENT OF VISUO-SEMIOTIC REASONING SKILLS AMONG PRE-SERVICE BIOLOGY TEACHERS

Lindelani Mnguni

University of South Africa

PRE-SERVICE SCIENCE TEACHERS' PROFESSIONAL LEARNING WITHIN INFORMAL SCIENCE LEARNING CONTEXTS: A UNIVERSITY AND COMMUNITY PARTNERSHIP

Saiqa Azam¹; Karen Goodnough¹; Patrick Wells¹; Ross Elliot²

¹Memorial University of Newfoundland; ²Ocean Learning Partnerships (OLP)

13:45 - 15:00

Interactive Poster P08 - EFFECTS OF SPECIFIC TEACHER TRAININGS

Area H5

Chairperson(s): Filippo Pallotta

DELPHI STUDY ON GOALS, OBJECTIVES, AND DESIGN FEATURES OF CERN TEACHER PROGRAMMES

Anja Kranjc Horvat¹; Gerfried Wiener²; Sascha Schmeling²; Andreas Borowski¹

¹University of Potsdam; ²CERN

DESIGN AND ASSESSMENT OF A SCORING RUBRIC FOR EVALUATING SCIENCE TEACHERS' CLASSROOM PRACTICES

Angelos Sofianidis; Maria Kallery

Aristotle University of Thessaloniki

THE TRANSITION FROM PRIMARY TO SECONDARY SCHOOL IN SCIENCE EDUCATION

Julia Brüggerhoff; Sarah Rau-Patschke; Stefan Rumann

University of Duisburg-Essen

THE BRAZILIAN CHEMISTRY TEACHERS: CULTURAL CAPITAL AND SOCIAL CLASS IN THE CHOICE FOR THE NECESSARY

Luciana Massi¹; Gabriela Agostini²

¹Universidade Estadual Paulista; ²Universidade Estadual Paulista (UNESP)

THE STRUCTURAL CHALLENGE IN BRAZILIAN TEACHER EDUCATION: THE PHYSICS TEACHER SHORTAGE

André Rodrigues; Cristiano Mattos

University of São Paulo

SCIENCE TEACHERS CONTINUOUS EDUCATION THROUGH THE THREE PEDAGOGICAL MOMENTS

Eliziane da Silva Dávila¹; Daniel Morin Ocampo²; Cirlande Cabral da Silva³; Luiz Caldeira Brant Tolentino-Neto²

¹Instituto Federal Farroupilha - Campus São Vicente do Sul; ²Universidade Federal de Santa Maria (UFSM); ³Instituto Federal do Amazonas (IFAM)

TRANSFORMING THE PEDAGOGICAL PRACTICES OF ETHIOPIAN PHYSICS TEACHERS FROM DIDACTIC TO DIALOGIC TEACHING

TAHA Rajab¹; Vanessa Kind¹; Mekbib Alemu²; Mesfin Tadesse²

¹Durham University; ²Addis Ababa University

EXPLORING THE POTENTIAL OF SUSTAINED ROUND —TABLE DISCUSSIONS AS A PROFESSIONAL DEVELOPMENT ACTIVITY FOR DEVELOPING IN-SERVICE TEACHERS' CONTENT KNOWLEDGE

Eunice Nyamupangedengu; Anastasia Buma
University of the Witwatersrand

SECONDARY TEACHERS LEARNING TO TEACH STEM: OUTCOMES OF A PROFESSIONAL LEARNING PROGRAM

Linda Hobbs; John Cripps Clark
Deakin University

EFFECTS OF A PHYSICS EDUCATION PROFESSIONAL DEVELOPMENT COURSE ON IN-SERVICE PRIMARY TEACHERS: CHALLENGES AND OPPORTUNITIES

Carolina Nicolas-Castellano¹; Asuncion Menargues¹; Joaquin Martinez-Torregrosa¹; Ruben Limiñana¹; Carla Zembal-Saul²; Sergio Rosa-Cintas¹; Isabel Lujan¹
¹University of Alicante; ²Penn State University

EVALUATION CONCEPTIONS AND SCIENCE TEACHING CHALLENGES IN THE CONTEXT OF TEACHING PLANNING

Nicole Glock Maceno¹; Marcelo Giordan²
¹University of São Paulo; ²University of Sao Paulo

RESULTS OF IMPROVED PROGRAM TO DEVELOP TEACHERS' ABILITIES TO CONSTRUCT AND EVALUATE ARGUMENTS

Tomokazu Yamamoto¹; Shinichi Kamiyama²
¹Hyogo University of Teacher Education; ²Obayashi Sacred Heart Primary School

DEVELOPMENT AND EVALUATION OF A TEACHER TRAINING ADDRESSING THE USE OF EXPERIMENTS IN CHEMISTRY EDUCATION

Henning Krake; Maik Walpuski
University of Duisburg-Essen

FOSTERING SCIENTIFIC SKILLS IN HIGH SCHOOL VIA TEACHER EDUCATION: AN EXPERIENCE OF COLLABORATION BETWEEN TEACHERS AND PHYSICS RESEARCHERS TO DESIGN EXPERIMENT-BASED LEARNING ACTIVITIES AND SUPPORT CURRICULUM DEVELOPMENT

Filippo Pallotta¹; Alberto Parola²; Maria Bondani³
¹University of Insubria, Department of Science and High Technology; ²University of Insubria, Department of Science and High Technology; ³CNR - Institute for Photonics and Nanotechnologies University of Insubria - Department of Science an

13:45 - 15:00 Interactive Poster P09 - STRAND 14 - FOCI OF AND APPROACHES TO TEACHER TRAININGS Area H6

Chairperson(s): Cirlande Cabral Silva

SCIENCE TEACHERS' PEDAGOGICAL DEVELOPMENT: FOCUSING ON LESSON STUDY

Tetsuo Isozaki¹; Susumu Nozoe²; Takako Isozaki³
¹Hiroshima University; ²University of Miyazaki; ³University of Toyama

DEVELOPING RESEARCH-BASED TEACHER PROFESSIONAL DEVELOPMENT ACTIVITIES - MAKING STATE-OF-THE-ART RESEARCH ACCESSIBLE FOR TEACHERS AND SCHOOLS

Silke Rönnebeck¹; Tobias Plöger¹; Ilka Parchmann²
¹Kiel University; ²IPN Leibniz-Institute for Science and Mathematics Education

URBAN ADVANTAGE: A PROFESSIONAL DEVELOPMENT PARTNERSHIP BETWEEN PRIMARY SCHOOLS AND INFORMAL SCIENCE INSTITUTIONS IN NEW YORK CITY

Angela Kelly; Lauren Slagus
Stony Brook University

THE RELATIONSHIP BETWEEN MENTOR TEACHER MENTORING CHARACTERISTICS AND MENTEE TEACHERS REFLECTIVE PRACTICE IN COLLABORATIVE MENTORING FOR BEGINNING SCIENCE TEACHER

Eugene Kang¹; Jihoon Park¹; Heehwa Kim¹; Jongseok Park²; Jeongwoo Son³; Jeonghee Nam¹
¹Pusan National University; ²Kyungpook National University; ³Gyeongsang National University

COLLABORATING WITH BIOLOGY TEACHERS TO ENGAGE STUDENTS IN EVIDENTIARY REASONING THROUGH INSTRUCTIONAL SCAFFOLDING

Chandrani Mishra; Kari Clase; Ala Samarapungavan; Nancy Pelaez; Stephanie Gardner; Nesibe Karakis; Shuangting Li
Purdue University

LEARNING HYPERSPACE FOR FORMATIVE ASSESSMENT AND INQUIRY-BASED TEACHING

Radka Zavodska; Iva Stuchlikova; Jan Petr; Lukas Rokos
University of South Bohemia in Ceske Budejovice, Faculty of Education

CO-DESIGN OF PROJECT-BASED LEARNING UNITS: DESIGNING A DIGITAL INSTRUMENT FOR ASSESSING LEARNING OUTCOMES OF A PROJECT-BASED LEARNING UNIT

Miikka Turkkila; Kalle Juuti; Jari Lavonen; Katariina Salmela-Aro
University of Helsinki

TEACHERS AS RESEARCHERS: A PROFESSIONAL DEVELOPMENT BASED PEDAGOGICAL INQUIRY INTO CONTEXTUALIZING TEACHING SCIENCE PROCESS SKILLS

Aminath Shiyama
University of Bristol

IMPROVING TEACHER PEDAGOGICAL DESIGN CAPACITY AND STUDENT COMPETENCY WITH ARGUMENTATION THROUGH A LESSON STUDY BASED PROFESSIONAL DEVELOPMENT

Jonathan Bowers¹; Lisa Kenyon¹; Leonard Kenyon¹; Brian Boyd¹; Ann Farrell¹; William Boone²; Brittany Juhas¹
¹Wright State University; ²Miami University

REFLECTIONS ABOUT THE SUPERVISED TEACHING PRACTICE IN BIOLOGY

Hileia Monteiro Maciel-Cabral¹; Cirlande Cabral Silva²; Luiz Caldeira Brant Tolentino Neto³; Patricia Macêdo de Castro⁴; Daniel Morin Ocampo³; Elizane da Silva Davila⁵

¹Universidade do Estado do Amazonas; ²INSTITUTO FEDERAL DO AMAZONAS; ³Universidade Federal de Santa Maria; ⁴Universidade Estadual de Roraima; ⁵Instituto Federal Farroupilha

13:45 - 15:00 Interactive Poster P05 - STRAND 3 - SCIENCE TEACHING PROCESSES

Area H7

Chairperson(s): Montserrat Tortosa

PEDAGOGY OF DIFFERENTIATED LEARNING AND TEACHING IN THE CHEMISTRY CLASSROOM: THE INFLUENCE OF AN INTERVENTION PROGRAM OF DIFFERENTIATED INSTRUCTION ON STUDENT'S MISCONCEPTIONS, AND SELF-EFFICACY BELIEFS AND ATTITUDES OF HIGH SCHOOL CHEMISTRY STUDENTS AND TEACHERS

Enas Easa, Ron BlonderWeizmann Institute of Science, Israel

ENHANCING SECONDARY SCHOOL STUDENTS' LEARNING AND INTEREST FOR ENERGY: RESULTS FROM THE IMPLEMENTATION OF AN INTERVENTION

Georgia Toli; Maria Kallery
Department of Physics, Aristotle University of Thessaloniki

EVALUATION OF A RESEARCH-BASED LEARNING NEUROSCIENCE CURRICULUM FOR SCIENTIFICALLY GIFTED STUDENTS: IMPLICATIONS FOR NURTURING FUTURE SCIENTISTS

KA CHUN SUEN¹; MAN HO LI¹; MEI YU LIN¹; RAYMOND CHUEN CHUNG CHANG²; WING KWONG CHAN¹
¹Po Leung Kuk Laws Foundation College; ²School of Biomedical Sciences, LKS Faculty of Medicine, The University of Hong Kong

EDUCATIONAL ILLUSIONS

Laura Weiss¹; Andreas Müller²
¹Université de Genève; ²Université de Genève

DIAGNOSIS OF DIFFICULTY-GENERATING CHARACTERISTICS BASED ON PROBLEM-SOLVING IN PHYSICS

Mareike Freese; Jan Winkelmann
Department of Physics Education, Goethe University Frankfurt

DRAWING OF CARTOON STRIPS AS A VISUALIZATION TOOL IN LEARNING THE THEORY OF TITRATION

Jouni Väliisaari; Piia Nuora
University of Jyväskylä

PROMOTING STUDENTS' INTEREST IN SCIENCE THROUGH SCHOOL-BASED BIOTECHNOLOGY CURRICULUM IN A HONG KONG SECONDARY SCHOOL

Mei Yu Lin; Man Ho Li; Ka Chun Suen; WING KWONG CHAN
Po Leung Kuk Laws Foundation College

SCIENCE CLASSES - A MODEL FOR INTERDISCIPLINARY SCIENCE EDUCATION

Alena Schulte; Claas Wegner
Bielefeld University

PRACTICAL SCIENCE EDUCATION AND TEACHER CHALLENGES

Tine Weise Håland; Torill Høyby; Linda Merete Smedbakken; Øyvind Rundtom
Skedsmo STEM center, Municipality of Skedsmo

QUALITY OF INSTRUCTION IN SCIENCE EDUCATION VIDEO STUDIES A SYSTEMATIC REVIEW BETWEEN GENERIC AND SUBJECT SPECIFIC CRITERIA

Benjamin Heinitz; Andreas Nehring
Leibniz Universität Hannover

RESEARCH-BASED PHYSICS USING SENSORS AT SECONDARY: STUDENTS' CHALLENGES AND DIFFICULTIES PERCEIVED

Montserrat Tortosa¹; Fina Guitart Mas²; Marek Skorsepa³

¹Associació per a la Innovació i la Recerca Educativa en Ciències; ²Universitat de Barcelona; ³Bel Matej University

13:45 - 15:00 **Interactive Poster P10 - STRAND 14 - TEACHERS' PERCEPTIONS, EXPERIENCES, PCK AND CK** **Area H8**

Chairperson(s): Peer Daugbjerg

LINKING PEDAGOGICAL CONTENT KNOWLEDGE AND PRACTICAL EXPERIENCE IN STEM TEACHER EDUCATION: A SYSTEMATIC REVIEW OF THE LITERATURE

Antoinette Meiners; Peter Wulff; Andreas Borowski
University of Potsdam

PEDAGOGICAL CONTENT KNOWLEDGE IN BIOLOGIE TEACHERS: A CASE STUDY FOR TEACHING EVOLUTION

Arlette Bessaber¹; Claudia Vergara²; Hernan Cofre³

¹Universidad Católica de Valparaíso; ²Alberto Hurtado University; ³Universidad Católica de Valparaíso

RELATIONSHIP OF EMOTIONS WITH ASSOCIATED VARIABLES TO THE SCIENCE TEACHING ON IN-SERVICE TEACHERS

Pedro Membiola¹; Katherine Acosta²; Antonio González¹

¹University of Vigo; ²University of Arica

ORIENTATION TO TEACHING INTRODUCTORY ELECTRICITY - AIMS AND MOTIVES OF TEACHERS

Thomas Schubatzky¹; Claudia Haagen-Schützenhöfer¹; Jan-Philipp Burde²; Thomas Wilhelm²; Lana Ivanjek³; Martin Hopf³; Liza Dopatka⁴; Verena Spatz⁴

¹University of Graz; ²Goethe-University Frankfurt; ³University of Vienna; ⁴University of Technology Darmstadt

CLOSING THE GAP BETWEEN TEACHING PRACTICE AND EDUCATIONAL RESEARCH: SCIENCE TEACHERS WITH A PHD DEGREE CONDUCTING PRACTICE-ORIENTED RESEARCH IN SCHOOL CONTEXT

Gjalt Prins¹; Harrie Eijkelhof²

¹Freudenthal Institute, Utrecht University; ²Freudenthal Institute

DEMISTIFYING IN-SERVICE TEACHERS' STRUGGLE: THEIR NEEDS AND CHALLENGES IN ENCOMPASSING STEM/STEAM EDUCATION

Turner Lam; Tzu Hua Wang; Fu Yuan Chiu

National Tsing Hua University

AN INVESTIGATION OF LIFE SCIENCE TEACHERS' CONTENT KNOWLEDGE AND PERSISTENT MISCONCEPTIONS

Amy Tankersley¹; Elizabeth Lewis¹; Ana Rivero²; Lyrica Lucas¹; Brandon Heldon³

¹University of Nebraska-Lincoln; ²Seattle University; ³Boulder Learning Inc.

THE QUALITY OF EXPERIENCED CHEMISTRY TEACHERS' TOPIC SPECIFIC PCK AND CONTENT KNOWLEDGE IN ELECTROCHEMISTRY

Fumai Mudindo; Marissa Rollnick; Eunice Nyamupangedengu

University of Witwatersrand

PRIMARY SCHOOL TEACHERS EXPERIENCE OF THE DIGITALISATION OF TEACHING

Pernilla Josefsson; Clara Eishow

School of Natural Science, Technology and Environmental

FIRST STEPS TOWARDS BUILDING ENGINEERING PCK - NOVICE TEACHERS IN THE CONTEXT OF PROFESSIONAL DEVELOPMENT

Peer Daugbjerg; Lars Brian Krogh; Martin Sillasen

VIA University College

WEDNESDAY 15:00 - 17:00

15:00 - 17:00 OP151 - STRAND 1 - FORMS OF REASONING IN SCIENCE LEARNING

Room A1

Chairperson(s): Takuya Matsuura

FROM CONCEPTUAL CONSERVATISM TO CONCEPTUAL CHANGE: THE HOW AND WHY OF MINDFULNESS IN BIOLOGY EDUCATION

Elizabeth Watts
Friedrich-Schiller-Universität Jena

REASONING THROUGH SPONTANEOUSLY GENERATED ANALOGIES

Nikolaos Fotou; Ian Abrahams
University of Lincoln

LEARNING EPIGENETIC MECHANISMS WITH ANALOGIES

Karin Thörne; Niklas Gericke; Birgitta McEwen
Karlstad University

ALGORITHMIC VERSUS CONCEPT-BASED TASKS FOR ENGINEERING STUDENTS

Gunilla Åkesson Nilsson
Blekinge Institute of Technology,

STUDENTS' CONCEPTIONS AS STEREOTYPES

Pedro Juan Sánchez Gómez
Universidad Complutense de Madrid

RELATIONSHIP BETWEEN DEEP UNDERSTANDING OF SCIENTIFIC THEORY AND SCIENTIFIC REASONING: BUOYANCY IN LIQUIDS

Takuya Matsuura
Hiroshima University

15:00 - 17:00 OP50 - STRAND 1 - REPRESENTATION AND METAREPRESENTATIONAL COMPETENCE IN SCIENCE LEARNING

Room A2

Chairperson(s): Sina Lenski

STUDENTS' USE OF SEMIOTIC MODES AND MODELS DURING A PROBLEM SOLVING TASK

Karine Bécu-Robinault
ENS de Lyon

INTEGRATION OF LECTURE DEMONSTRATION EXPERIMENTS IN RECITATION SESSIONS USING VIDEO-ANALYSIS PROBLEMS

Stefan Küchemann; Pascal Klein; Jochen Kuhn
TU Kaiserslautern

VISUAL REPRESENTATIONS IN PHYSICS - EXAMPLES FROM TEXTBOOKS FOR SECONDARY SCHOOL

Charlotte Lagerholm¹; Claes Malmberg²; Urban Eriksson¹
¹Lund University; ²Halmstad University

YOUNG CHILDREN AND PERSONIFYING REASONING

Marida Ergazaki; Aggeliki Dimitrakopoulou; Alexandra Spai; Dimitra Nousi
University of Patras

A COMPARATIVE STUDY OF METAREPRESENTATIONAL COMPETENCE BETWEEN INDONESIAN AND TAIWANESE COLLEGE STUDENTS

Yun-Ping Ge¹; Hak Ping Tam²
¹National Dong-Hua University; ²National Taiwan Normal University

EMOTIONAL DESIGN AND MULTIMEDIA LEARNING: A NARROW RIDGE BETWEEN BENEFIT AND OVERLOAD?

Sina Lenski; Jörg Großschedl
University of Cologne

15:00 - 17:00 OP51 - STRAND 2 - INTEREST AND MOTIVATION IN STEM

Room B1

Chairperson(s): Ayla Cetin-Dindar

OBSERVING AND FOSTERING SITUATIONAL INTEREST IN CHEMISTRY LESSONS

Sabrina Bruns; Sascha Bernholt; Andrea Bernholt; Ilka Parchmann
IPN Leibniz-Institute for Science and Mathematics Education at the University of Kiel

INDUSTRY-SCHOOL PROJECTS AS AN AIM TO FOSTER SECONDARY SCHOOL STUDENTS' INTEREST IN SCIENCE-BASED TECHNOLOGY CAREERS

Robbert Smit; Nicolas Robin; Christina De Toffol; Sanja Atanasova
University of Teacher Education St. Gallen

STUDENTS' CONCEPTIONS OF STEM PROFESSIONALS AND THEIR RELATION TO THEIR STEM CAREER INTEREST

Winnie Wing Mui So; Yu Chen
The Education University of Hong Kong

AN INNOVATIVE DESIGN IN RESEARCH, EDUCATION, AND MENTORSHIP PRE-COLLEGE PROGRAM

Hiba Hamdan¹; Enja Osman²
¹University of Cambridge; ²American University of Beirut

THE EFFECT OF EDUCATIONAL GAMES ON STUDENT MOTIVATION IN SCIENCE

Ayla Cetin-Dindar Bartin University

15:00 - 17:00 OP52 - STRAND 6 - NARRATIVES AND HISTORY, MODELS AND IMAGINATION FOR TEACHING Room B2

Chairperson(s): Sophie Canac

SCIENTIFIC CONCEPTS AND THE ROLE OF IMAGINATION IN THE LANGUAGE GAMES OF THE SCIENCE CLASSROOM

Magdalena Kersting
University of Oslo, Dept. of Physics

THE INFLUENCE OF LANGUAGE ON STUDENTS' CONCEPTIONS OF THE NATURE OF MODELS

Ohad Levkovich; Anat Yarden
Weizmann Institute of Science

PRE-SERVICE BIOLOGY TEACHERS' CLASSROOM PRACTICES BASED ON HISTORY OF SCIENCE

Cicek Dilek Bakanay¹; Burcu Gülay Güney²
¹Istanbul Aydin University; ²Istanbul Aydin University

THE BON-IDEA HISTORY INFORM THE DESIGN OF NARRATIVES FOR HIGHLIGHTING GENERAL ASPECTS OF NOS?

Georgios Ampatzidis; Marida Ergazaki
University of Patras

DEVELOPMENT OF A RESOURCE FOR THE TEACHING OF CHEMICAL FORMULAS AND ITS APPROPRIATION BY TEACHERS

Sophie Canac¹; Isabelle Kermen²
¹Université Paris-Est Créteil; ²Université d'Artois

15:00 - 17:00 OP53 - STRAND 8 - SCIENTIFIC INQUIRY AND SCIENTIFIC LITERACY Room B3

Chairperson(s): Chuckie Calsado

INTERNATIONAL COLLABORATIVE INVESTIGATION OF SEVENTH GRADE AND HIGH SCHOOL STUDENTS' UNDERSTANDINGS OF SCIENTIFIC INQUIRY: IS THERE EVIDENCE OF PROGRESS?

Judith Lederman¹; Norman Lederman¹; Selina Bartels²; Juan Jimenez¹
¹Illinois Institute of Technology; ²Valparaiso University

VIEWS ABOUT SCIENTIFIC INQUIRY: A STUDY OF GR 12 LEARNERS IN A SOUTH AFRICAN SCHOOL

Estelle Gaigher¹; Annemarie Hattingh²; Gillian Kay²
¹University of Pretoria; ²University of Cape Town

DO LUNAR PHASES INFLUENCE THE GROWTH OF PLANTS? SCIENTIFIC INQUIRY TO ENCOURAGE CRITICAL THINKING IN THE CLASSROOM

Tatiana Pina; Olga Mayoral; Jordi Solbes
University of Valencia

INQUIRY-BASED TEACHING AND LEARNING THROUGH SCIENCE FAIRS

Jürgen Paul; Yelva Larsen; Jorge Groß
University of Bamberg

BASELINE INQUIRY ON THE NATIONALIST, SCIENTIFIC, AND MASS-ORIENTED EDUCATION (NSMOE) STEM FRAMEWORK AND PEDAGOGY OF LUMAD COMMUNITY SCHOOLS IN MINDANAO, PHILIPPINES — ISSUES, CHALLENGES, SUCCESSSES AND POSSIBILITIES

Chuckie Calsado; Arlene Clarrise Yu Julve; Jonallin Yang
AGHAM- Advocates of Science and Technology for the People

15:00 - 17:00 OP54 - STRAND 8 - ETHICAL ASPECTS OF SOCIO-SCIENTIFIC ISSUES Room B4

Chairperson(s): Marianne Bissonnette

CAN SCIENCE BE DANGEROUS? REFLECTION ABOUT ETHICALLY AND CULTURALLY SENSITIVE TOPICS IN THE SECONDARY SCIENCE CLASS

Veerle Verschoren; Jan Sermeus; Eef Cornelissen; Jelle De Schrijver
Odisee University College

"I DO NOT LIKE A LENTIL BURGER FOR DINNER" HIGH SCHOOL STUDENTS' MORAL REASONING IN SOCIO-SCIENTIFIC ISSUES

Tore Van der Leij
Groningen University

HOW DO PRE-SERVICE PRIMARY TEACHERS ASSESS THE CIRCUS WITH PERFORMING ANIMALS AND ITS EDUCATIONAL VALUE? A STUDY WITH PORTUGUESE, SPANISH AND GREEK STUDENTS

António Almeida¹; Beatriz Garcia Fernandez²; Penelope Papadopoulou³
¹Instituto Politécnico de Lisboa; ²Facultad de Educación de Ciudad Real, Universidad de Castilla-La Mancha; ³University of Western Macedonia, Greece

WHAT DO THE STUDENTS OF THE 2ND YEAR OF BACCALAUREATE THINK ABOUT GENETIC ENGINEERING IN THE PRODUCTION OF HORMONES?

Cristina Ruiz González; Luisa López Banet; Enrique Ayuso Fernández
Universidad de Murcia

MEDIA LITERACY : LEARNING TO DIFFERENTIATE SCIENCE AND PSEUDOSCIENCE

Marianne Bissonnette; Pierre Chastenay; Chantal Francoeur
Université du Québec à Montréal

15:00 - 17:00 OP55 - STRAND 8 - DEVELOPING FRAMEWORKS FOR SSI AND SCIENTIFIC LITERACY Room B5

Chairperson(s): Hyunju Lee

HELPING SELF-DIRECTED LEARNERS TO UNDERSTAND SCIENCE: IMPLICATIONS FOR INFORMAL EDUCATION PROVIDERS AND SCHOOL CURRICULUM

Leonie Rennie¹; Susan Stocklmayer²; John Gilbert³
¹Curtin University; ²Australian National University; ³The University of Reading

COLLABORATIVE PROCESSES IN THE EU PARISSE PROJECT FOCUSED ON SSI AND INQUIRY

Russell Tytler; Peta White
Deakin University

SCHOOLS AND THE LOCAL COMMUNITY: AFFORDANCES AND CHALLENGES FOR SCIENCE CURRICULUM AND TEACHERS

Xavier Fazio
Brock University

SCIENTIFIC LITERACY: GOING BEYOND DECISION-MAKING

Rosária Justi; Beatriz Almeida; Monique Santos
Universidade Federal de Minas Gerais

CHALLENGES OF PRE-SERVICE SCIENCE TEACHERS IN TAKING THEIR FIRST STEPS TOWARD DESIGNING AND IMPLEMENTING SSI LESSONS

Hyunju Lee; Suhi Kwon
Ewha Womans University

15:00 - 17:00 OP56 - STRAND 9 - TEACHING AND LEARNING ABOUT HEALTH Room B6

Chairperson(s): Benedikt Heuckmann

WAKE UP- PREDICTORS OF STEM CELL DONATION FOR LEUKEMIA PATIENTS

Julia Holzer; Doris Elster
Universität Bremen

HEALTH LITERACY FOR CHILDREN WITH CHRONIC KIDNEY DISEASE

S.Lizette Ramos¹; Beatriz Panduro-Espinoza²
¹Universidad de Guadalajara; ²Hospital Civil de Guadalajara Dr. Juan I. Menchaca y Universidad de Guadalajara

LEARNING ABOUT HEALTHY NUTRITION WITH AN ESCAPE GAME

Tal Yachin; Miri Barak
Technion - Israel Institute of Technology

STUDENTS' CONCEPTIONS OF OLD AGE AND AGEING

Franziska Ginschel; Kirsten Schlüter
Institute of Biology Education

STUDENTS' INTERESTS IN SEXUALITY AND HEALTH EDUCATION TOPICS: THE REQUEST FOR SCIENCE EDUCATION

Zélia Anastácio
Universidade do Minho

EXPLAINING TEACHERS' WILLINGNESS TO TEACH ABOUT CANCER

Benedikt Heuckmann; Marcus Hammann; Roman Asshoff
University of Münster

15:00 - 17:00 **OP57 - STRAND 12 - GENDER, EDUCATIONAL DECISIONS AND PARTICIPATION** **Room B7**

Chairperson(s): Anna Günther-Hanssen

IMPLICIT THEORIES ON GENDER AND SCIENCE EDUCATION

Ilse Bartosch¹; Malte Hüsing²; Anja Lembens¹; Bernhard Müllner¹; Agnes Turner²
¹University of Vienna; ²University of Klagenfurt

EDUCATIONAL DECISIONS OF YOUNG WOMEN UNDER THE PERSPECTIVE OF IDENTITY

Freja Kressdorf; Thorid Rabe
Martin-Luther-University

WHY SOME PERSIST: CASE STUDIES OF ADOLESCENT GIRLS' EXTRACURRICULAR SCIENCE PARTICIPATION

Stephanie Rafanelli
Stanford University

A FRAMEWORK FOR STUDYING RURAL YOUNG PEOPLE'S STEM EDUCATION, ASPIRATIONS AND 'SCIENCE-FOR-DEVELOPMENT'

Aizuddin Mohamed Anuar; Sibel Erduran; Maia Chankseliani
University of Oxford

CHARACTERISING THE STANCE ON STEM OF STUDENTS FROM SECONDARY SCHOOL

Carme Grimalt-Álvaro; Digna Couso
CRECIM (Autonomous University of Barcelona)

CHILDREN'S ENTANGLEMENTS WITH SCIENTIFIC CONCEPTS: EMBODIED SCIENTIFIC SUBJECTIVITY IN PRESCHOOL EMERGENT SCIENCE

Anna Günther-Hanssen
Department of Education, Uppsala University

15:00 - 17:00 **OP153 - STRAND 7 - CRITICAL ENGAGEMENT, EPISTEMIC COGNITION AND ARGUMENTATION IN BIOLOGY EDUCATION** **Room C1**

Chairperson(s): Jonna Wiblom

NORM CRITICAL SEXUALITY EDUCATION IN SWEDISH UPPER SECONDARY SCHOOL

Auli Arvola Orlander
Departement of Mathematics and Science Education

SCRIPTURAL COMPETENCE AND CONSTRUCTION OF CONCEPTUAL KNOWLEDGE IN BIOLOGY. AN EXAMPLE IN SECONDARY SCHOOL (ECRICOL PROJECT)

Yann LHOSTE¹; Séverine PERRON²; Patricia SCHNEEBERGER²; Denise ORANGE-RAVACHOL³
¹Université des Antilles; ²Université de Bordeaux; ³Université de Lille

HOW DO SCHOOL STUDENTS USE THEIR EXTANT KNOWLEDGE IN CONTEMPORARY BIOMEDICAL RESEARCH?

Ralph Levinson¹; Stephen Price²; Haira Gandolfi¹; Paul Davies¹; Constantinos Korfiatis³
¹University College London Institute of Education; ²University College London; ³University of Cyprus

A TRAINING PROGRAMME TO IMPROVE THE ARGUMENTATION COMPETENCE OF BIOLOGY STUDENTS AGED 16-18. PRELIMINARY STUDY

José Antonio García Pérez; Daniel Cebrián-Robles; Ángel Blanco-López
Facultad de Ciencias de la Educación. Universidad de Málaga

DESIGNING FOR DIALOGUE IN TEACHING WITH SOCIO-SCIENTIFIC CONTROVERSIES

Jonna Wiblom; Maria Andrée; Carl-Johan Rundgren
Department of Mathematics and Science Education

15:00 - 17:00 OP59 - STRAND 4 - TEACHERS' ATTITUDES TOWARDS USING TECHNOLOGY IN CLASS Room D1

Chairperson(s): Bat-Shahar Dorfman

WHAT HAPPENS IN DIGITAL SCIENCE CLASSROOMS?

Susanne Walan
Karlstad University

EXAMINING THE PHYSICS TEACHERS' SELF-EFFICACY BELIEFS TOWARDS THE USE OF INFORMATION AND COMMUNICATION TECHNOLOGY

Osman Sinan Demir; Uygur Kanli
Gazi University Department of Physics Education

HIGH TECH LEARNING ENVIRONMENTS — ARE TEACHERS READY FOR THE FUTURE?

Haydee De Loof¹; Susanne Walan²; Jelle Boeve-dePauw¹; Niklas Gericke²
¹University of Antwerpen; ²Karlstad University

HOW DO TEACHERS GUIDE STUDENTS IN THE WRITING OF AN EXPERIMENTAL PROTOCOL USING A PROTOCOL EDITOR

Claire Wajeman; Isabelle Girault; Cédric d'Ham
Grenoble Alpes University

PROMOTING TEACHERS' TPACK AND TPACK-CONFIDENCE THROUGH A VIDEO EDITING WORKSHOP IN BIOCHEMISTRY

Bat-Shahar Dorfman¹; Bronwyn Terrill²; Kate Patterson²; Anat Yarden¹; Ron Blonder¹
¹Weizmann Institute of Science; ²Garvan Institute of Medical Research

15:00 - 17:00 OP60 - STRAND 5 - DESIGN AND PROBLEM-BASED STEM INSTRUCTION Room D2

Chairperson(s): Uygur KANLI

DESIGNING CAREER-RELATED INSTRUCTION IN SCIENCE EDUCATION

Anssi Salonen; Sirpa Kärkkäinen; Tuula Keinonen
University of Eastern Finland

EPISTEMOLOGICAL ACTIVATORS TO VALUE S-T-E-M CONCEPTS FOR EDUCATION

Giovanni Ravaioli¹; Eleonora Barelli¹; Laura Branchetti²; Michael Lodi¹; Sara Satanassi¹; Olivia Levrini¹
¹University of Bologna; ²University of Parma

DIDACTIC PROFILES IN PBL STEM TEACHING-LEARNING SEQUENCES

Jordi Domènech-Casal
Universitat Autònoma de Barcelona

GIFTED STUDENTS DESIGNING ECO-FRIENDLY RESIDENCE PROJECTS

Engin Karahan¹; Ayçin Ünal²
¹Eskişehir Osmangazi University; ²Mugla Science and Arts Center

INVESTIGATING THE EFFECTS OF ROBOTIC ACTIVITIES IN SCIENCE CENTERS ON THE DEVELOPMENT OF STUDENTS' SCIENCE PROCESS SKILLS

Ömer Faruk Akca; Uygur Kanli; Fitnat Köseoğlu
Gazi University, Gazi Faculty of Education, Department of Math and Science Education Program

15:00 - 17:00 OP61 - STRAND 5 - TEACHING AND LEARNING IN BIOLOGY I Room D3

Chairperson(s): Tuomas Aivelo

INTRODUCTION OF SYSTEMS THINKING IN BIOLOGY EDUCATION

Melde G.R. Gilissen; Marie-Christine P.J. Knippels; Wouter R. van Joolingen
Utrecht University

THE IDEAS-COSMOS-EVIDENCE MODEL AND THE TEACHING OF THE EVOLUTION THEORY: A FIRST APPROACH

Pinelopi Papadopoulou; Christina Dinolazou
University of Western Macedonia, Greece

ANALYSIS OF THE PRODUCTION OF SCIENTIFIC PROJECTS BY UNDERGRADUATE BIOLOGY STUDENTS FROM AN OPEN INQUIRY-BASED SEQUENCE IN PHYSIOLOGY

Daniel Manzonni-de-Almeida¹; Sílvia Trivelato, F.L.²; Pedro Marinho, E. L.³; Marsilvio Gonçalves Pereira³
¹Escola de Ciências Biológicas e da Saúde, Centro Universitário das Faculdades Metropolitanas Unidas; ²GEPEB, Faculdade de Educação, Universidade de São Paulo; ³Centro de Educação, Universidade Federal da Paraíba

INVESTIGATIONS OF MODELLERS AND MODEL VIEWERS IN AN OUT-OF-SCHOOL GENE-TECHNOLOGY LABORATORY

Julia Mierdel; Franz Bogner
University of Bayreuth

CHOOSING COURSE CONTENTS: TEACHERS' APPROACHES TO GENETICS TEACHING MIRROR INCLUSION OR AVOIDANCE OF SENSITIVE ISSUES

Tuomas Aivelo; Anna Uitto
University of Helsinki

15:00 - 17:00 **OP191 - STRAND 10 - CHALLENGES IN SCIENCE EDUCATION** **Room E2 - Italia**

Chairperson(s): Joshua Ellis

IMPLEMENTATION OF INQUIRY-BASED SCIENCE CURRICULUM REFORM IN CHALLENGING TEACHING ENVIRONMENT: PHILIPPINE CONTEXT

Dennis Danipog¹; Suzanne Rice²; Susan-Marie Harding²
¹University of the Philippines; ²University of Melbourne

EMERGENT NETWORKS AND RELATIONS BETWEEN DIFFERENT LEVELS OF A PHYSICS CLASSROOM'S COMPLEXITY

Ernani Rodrigues; Mauricio Pietrocola
Universidade de São Paulo

HOW DO TEACHERS TEACH UNCERTAINTY IN FRENCH HIGH SCHOOLS?

Julien Browaeys¹; Nicolas Decamp²; Deborah Martin³
¹MSC, Université Paris Diderot; ²LDAR Université Paris Diderot, UA, UCP, UPEC, U Rouen; ³Education Nationale

INTEGRATIVE STEM M.ED. DEGREE ALIGNING WITH CONTEMPORARY PERSPECTIVES IN ACADEMIA AND INDUSTRY

Noa Ragonis; Tili Wagner; Daphne Goldman; Osnat Dagan
Beit Berl College

TOWARD A PRODUCTIVE DEFINITION OF TECHNOLOGY IN STEM EDUCATION

Joshua Ellis¹; Jeanna Wieselmann²; Gillian Roehrig²; Emily Dare²; Elizabeth Ring-Whalen³
¹Florida International University; ²University of Minnesota; ³St. Catherine University

15:00 - 17:00 **INVITED ROUND TABLE SYMPOSIUM DISCIPLINE-BASED EDUCATION RESEARCH JOURNALS** **Room F1**

Chairperson(s): Paola R.L. Heron

CBE-LIFE SCIENCES EDUCATION

Stephanie M. Gardner,
Department of Biological Sciences, Purdue University, USA

CHEMISTRY EDUCATION RESEARCH AND PRACTICE

David Treagust,
School of Education, Curtin University, Australia

THE JOURNAL OF GEOSCIENCE EDUCATION

Anne E. Egger,
Geological Sciences and Science Education Central Washington University Ellensburg, USA

PHYSICS EDUCATION

Gary Williams, Institute of Physics, London, UK

PHYSICAL REVIEW – PHYSICS EDUCATION RESEARCH

Paula Heron,
Department of Physics, University of Washington, Seattle, USA

15:00 - 17:00 **INVITED ROUND TABLE SYMPOSIUM SCIENCE EDUCATION JOURNALS** **Room F2**

Chairperson(s): Sibel Erduran, Giulia Tasquier

CULTURAL STUDIES OF SCIENCE EDUCATION

Christina Siry¹, Catherine Milne², Michael P. Mueller³
¹University of Luxembourg, ²New York University, USA, ³University of Alaska Anchorage, USA

INTERNATIONAL JOURNAL OF SCIENCE EDUCATION

Jan Van Driel, University of Melbourne, Australia

ENHANCING GLOBAL SCHOLARSHIP IN THE JOURNAL OF RESEARCH IN SCIENCE TEACHING

Dana L. Zeidler¹, Fouad Abd-El-Khalick²

¹University of South Florida, USA, ²University of North Carolina at Chapel Hill, USA

JOURNAL OF SCIENCE TEACHER EDUCATION: DEVELOPING KNOWLEDGE ABOUT SCIENCE TEACHER EDUCATION

Wayne Melville¹, Geeta Verma², Todd Campbell³, Byung-Yeol Park³

¹Lakehead University, Canada, ²University of Colorado Denver, USA, ³University of Connecticut, USA

RESEARCH IN SCIENCE AND TECHNOLOGICAL EDUCATION

Ann Childs, Judith Hillier, Jane McNicholl

Oxford University, UK

RESEARCH IN SCIENCE EDUCATION JOURNAL

Donna King, Queensland University of Technology, Australia

SCIENCE & EDUCATION: CONTRIBUTIONS FROM HISTORY, PHILOSOPHY, AND SOCIOLOGY OF SCIENCE AND MATHEMATICS

Kostas Kampourakis, University of Genève, Switzerland

EDITOR VOICES FROM SCIENCE EDUCATION: UPDATES ON A JOURNAL'S FIRST 100 YEARS

John Settlage¹, Sherry Southerland²

¹University of Connecticut, USA, ²Florida State University, USA

STUDIES IN SCIENCE EDUCATION

Justin Dillon, University of Exeter, UK

15:00 - 17:00

OP62 - STRAND 15 - ENGINEERING AND COMPUTATIONAL THINKING IN PRESCHOOL

Room F3

Chairperson(s): Elin Eriksson

ENHANCING COMPUTATIONAL THINKING SKILLS IN EARLY CHILDHOOD EDUCATION

Kalliopi Kanaki; Michail Kalogiannakis

University of Crete - Department of Preschool Education

A FRAMEWORK OF EARLY CHILDHOOD SCIENCE AND DIGITAL LEARNING: A COMPARATIVE ANALYSIS OF AUSTRALIAN AND FINNISH CURRICULA

Sari Havu-Nuutinen¹; Sarika Kewalramani²; Sini Kontkanen¹; Susanna Pöntinen¹; Nikolai Veresov²

¹University of Eastern Finland; ²Monash University

PRESCHOOL CHILDREN'S ENGINEERING PLANS

Nicole Glen

Bridgewater State University

DEVELOPING A ROBOT-SUPPORTED INCLUSIVE EDUCATION (ROSIE): A PLAY-BASED APPROACH TO STEM-TEACHING AND INCLUSION IN EARLY CHILDHOOD EDUCATION

Lykke Bertel¹; Eva Brooks¹; Susanne Dau²

¹Aalborg University; ²University College North

SCIENCE TEACHING IN PRESCHOOL WITH THE USE OF STRUCTURED TEACHING MATERIAL

Elin Eriksson; Monika Vinterek

Dalarna university

15:00 - 17:00

OP63 - STRAND 10 - CURRICULUM DEVELOPMENT 2

Room G1

Chairperson(s): Teresa Lupión-Cobos

SCIENCE CONTENT TRANSFORMATION: VIEWS, CRITICISM, EXAMPLES AND PROPOSAL

Petros Kariotoglou; Anastasios Zoupidis

University of Western Macedonia, Greece

SCIENTISTS' VIEWS OF SCIENTIFIC ORIGINALITY : OPPORTUNITIES AND CONSTRAINTS IN SCHOOL SCIENCE

Sarah Frodsham; Debra McGregor

Oxford Brookes University

DISCIPLINARY LITERACY AND INQUIRY-BASED INSTRUCTION: MAXIMIZING OR MISSING OPPORTUNITIES FOR GROWTH

Emily Hayden¹; Michelle Baird²

¹Iowa State University; ²Empire State College

EMPLOYING MODELING-BASED LEARNING TO MEET SCIENCE EDUCATION POLICY REFORMS FOCUSED ON INCLUDING DISCIPLINARY LITERACY

Michelle Eades-Baird¹; Emily Hayden²

¹SUNY Empire State College; ²Iowa State University

FACTORS INFLUENCING TEACHER RESPONSE TO EXTERNALLY DRIVEN CURRICULUM REFORM. A CASE STUDY.

Teresa Lupión-Cobos; Jose Hierrezuelo-Osorio; Isabel Cruz-Lorite; Ángel Blanco-López
University Of Malaga

15:00 - 17:00 **OP64 - STRAND 11 - FORMATIVE ASSESSMENT IN SCIENCE TEACHING** **Room G2**

Chairperson(s): Erika Offerdahl

INTERPRETATION AND UTILIZATION OF WRITTEN FEEDBACK COMMENTS BY ELEMENTARY SCHOOL STUDENTS WORKING ON SCIENCE INVESTIGATION TASKS

Evangelia Irakleous; Nikos Papadouris; Costas Constantinou
University of Cyprus

WHAT COMPETENCES DO TEACHERS FOCUS AT WHEN FORMATIVELY ASSESSING THEIR STUDENTS' IN INQUIRY-BASED SCIENCE EDUCATION?

Regula Grob¹; Monika Holmeier²; Peter Labudde²
¹University of Teacher Education Lucerne PHLU; ²Center for Science and Technology Education, University of Teacher Education Northwestern Switzerland

A TEACHER SCAFFOLDING STUDENTS FORMATIVE ASSESSMENT DURING FINNISH LESSONS IN MAGNETISM

Sari Harmoinen
University of Oulu

SCIENCE EDUCATION STUDENTS' OUTCOME AND ATTITUDE EFFECT WITH DIGITAL FORMATIVE ASSESSMENT INTERFACE

Jin Su Jeong; David González-Gómez; Florentina Cañada-Cañada; J. Samuel Sánchez-Cepeda; M. Carmen Conde-Núñez
University of Extremadura

MEASURING INSTRUCTOR-GENERATED FEEDBACK UNDERGRADUATE STEM CONTEXTS

Erika Offerdahl¹; Melody McConnell²; Jeffrey Boyer²; Aramati Casper³
¹Washington State University; ²North Dakota State University; ³Colorado State University

15:00 - 17:00 **OP65 - STRAND 3 - TEACHER STRATEGIES I** **Room G3**

Chairperson(s): Asli Saylan Kirmizigül

EXPLORING PRACTICING AND PRE-SERVICE TEACHERS' PROCEDURAL METACOGNITIVE KNOWLEDGE: INITIAL FINDINGS AND POTENTIAL IMPLICATIONS

Gregory Thomas
University of Alberta

PERCEPTION OF EXPLANATIONS IN CHEMISTRY EDUCATION

Michael Elmer; Oliver Tepner
University of Regensburg

TEACHERS' PERSPECTIVES ON SCAFFOLDING OF DESIGN ACTIVITIES IN THE CHEMISTRY CLASSROOM

Sathyam Sheoratan¹; Ineke Henze¹; Erik Barendsen²; Marc de Vries¹
¹Delft University of Technology; ²University of Nijmegen

WHAT IS THE QUESTION? CHARACTERIZING TEACHER QUESTIONING PRACTICE IN SECONDARY BIOLOGY LESSONS IN MEXICO

Maria Guadalupe Perez-Martinez¹; Maria Teresa Guerra Ramos²; Jose Alberto Rojas Calzada³; Sara Sofia Calvario Ruiz³
¹CONACYT - Universidad Autonoma de Aguascalientes; ²CINVESTAV-Unidad Monterrey; ³Universidad Autonoma de Aguascalientes

COMPARISON OF COMPUTER-AIDED AND HANDS-ON TEACHING APPROACHES ON STUDENTS' ANXIETY TOWARDS SCIENCE

Asli Saylan Kirmizigül; Hasan Kaya
Erciyes University

15:00 - 17:00 **OP66 - STRAND 3 - TEACHING AND LEARNING STRATEGIES ON MODELLING OR REASONING** **Room G4**

Chairperson(s): Farahnaz Sadidi

THE ROLE OF MATHEMATICS FOR PHYSICS TEACHING AND LEARNING IN UPPER-SECONDARY SCHOOL

Lena Hansson; Örjan Hansson; Kristina Juter; Andreas Redfors
Kristianstad University

INDIVIDUAL MODELLING ROUTES IN THE PROCESS OF SCIENTIFIC-MATHEMATICAL MODELLING

Johannes Meister; Annette Upmeier zu Belzen
Humboldt-Universität zu Berlin

COLLABORATIVE THOUGHT EXPERIMENTS: WHAT IS IT AND HOW DOES IT OCCURRED?

Hartono Bancong; Jinwoong Song
Seoul National University

MODELLING WITH EMBODIMENT IN SCIENCE EDUCATION: AN EVALUATION UNDER TWO APPROACHES

Paula Tuzón¹; Jordi Solbes²; Samuel Hernandez²; Maria Angeles Gomez-Climent³
¹Universitat de València; ²Universitat de Valencia; ³Universidad Internacional de La Rioja, Universidad de Valencia

DEVELOPING STUDENTS' CRITICAL THINKING: LIKELIHOOD AND UNCERTAINTY ANALYSIS IN PARTICLE PHYSICS

Farahnaz Sadidi; Gesche Pospiech
Technische Universität Dresden

15:00 - 17:00 **OP67 - STRAND 13 - PRESERVICE TEACHERS' CONCEPTUAL KNOWLEDGE** **Room G5**

Chairperson(s): Frackson Mumba

EVALUATION OF THE EFFECTIVENESS OF A PRE-SERVICE CHEMISTRY TEACHERS' PROFESSIONAL VISION DEVELOPEMENT COURSE

Linda Honskusová; Martin Rusek
Charles University, Faculty of Education

PRE-SERVICE TEACHERS' EXPLANATIONS OF PHYSICAL PHENOMENA USING A SELF-CONSTRUCTED PARTICLE MODEL OF MATTER

Arnau Amat; Isabel Jiménez-Bargalló
Universitat de Vic

CONCEPTIONS ABOUT "MESAUREMENT" AND "ATTRIBUTE" OF PRE-SERVICE PRIMARY SCHOOL TEACHERS IN FRANCE

Clement MAISCH
Université de Cergy-Pontoise

ENHANCING PRE-SERVICE ELEMENTARY TEACHERS' PHYSICAL SCIENCE CONCEPTUAL KNOWLEDGE AND OWNERSHIP

Dermot Donnelly; Jennifer Click; Sara Meadows; Frederick Nelson; David Andrews
California State University Fresno

ARGUMENT-DRIVEN INQUIRY: INVESTIGATION OF PRE-SERVICE TEACHERS' CONCEPTUAL UNDERSTANDINGS OF CHEMISTRY CONCEPTS

Guluzar Eymur¹; Pinar Seda Çetin²
¹Giresun Üniversitesi; ²Abant İzzet Baysal Üniversitesi

DEVELOPING PRE-SERVICE SCIENCE TEACHERS' UNDERSTANDING OF ENGINEERING DESIGN AND SCIENTIFIC METHOD

Frackson Mumba
University of Virginia

15:00 - 17:00 **OP68 - STRAND 14 - PEDAGOGICAL CONTENT KNOWLEDGE IV** **Room G6**

Chairperson(s): Samanta Angeliki

RESOLVING SHULMAN'S "AMALGAM": A NEW MODEL FOR PEDAGOGICAL CONTENT KNOWLEDGE (PCK)

Vanessa Kind¹; Kennedy Chan²
¹University of Durham; ²Hong Kong University

STUDYING EXPERIENCES OF SCIENCE TEACHERS: EXPLORING PERSONAL PEDAGOGICAL CONTENT KNOWLEDGE OF GRADE SIX AND NINE TEACHERS

Saiqa Azam
Memorial University of Newfoundland

IN-SERVICE CHEMISTRY TEACHERS' PCK OF ELECTROCHEMISTRY: A CASE IN SÃO PAULO, BRAZIL

Pablo Castro; Carmen Fernandez
University of São Paulo

THE IMPACT OF A LEARNING STUDY ON THE DEVELOPMENT OF PCK IN STOICHIOMETRY: THE STORY OF THREE TEACHERS

Stephen Andrew Malcolm; Elizabeth Mavhunga; Marissa Rollnick
University of the Witwatersrand

RELATIONSHIP BETWEEN TEACHERS' TSPK, BELIEFS AND STUDENT OUTCOMES IN INTRODUCTORY ELECTRICITY

[Thomas Schubatzky](#)¹; [Claudia Haagen-Schützenhöfer](#)¹; [Jan-Philipp Burde](#)²; [Thomas Wilhelm](#)²; [Lana Ivanjek](#)³; [Martin Hopf](#)³; [Liza Dopatka](#)⁴; [Verena Spatz](#)⁴

¹University of Graz; ²Goethe-University Frankfurt; ³University of Vienna; ⁴University of Technology Darmstadt

GREEK SCIENCE TEACHERS' TPACK EXPRESSION FOLLOWING PROFESSIONAL DEVELOPMENT

[Angeliki Samanta](#)¹; [Dimitrios Psillos](#)²

¹27th Primary School of Acharnes; ²Aristotle University of Thessaloniki

15:00 - 17:00 OP69 - STRAND 14 - CLASSROOM ASSESSMENT PRACTICES**Room G7****Chairperson(s): Sandhya Krishnan****TEACHERS' VIEW ON FORMATIVE ASSESSMENT – THE IMPACT OF EXPERIMENTAL TEACHING WITH PEER-ASSESSMENT**

[Iva Stuchlikova](#); [Alena Hospesova](#); [Iva Zlabkova](#); [Jan Petr](#); [Radka Zavadska](#); [Lukas Rokos](#)
Jihočeská univerzita v Českých Budějovicích

BOUNDARY OBJECTS AND CHANGES IN ASSESSMENT PRACTICES IN INQUIRY SCIENCE LESSONS

[Catarina Correia](#)¹; [Natasha Serret](#)²; [Chris Harrison](#)¹

¹King's College London; ²Nottingham Trent University

ENHANCING PHYSICS TEACHERS' PROFESSIONAL DEVELOPMENT USING A DESIGN-BASED RESEARCH PROJECT

[Thomas Frågåt](#); [Maria Vetleseter Bøe](#); [Carl Angell](#)

Department of Physics, University of Oslo

EVALUATING SCIENCE TEACHERS' TEACHING PRACTICES: STRENGTHS AND WEAKNESSES

[Angelos Sofianidis](#); [Maria Kallery](#)

Aristotle University of Thessaloniki

PRODUCTIVE NEGATIVITY UNDERLYING FORMATIVE ASSESSMENT IN GAME-BASED LEARNING OF SCIENCE

[Sandhya Krishnan](#); [Georgia Hodges](#)

The University of Georgia

15:00 - 17:00 OP70 - STRAND 14 - PROFESSIONAL DEVELOPMENT PROGRAMS OR COURSES**Room G8****Chairperson(s): Claude-Émilie Marec****INVESTIGATING THE CONSISTENCY BETWEEN SCIENCE TEACHERS' VIEWS AND PRACTICES DURING A PROFESSIONAL DEVELOPMENT PROGRAM**

[Christina Tsaliki](#)¹; [Pinelopi Papadopoulou](#)¹; [George Malandrakis](#)²; [Petros Kariotoglou](#)³

¹University of Western Macedonia, Greece; ²Aristotle University of Thessaloniki, Greece; ³University of Western Macedonia, Florina, Greece

COMPONENTS OF PROFESSIONAL GROWTH IN SCIENCE TEACHERS: ANATOMY, PHYSIOLOGY AND TRAJECTORY OF TEACHER TRANSFORMATION

[Corina Gonzalez Weil](#); [Christopher Chacana-González](#); [Joaquín Donoso-Pérez](#); [Rafael Fernández-Verdugo](#); [Bárbara González-Urzúa](#)

Pontificia Universidad Católica de Valparaíso

A CASE OF DEVELOPING STEM CONCEPTIONS IN AN ONLINE TEACHER PROFESSIONAL DEVELOPMENT

[Tasneem Anwar](#)

The Aga Khan University

USING ACTIVITY THEORY TO ANALYZE CONTRADICTIONS IN A SCIENCE TEACHER TRAINING COURSE

[Eftychia Nanni](#); [Eleni Kolokouri](#)

University of Ioannina

DEVELOPMENT OF ELEMENTARY SCHOOL TEACHERS' SELF-EFFICACY FOLLOWING A SCIENCE AND TECHNOLOGY TRAINING AND SUPPORT PROGRAM

[Claude-Émilie Marec](#)¹; [Christian Tessier](#)²; [Simon Langlois](#)³

¹UQAM; ²Collège Bois-de-Boulogne; ³Cégep Marie-Victorin

THURSDAY 9:00 - 11:00

09:00 - 11:00 Symposium 40 - CHILDREN'S LEARNING IN MULTIPLE SCIENTIFIC CONTEXTS: FROM MOTIVATION TO STEM EDUCATION Room A1

Chairperson(s): Eleni Kolokouri, Katerina Plakitsi; Discussant: Estelle Blanquet

DEVELOPMENT OF THE SCIENTIFIC METHOD IN THE EARLY YEARS WITHIN A SOCIO-CULTURAL FRAME

Eleni Kolokouri; Katerina Plakitsi
University of Ioannina

MOTIVE AS AN ANALYTICAL TOOL TO ASSESS FOCUS IN PRESCHOOL SCIENCE ACTIVITIES

Clara Vidal Carulla; Karina Abdou
Linnaeus University, Kalmar, Sweden

EMPATHIZING AND SYSTEMIZING IN EARLY YEARS — A VIDEO-BASED STUDY ON THE MOTIVATION TO DO SCIENCE

Nina Skorsetz¹; Manuela Welzel-Breuer²
¹Goethe University, Frankfurt; ²Heidelberg University of Education

HOW TO STIMULATE LOW-SES MULTI-LANGUAGE LEARNING FOUR-YEAR-OLDS?

Thijs Eeckhout; Helena Taelman; Marlies Algoet
Odisee, University of Applied Sciences, Education (Teacher Training), Brussels, Belgium

09:00 - 11:00 Symposium 48 - MULTI-THEORETICAL FRAMEWORKS AND METHODOLOGIES FOR ADVANCING EQUITY: FIGURED-WORLDS, IDENTITIES, AGENCIES, AND SUBJECTIVITIES Room A2

Chairperson(s): Lucy Avraamidou; Discussant: Gillian Bayne

TOWARDS ONTO-EPISTEMIC JUSTICE: MAKING IDENTITIES AND AGENCIES OF BILINGUAL/MULTILINGUAL LEARNERS VISIBLE IN SCIENCE EDUCATION

Shakhnoza Kayumova; Akira Harper
University of Massachusetts-Dartmouth

RE-IMAGINING PRIMARY SCHOOL SCIENCE: RESOURCE-RICH APPROACHES TO HIGHLIGHT CHILDREN'S MULTILINGUAL INTERACTIONS

Christina Siry; Sara Wilmes
University of Luxembourg

FIGURED WORLDS IN THE UNIVERSITY QUANTUM MECHANICS CLASSROOM

Anna Danielsson¹; Susanne Engström²; Per Norström²; Kristina Andersson³
¹Uppsala University; ²KTH Royal Institute of Technology, Sweden; ³Uppsala University, Sweden

IDENTITY, AGENCY AND SUBJECTIVITIES OF AFRO-DIASPORIC TEACHERS IN STEM CLASSROOMS

Jennifer Adams¹; Atasi Das²; La Toya Strong²; Susan McCullough³
¹University of Calgary; ²The Graduate Center, CUNY, USA; ³Queens College, CUNY, USA

09:00 - 11:00 Symposium 41 - CATCHING AND HOLDING STUDENTS' INTEREST IN SCIENCE LEARNING Room B1

Chairperson(s): Kimberley Pressick-Kilborn, Niels Dohn; Discussant: Martina Nieswandt

CATCHING AND HOLDING STUDENTS' INTEREST IN SCRATCH CODING

Niels Dohn
Aarhus University

CATCHING AND HOLDING STUDENTS' INTEREST IN BIOLOGY CLASSES BY SUPPORTING THEIR AUTONOMY

Nadine Großmann¹; Cornelia Stiller¹; Inga Desch²; Matthias Wilde¹
¹Bielefeld University; ²n/a

CURIOSITY TOWARDS SCIENCE INQUIRY IN PRESCHOOL AND PRIMARY SCHOOL

Stine Mariegaard¹; Morten Petersen²; Claus Michelsen¹
¹University of Southern Denmark; ²UCL University College

PEDAGOGICAL PRACTICES THAT CATCH AND HOLD PRIMARY STUDENTS' INTEREST IN SCIENCE: (RE-)EXAMINING THE IMPORTANCE OF 'CONNECTEDNESS'

Kimberley Pressick-Kilborn
University of Technology Sydney

09:00 - 11:00 Symposium 42 - PISA 2015: WHAT CAN SCIENCE EDUCATION LEARN FROM THE DATA? Room B2

Chairperson(s): Jonathan Osborne; Discussant: Jonathan Osborne

SCIENCE TEACHING AND LEARNING: ANALYSIS OF PISA 2015 DATA FROM THE UNITED STATES AND GERMANY

Cory Forbes¹; Knut Neuman²; Anna Schiepe-Tiska³
¹Univ; ²IPN, Kiel; ³TUM, Munich

POSSIBLE CHARACTERISTICS OF PISA SCIENCE ITEMS DISCRIMINATING STUDENTS PERFORMANCE ACCORDING TO THEIR SOCIO-ECONOMICO-CULTURAL LEVEL AND THEIR ACADEMIC LEVEL

Mylène Duclos¹; Florence Le Hebel¹; Andrée Tiberghien²; Pascale Montpied²; Valérie Fontanieu³
¹UMS LLE Ecole Normale Supérieure de Lyon,; ²CNRS, Lyon; ³IFE, Ecole Normale Supérieure de Lyon

ESTABLISHING MULTIDIMENSIONALITY: IDENTIFYING PATTERNS OF INQUIRY-DRIVEN SCIENCE INSTRUCTION

Sara Dozier
 Stanford University

EXPLOITING COMPUTER-GENERATED DATA TO STUDY STUDENTS' TEST-TAKING BEHAVIOR

Davide Azzoloni; Loris Vergolini; Nicola Bazoli
 IRVAPP (Research Institute for the Evaluation of Public Policies) Bruno Kessler Foundation

09:00 - 11:00 Symposium 43 - SCIENCE IN EXHIBITIONS: DIFFERENT PERSPECTIVES FROM DIFFERENT ACTORS Room B3

Chairperson(s): Marianne Achiam, Alexandra Moormann; Discussant: Kerstin Kremer

MUSEUM SCIENCE EXHIBITIONS AS 'WRITERLY' OR 'READERLY'

Justin Dillon
 University of Exeter

COMMUNICATION OBJECTIVES AND GOALS WITHIN A NATURAL HISTORY MUSEUM EXHIBITION

Alexandra Moormann¹; Kerstin Kremer²
¹Museum für Naturkunde; ²IPN Kiel Leibniz Institute for Science and Mathematics Education at Kiel University

SCIENTIST TALK: CONJECTURES OF THE IMPLIED VISITOR

Line Bruun Nicolaisen
 University of Copenhagen

SCIENTISTS' PERSPECTIVES ON SCIENCE EXHIBITIONS

Marianne Achiam; Jens Dolin
 Department of Science Education, University of Copenhagen

09:00 - 11:00 Symposium 44 - WHAT DOES IT MEAN TO BE CRITICAL IN SCIENCE EDUCATION? IBERO-AMERICAN PERSPECTIVES Room B4

Chairperson(s): Isabel Martins; Discussant: Christina Siry

WHAT COUNTS AS CRITICAL IN SCIENCE EDUCATION?

Livia Mantuano¹; Isabel Martins¹; Mariona Espinet²
¹Universidade Federal do Rio de Janeiro; ²Universitat Autònoma de Barcelona

CRITICAL APPROACHES IN SCIENCE EDUCATION: SOUTH AMERICAN PERSPECTIVES

Vilanova Rita¹; Isabel Martins¹; Ana Barrios²; Silvina Cordero³; Ana Dumrauf³; Livia Mantuano¹; Ruth Pantoja²
¹Universidade Federal do Rio de Janeiro; ²Universidad de Nariño; ³Universidad Nacional de La Plata

A SEARCH FOR PERSPECTIVES ON THE CONCEPT OF CRITIC IN SCIENCE EDUCATION JOURNALS: THE CASE OF MEXICO

Lizette Ramos¹; Adrianna Gomez²
¹Universidad de Guadalajara; ²Cinvestav, Mexico

EXPLORING CRITICALITY IN THE SPANISH SCIENCE EDUCATION RESEARCH LITERATURE: THE CASE OF ENSEÑANZA DE LAS CIENCIAS

Laura Valdes Sanchez¹; Samuel Molina Schnorr²; Mariona Espinet¹
¹Universitat Autònoma de Barcelona; ²Universidade de São Paulo

09:00 - 11:00 **Symposium 45 - SCIENCE TEACHER PROFESSIONAL DEVELOPMENT: ADDRESSING CHALLENGES OF COMPLEXITY, RESPONSIVITY, AND SCALE** **Room B5**

Chairperson(s): Hannah Sevia; Discussant: David Treagust

SUPPORTING NOVICE SCIENCE TEACHERS IN HIGH-POVERTY SCHOOLS: CHALLENGES TO A SYSTEM-LEVEL APPROACH

Gail Richmond; Craig Wray
 Michigan State University

INTEGRATION INTO THE SCHOOL SYSTEM: CHALLENGES OF SECOND CAREER STEM TEACHERS

Effrat Akiri; Gabbriella Shwartz; Yehudit Judy Dori
 Technion - Israel Institute of Technology

A TEACHER-RESEARCHER JOINT VENTURE INITIATES CONCEPTUAL CHANGE IN STEM EDUCATION

Christel Balck¹; Jan Sermeus¹; Wim Temmerman¹; Bram Robberecht¹; Jelle De Schrijver¹; Beatriz Garcia Fernandez²; Tsepo Mokuku³

¹Odisee University College teacher training secondary education Belgium; ²Universidad de Castilla-La Mancha, Ciudad Real, Spain; ³National University of Lesotho, Roma, Lesotho

TEACHER-DRIVEN PARTNERSHIP TO SUPPORT MID-CAREER CHEMISTRY TEACHERS

Hannah Sevia¹; Scott Balicki²; Gregory Banks²; Michael Clinchot²; Vesal Dini³; Marianne Dunne²; Robert Huie²; Rebecca Lewis⁴; Stephanie Murray¹; Raúl Orduña Picón¹; Pamela Pelletier²; Vicente Talanquer⁵

¹University of Massachusetts Boston; ²Boston Public Schools; ³Tufts University; ⁴Hingham Public Schools; ⁵University of Arizona

09:00 - 11:00 **Symposium 46 - STRATEGIES OF NOS RESEARCH: STRENGTHS, LIMITATIONS, AND LOOKING FORWARD** **Room B6**

Chairperson(s): Andreas Nehring; Discussant: Norman Lederman, Judith Lederman

LET'S BE PRACTICAL: A CRITICAL REVIEW OF STUDIES ON LEARNING THE NATURE OF SCIENCE AMONG STUDENTS AND SCIENCE TEACHERS

Hernán Cofré¹; Paola Nuñez¹; David Santibañez²; Jose Manuel Pavez³; Martina Valencia¹; Claudia Vergara⁴

¹P. Universidad Católica de Valparaíso; ²Universidad Católica Silva Henríquez; ³University of Georgia; ⁴Universidad Alberto Hurtado

DEVELOPING SECONDARY SCIENCE TEACHERS' EPISTEMOLOGICAL VIEWS OF SCIENCE AND PCK FOR ARGUMENTATION

Patrick Enderle; Renee' Schwartz
 Georgia State University

SCIENCE TEACHERS' PCK OF ARGUMENTATION AND EPISTEMOLOGICAL BELIEFS: INFLUENCE OF A PD PROGRAM

Ozden Sengul¹; Patrick Enderle²; Renee' Schwartz²

¹Bogazici University; ²Georgia State University

SYSTEMATICALLY REANALYSING QUANTITATIVE STUDIES ON EPISTEMIC BELIEFS IN SCIENCE: SAME SAME BUT DIFFERENT?

Andreas Nehring¹; Andrea Bernholt²; Peter Edelsbrunner³; Nele Kampa²; Julia Schiefer⁴

¹Leibniz Universität Hannover - Institute for Science Education; ²Leibniz-Institut für die Pädagogik der Naturwissenschaften und Mathematik (IPN); ³ETH Zürich; ⁴Universität Tübingen

09:00 - 11:00 **Symposium 12 - METAPHOR AND NARRATIVE IN SCIENCE AND SCIENCE EDUCATION** **Room B7**

Chairperson(s): Jörg Zabel, Annamaria Contini; Discussant: Tamer Amin

STORIES ABOUT NATURE AS AESTHETIC EXPERIENCE IN SCIENCE EDUCATION

Annamaria Contini; Lorenzo Manera; Alice Giuliani

University of Modena and Reggio Emilia, Italy, Department of Education and Human Sciences

METAPHORS AND STORIES IN A SCIENCE CLASSROOM – AN EXAMPLE

Federico Corni; Tiziana Altiero; Enrico Giliberti; Alessandra Landini
Department of Education and Humanities, University of Modena and Reggio Emilia, Italy

EXPERIENCING FORCES OF NATURE THROUGH THEIR STORIES

Hans Fuchs¹; Elisabeth Dumont²
¹Institute of Applied Mathematics and Physics, Winterthur, Switzerland; ²Institute of Applied Mathematics and Physics, ZHAW, Winterthur, Switzerland

NATURE AS A BREEDER: ABOUT BIOLOGY AS A METAPHORICAL SCIENCE, AND THE IMPLICATIONS FOR TEACHING

Jörg Zabel
University of Leipzig

09:00 - 11:00 **Invited Symposium 09 - THE ROLE OF NATIONAL AND REGIONAL JOURNALS IN PROMOTING SCIENCE EDUCATION RESEARCH IN EUROPE** **Room C1**

Chairperson(s): Mariona Espinet; Discussant: Justin Dillon

THE CASE OF THE SPANISH JOURNAL ENSEÑANZA DE LAS CIENCIAS

Mariona Espinet; Anna Marbà; Conxita Márquez
Departament de Didàctica de la Matemàtica i de les Ciències Experimentals, Universitat Autònoma de B

PUBLISHING AND DISSEMINATING RESEARCH OUTCOMES: CHALLENGES OF A FRENCH INTERNATIONAL JOURNAL OF RESEARCH IN SCIENCE AND TECHNOLOGY EDUCATION

Isabelle Kermen¹; Yann Lhoste²
¹Université d'Artois, LDAR, France; ²Université des Antilles, Pôle Martinique

NORDIC STUDIES IN SCIENCE EDUCATION (NORDINA)

Carl-Johan Rundgren¹; Are Turmo²
¹Department of Mathematics and Science Education at Stockholm University, Stockholm, Sweden; ²Norwegian Centre for Science Education, University of Oslo, Oslo, Norway

ZEITSCHRIFT FÜR DIDAKTIK DER NATURWISSENSCHAFTEN (ZFDN) – GERMAN JOURNAL OF SCIENCE EDUCATION

Knut Neumann¹; Annette Upmeyer zu Belzen²; Claudia von Aufschnaiter³
¹IPN - Leibniz Institute for Science and Mathematics Education, Kiel University, Germany; ²Humboldt-Universität zu Berlin, Germany; ³Institut für Didaktik der Physik, Justus-Liebig-Universität Gießen, Germany

09:00 - 11:00 **Invited Symposium 10 - SIG 1 - COMPUTATIONAL THINKING, CODING AND DIGITAL TECHNOLOGIES IN EARLY CHILDHOOD** **Room D1**

Chairperson(s): Coral Campbell; Discussant: Coral Campbell

PREPARING PRE-SERVICE TEACHERS TO PROMOTE STEM ACTIVITIES IN PRESCHOOL CLASSROOMS WITH SCRATCHJR

Michail Kalogiannakis; Stamatios Papadakis
University of Crete

INTERSUBJECTIVE COMMUNICATION AND DIGITALIZATION IN EARLY YEARS CHEMISTRY AND PHYSICS

Andreas Redfors¹; Marie Fridberg²; Agneta Jonsson¹; Susanne Thulin¹
¹Kristianstad University; ²Kristianstad University

CREATIVITY AND CODING IN EARLY CHILDHOOD EDUCATION

Karen Murcia¹; Coral Pepper¹; Mathilda Joubert²
¹Curtin University; ²SHERIDAN COLLEGE

UNPLUGGED PROGRAMMING IN EARLY CHILDHOOD: THE POSSIBILITIES?

George Aranda; Joseph Ferguson
Deakin University

09:00 - 11:00 **Invited Symposium 11 - SIG 4 - PREDICTION AND ADAPTION IN SCIENCE|ENVIRONMENT|HEALTH CONTEXTS** **Room D2**

Chairperson(s): Albert Zeyer; Discussant: Alla Keselman

A DUAL-PROCESS APPROACH TO SCIENTIFIC LITERACY: PREDICTIVE AND ADAPTIVE RATIONALITY

Albert Zeyer
Bern University of Applied Sciences

PUPILS' PERCEPTIONS ABOUT THE CONSEQUENCES OF THEIR SUSTAINABILITY-RELEVANT BEHAVIOUR

Deidre Bauer¹; Julia Arnold²; Kerstin Kremer¹
¹IPN - Leibniz Institute for Science and Mathematics Education, Kiel, Germany; ²FHNW University of Applied Sciences and Arts Northwestern Switzerland

CAN PRE-SERVICE TEACHERS' PERCEPTION OF ALLERGIC STUDENTS' QUALITY OF LIFE BE A PREDICTOR OF THEIR ADAPTATION IN FUTURE PROFESSION?

Iztok Devetak¹; Sonja Posega Devetak²; Tina Vesel Tajnsek³
¹University of Ljubljana, Faculty of Education, Ljubljana, Slovenia; ²General and teaching hospital Izola, Department of pediatrics, Izola, Slovenia; ³University Children's Hospital, Department of Allergology, Rheumatology and Clinical Immunology, Lju

DEVELOPMENT OF ADAPTIVE DIDACTIC RESOURCES FOR DECISION-MAKING ON ENVIRONMENTAL HEALTH PROBLEMS. FIRST STEP: CURRICULAR ANALYSIS

Gavidia Valentin; Álvaro Nuria; Olga Mayoral
Universitat de València

09:00 - 11:00 **Invited Symposium 12 - SIG 5 - ENGAGING WITH ISSUES OF CULTURE AND POWER WITHIN SCIENCE IDENTITIES RESEARCH (SCIENCE IDENTITIES SIG SYMPOSIUM)** **Room D3**

Chairperson(s): Louise Archer, Henriette Tolstrup Holmegaard; Discussant: Anders Johansson

ISSUES OF CULTURE, POWER, AND IDENTITIES FOR U.S. SCIENCE EDUCATORS

Mary Atwater
University of Georgia, USA

"I AM A YOUNG IMMIGRANT WOMAN DOING PHYSICS AND ON TOP OF THAT I AM MUSLIM": IDENTITIES AS COALITIONS

Lucy Avraamidou
University of Groningen

CULTURED IDENTITIES: A SOCIOLOGICAL ANALYSIS OF HOW THE CULTURE OF SCHOOL PHYSICS SHAPES STUDENTS' VIEWS OF ADVANCED PHYSICS AS 'NOT FOR ME'

Louise Archer
UCL Institute of Education

NAVIGATING SCIENCE IDENTITIES ACROSS CULTURAL CONTEXTS - TRANSITIONS, CULTURE AND NEGOTIATIONS

Lena Moller Madsen; Henriette Tolstrup Holmegaard
University of Copenhagen

09:00 - 11:00 **Invited Symposium 08 - CROSSING BOUNDARIES - EXAMINING AND PROBLEMATIZING INTERDISCIPLINARITY IN SCIENCE EDUCATION** **Room E2 - Italia**

Chairperson(s): Shulamit Kapon; Discussant: Sibel Erduran

LEARNING PHYSICS THROUGH MAKER PROJECTS — BETWEEN DISCIPLINARY AUTHENTICITY AND PERSONAL RELEVANCE

Maayan Schvartzer¹; Tal Peer²; Shulamit Kapon¹
¹Technion - Israel Institute of Technology; ²Acheret Center

INTERDISCIPLINARITY IN STEM AS BOUNDARY PLAY

Pratim Sengupta; Marie-Claire Shanahan
University of Calgary

SLIPPING BETWEEN DISCIPLINES: HOW FORMING CAUSAL EXPLANATIONS MAY COMPEL CROSSING DISCIPLINARY BOUNDARIES

Sharon T. Levy¹; Asnat R. Zohar¹; Ilana Dubovi²
¹University of Haifa; ²Ben-Gurion University

DISCIPLINES AND INTERDISCIPLINARITY IN STEM EDUCATION TO FOSTER SCIENTIFIC AUTHENTICITY AND DEVELOP EPISTEMIC SKILLS

Laura Branchetti¹; Olivia Levrini²
¹University of Parma; ²University of Bologna

09:00 - 11:00 **Symposium 37 - USE OF VISUAL REPRESENTATIONS IN ASTRONOMY EDUCATION: ISSUES, AFFORDANCES AND RESEARCH PERSPECTIVES** **Room F1**

Chairperson(s): **Italo Testa**; **Discussant:** **Kristina Zuza**

VISUALISATION AND SPATIAL THINKING IN PRIMARY (ELEMENTARY) STUDENTS' UNDERSTANDINGS OF ASTRONOMY

Russell Tytler¹; Peta White¹; Joanne Mulligan²
¹Deakin University; ²Macquarie University

STUDENTS' CONCEPTUAL UNDERSTANDINGS ENHANCED THROUGH TECHNOLOGY INSTRUCTION AND VISUALIZATIONS

Kathy Cabe Trundle¹; Mesut Saçkes²
¹Utah State University, US; ²Balıkesir University, Turkey

EXTRAPOLATION OF 3D AND ITS IMPORTANCE FOR TEACHING AND LEARNING PHYSICS AND ASTRONOMY - AN EXAMPLE FROM ASTROPHYSICS

Urban Eriksson
 National Resource Center for Physics Education, Department of Physics, Lund university, Lund, Sweden

COMPARING THE EFFECTS OF TEXTBOOK AND INNOVATIVE VISUAL REPRESENTATIONS ON STUDENTS' CONCEPTUALIZATION OF FAMILIAR ASTRONOMY PHENOMENA

Italo Testa¹; Silvia Galano¹; Arturo Colantonio²; Emanuella Puddu³; Silvio Leccia³
¹Federico II University; ²School of Science and Technology, Physics Division, University of Camerino, Italy; ³INAF - Astronomical Observatory of Capodimonte, Naples, Italy

09:00 - 11:00 **Symposium 02 - KNOWLEDGE FORMS AND TRANSFER IN SCIENCE EDUCATION** **Room F2**

Chairperson(s): **Nina Bonderup Dohn**; **Discussant:** **Andr e Tiberghien**

THE CONTEXT-DEPENDENCE OF KNOWLEDGE FORMS IN SCIENCE EDUCATION - A PHILOSOPHICAL ANALYSIS

S ren Harnow Klausen; Nina Bonderup Dohn
 University of Southern Denmark

REAL EXPERIMENTS, COMPUTER SIMULATIONS AND MODELING: ACHIEVING SYNERGIES BETWEEN FORMS OF KNOWLEDGE IN AN ELECTRIC CIRCUIT THEORY LAB

Jonte Bernhard¹; Anna-Karin Carstensen²
¹Link ping Universitet; ²J nk ping University

CONCEPTUAL PROBLEMS IN TRANSFORMATION OF KNOWLEDGE BETWEEN DISCIPLINES: REACTION KINETICS

Michael May
 University of Southern Denmark

POSITIONING STUDENTS TO DEVELOP AND TRANSFORM KNOWLEDGE IN INQUIRY-BASED VERSUS COOK-BOOK LABORATORY WORK

Nina Bonderup Dohn¹; Niels Bonderup Dohn²
¹University of Southern Denmark; ²Aarhus University

09:00 - 11:00 **Symposium 39 - ARGUMENTATION AS AN EPISTEMIC PRACTICE** **Room F3**

Chairperson(s): **Manuel Bächtold**; **Discussant:** **Kalypso Iordanou**

DIFFERENTIATING POINTS OF VIEW AND KNOWLEDGE IN PERSONAL EPISTEMOLOGY: TOWARDS A BETTER UNDERSTANDING OF ARGUMENTATION

K vin De Checchi¹; Manuel Bächtold¹; Val rie Tartas²
¹University of Montpellier; ²University Jean Jaur s Toulouse

EPISTEMIC AIMS AND RELIABLE PROCESSES IN ARGUMENTATION: DISCUSSING THE ACCEPTABILITY OF DIETS

Pablo Brocos Mosquera¹; Maria Pilar Jim nez-Aleixandre¹; Michael Baker²
¹University of Santiago de Compostela; ²CNRS - T l com ParisTech

ARGUING TO EXPLAIN THE EVOLUTIONARY LINKS BETWEEN TWO HUMAN DISEASES: A CASE STUDY RESEARCH

Noa Ageitos¹; Blanca Puig Mauriz¹; Laura Colucci-Gray²
¹University of Santiago de Compostela; ²The University of Edinburgh

DEVELOPING ARGUMENTATIVE SKILLS WITH COMPUTER-MEDIATED DEBATES ON SOCIO-SCIENTIFIC ISSUES

Gabriel Pallarès; Manuel Bächtold; Valérie Munier
 University of Montpellier

09:00 - 11:00 **Symposium 49 - UNDERSTANDING THE ROLE OF COHERENT SCIENCE TEACHER EDUCATION IN PROMOTING COHERENT SCIENCE INSTRUCTION: INSIGHTS FROM AN INTERNATIONAL COLLABORATION** **Room G1**

Chairperson(s): Jeffrey Nordine; Discussant: Amanda Berry

PROMOTING COHERENT SCIENCE INSTRUCTION THROUGH SCIENCE TEACHER EDUCATION

Jeffrey Nordine¹; Ibrahim Delen²; Robert Evans³; Kalle Juuti⁴; Jari Lavonen⁴; Pernilla Nilsson⁵; Mathias Ropohl⁶; Matthias Stadler⁷

¹Leibniz Institute for Science and Mathematics Education (IPN) at Kiel University; ²Usak University; ³University of Copenhagen; ⁴University of Helsinki; ⁵Halmstad University; ⁶University of Duisberg-Essen; ⁷University of Bergen

COHERENCE IN SCIENCE TEACHER EDUCATION: SUPPORTING PRESERVICE TEACHERS' USE OF DIGITAL TECHNOLOGIES IN SCIENCE

Pernilla Nilsson; Pernilla Granklint Enochson; Mattias Rundberg
 Halmstad University

COHERENCE IN SCIENCE TEACHER EDUCATION: A CASE STUDY IN FINNISH TEACHER EDUCATION

Kalle Juuti; Jari Lavonen; Johanna Jauhainen; Timo Kärkkäinen
 University of Helsinki

TRANSITION FROM UNIVERSITY TO SCHOOL-BASED TEACHER EDUCATION

Mathias Ropohl¹; Robert Evans²; Jakob Rasmus Holm²; Jenny Lorentzen³

¹University of Duisburg-Essen; ²University of Copenhagen; ³IPN - Leibniz Institute for Science and Mathematics Education

09:00 - 11:00 **Symposium 50 - ADDRESSING DIVERSITY IN SCIENCE - REQUIREMENTS, CHALLENGES, METHODS** **Room G2**

Chairperson(s): Stefan Sorge; Discussant: Gillian Roehrig

SAME SAME BUT DIFFERENT? UNDERSTANDING DIFFERENCES IN TEACHERS' DIVERSITY-RELATED BELIEFS AND SELF-EFFICACY

Alice Langhans; Stefan Sorge; Katrin Engeln; Knut Neumann
 Leibniz Institute for Science and Mathematics Education at Kiel University

TEACHING SCIENCE IN MULTICULTURAL CLASSROOMS: CHALLENGES AND OPPORTUNITIES FOR INTERCULTURAL LEARNING

Josette Farrugia
 University of Malta

MAKING USE OF CONTEXTS AND INQUIRY TO ENGAGE ALL STUDENTS IN STEM LEARNING

Marta Romero Ariza; Ana María Abril Gallego; Antonio Quesada Armenteros
 University of Jaén

CLASSROOM INTERACTIONAL MANAGEMENT IN ACHIEVEMENT-RELATED DIVERSITY SCIENCE AND MATH CLASSROOMS

Gökhan Kaya¹; Metin Şardağ²; Gültekin Cakmakci³

¹Kastamonu University; ²Van Yüzüncü Yıl University; ³Hacettepe University

09:00 - 11:00 **Symposium 52 - CAREER-BASED SCENARIOS PROMOTING STUDENTS CAREER AWARENESS AND INTEREST TOWARDS SCIENCE — THE MULTICO PROJECT** **Room G4**

Chairperson(s): Tuula Keinonen, Costas Constantinou; Discussant: Jari Lavonen

USING A PHYSICS BASED CAREER SCENARIO TO PROMOTE FEMALE STUDENTS' INTEREST IN PHYSICS AND PHYSICS CAREERS

John Connolly; Shirley Simon
 University College London

ESTABLISHING RELEVANCE OF SCIENCE LEARNING THROUGH CAREER-BASED SCENARIOS

Miia Rannikmäe; Regina Soobard; Klaara Kask
University of Tartu

STRENGTHENING STUDENTS' INTEREST IN SCIENCE: THE CASE OF 'SAVING THE POLAR BEARS'

Irene Drymiotou; Costas Constantinou
University of Cyprus

FOSTERING STUDENTS' INTEREST IN SCIENCE: THE ROLE OF VISITS TO AUTHENTIC WORKPLACES AND CONTACT TO SCIENCE EXPERTS

Lara Weiser; Annette Scheerso
University of Bonn

09:00 - 11:00 Symposium 01- EVOLUTION EDUCATION RE-CONSIDERED Room G5

Chairperson(s): Michael Reiss; Discussant: Ute Harms

LEARNING EVOLUTION ALONG A LEARNING PROGRESSION - LONGTERM CASE-STUDIES FROM AUSTRIA

Heidemarie Amon¹; Jaqueline Scheibstock²; Martin Scheuch³
¹Universität Wien AECC; ²Universität Wien AECC-Bio; ³University College for Agricultural and Environmental Education

BRIDGING THE GAP TOWARDS FLYING: ARCHAEOPTERYX AS A UNIQUE INQUIRY-BASED LEARNING MODULE

Franz Bogner
University of Bayreuth

UNDERSTANDING EVOLUTION 5-14: PRACTICAL GUIDANCE AND THEORETICAL REFLECTIONS

Terry Russell
University of Liverpool

MODELS AND MODELING IN EVOLUTION

Anita Schuchardt¹; Kathy Malone²
¹University of Minnesota; ²Nazarbayev University

THURSDAY 15:00 - 16:30

15:00 - 16:30 OP71 - STRAND 13 - PRE-SERVICE TEACHER EDUCATION STRATEGIES Room A1

Chairperson(s): Teresa Conceição

PLANNING SCIENCE LESSONS WITH CONCEPTUAL INSTRUCTION MAPS

Christoph Gut¹; Maja Brückmann²
¹Zurich University of Teacher Education; ²University of Oldenburg

PRESERVICE SCIENCE TEACHERS' USE OF VISUAL REPRESENTATIONS WHEN COMMUNICATING SCIENCE INFORMATION

Christine Tippet¹; William McClune²
¹University of Ottawa; ²Queens University, Belfast

SCIENCE TEACHERS' VIEWS ON COTEACHING WITH SCIENCE TEACHER EDUCATORS IN PRESERVICE TEACHER EDUCATION

Karen Marangio; Rebecca Cooper; Amanda Berry
Monash University

LESSON STUDY AS A PROFESSIONAL DEVELOPMENT MODEL TO PROMOTE PRE-SERVICE PHYSICS AND CHEMISTRY TEACHERS' LEARNING ABOUT MULTIPLE REPRESENTATIONS

Teresa Conceição; Mónica Baptista; João Pedro da Ponte
University of Lisbon, Institute of Education

15:00 - 16:30 OP72 - STRAND 13 - PRE-SERVICE TEACHERS ENGAGING IN MODELING IN SCIENCE Room A2

Chairperson(s): Siv G. Aalbergsjø

MODELING AND DEVELOPMENT OF CONTENT KNOWLEDGE AND ITS IMPORTANCE FOR EXPLAINING PHYSICS

Patrick Enkrott¹; David Buschhüter¹; Andreas Borowski²
¹University of Potsdam; ²Universität Potsdam

A CASE STUDY EXAMINING HOW DIFFERENT PATHWAYS TO PRIMARY TEACHING EXPERIENCE SCIENTIFIC MODELING

Tina Vo¹; Thomas (TJ) McKenna²

¹University of Nevada-Las Vegas; ²Boston University, Boston, Massachusetts, USA

DEVELOPING A TYPOLOGY OF PRE-SERVICE SCIENCE TEACHERS' MODELLING STRATEGIES

Maximilian Göhner; Moritz Krell

Freie Universität Berlin

STUDENT TEACHERS' VIEWPOINTS ON WORKING WITH MODELS AND MODELLING IN CHEMISTRY

Siv G. Aalbergsjø; Per Øyvind Dokken Sollid

OsloMet - Oslo Metropolitan University

15:00 - 16:30

OP73 - STRAND 2 - SELF-PERCEPTION AND SOCIAL ISSUES IN SCIENCE LEARNING

Room B1

Chairperson(s): Kristie Gutierrez

PSYCHOLOGICAL PATTERNS IN CHEMISTRY SELF-CONCEPT: RELATIONS WITH GENDER AND CULTURE

Lilith Rüschenpöhler; Silvija Markic

Ludwigsburg University of Education

A METACOGNITIVE ACTIVITY TO TEACH ABOUT THE AMOUNT OF SUBSTANCE CONCEPT USING SELF-QUESTIONING STRATEGY

JADIS H. PICIRILLI SILVA; SOLANGE LOCATELLI

Federal University of ABC

OUTREACH ACTIVITIES FOR YOUTH IN A RESEARCH UNIVERSITY — THE PARTICIPANTS VIEWS

Efrat Nativ Ronen; Tali Tal

Technion Israel Institute of Technology

LEADING FAMILIES TO STEM WITH EXTRA SCHOOL LEARNING

Kristie Gutierrez¹; Margaret Blanchard²

¹Old Dominion University; ²North Carolina State University

15:00 - 16:30

OP141 - STRAND 2 - LABORATORY, HANDS-ON ACTIVITIES AND SKILLS DEVELOPMENT

Room B2

Chairperson(s): Martina Nieswandt

HOW CAN SCIENCE INQUIRY ENCOURAGE SOCIAL COHESION?

Alberto Bellocchi

Queensland University of Technology

PROBING CONCEPTUAL LEARNING DURING PRACTICAL WORK IN CHEMISTRY — A CASE STUDY

Ylva Pamment

Department of Educational Sciences, Lund Universitet

EXPERIMENTING WITH PROMPTS VS. RECIPE-STYLE EXPERIMENTING: IMPACT ON MOTIVATION AND ACHIEVEMENT

Cornelia Stiller; Matthias Wilde

Bielefeld University

AFFECT — A VITAL COMPONENT FOR MEANINGFUL ENGAGEMENT IN HIGH SCHOOL BIOLOGY INQUIRY AND ENGINEERING DESIGN GROUP ACTIVITIES

Martina Nieswandt¹; Elizabeth McEneaney²

¹University of Massachusetts Amherst; ²University of Massachusetts, Amherst

15:00 - 16:30

OP75 - STRAND 8 - OUT-OF-SCHOOL EXPERIENCES

Room B3

Chairperson(s): Yelva Larsen

CONTROVERSIES RELATED TO BIODIVERSITY IN MUSEUM'S AUDIENCE PERSPECTIVE

Iohana Barbosa Pereira; Martha Marandino

Universidade de São Paulo

EFFECTS OF AUTHENTICITY AT OUT OF SCHOOL LEARNING OFFERS ON SCIENTIFIC UNDERSTANDING AND SYSTEMS THINKING SKILLS OF SECONDARY LEVEL ONE STUDENTS

Daniela Schriebl¹; Andreas Müller²; Nicolas Robin¹

¹PHSG; ²University of Geneva

CITIZEN SCIENCE SUPPORTED: A LEARNER-ORIENTATED INTERACTIVE BUMBLEBEE IDENTIFICATION TOOL

Jorge Gross; Yelva Larsen; Jürgen Paul
University of Bamberg

EXPERIENCE-BASED LEARNING: A FEARLESS CONTACT WITH HONEYBEES AS IMPORTANT POLLINATORS

Yelva Larsen; Jürgen Paul; Jorge Groß
Bamberg University

15:00 - 16:30 **OP76 - STRAND 9 - LEARNING OUTSIDE THE CLASSROOM II** **Room B4**

Chairperson(s): Ingrid Eikeland

WHAT DO THE FUTURE TEACHERS TEACH WHEN MAKING A BIOLOGY FIELD TRIP? A STUDY IN SOUTHERN COLOMBIA

Elias Francisco Amortegui¹; Valentin Gavidia Catalan²; Olga Mayoral García-Berlanga²
¹Universidad Surcolombiana; ²Universidad de Valencia

INTERACTIONS OF KNOWLEDGE ACROSS FIELD AND CLASSROOM SETTINGS

Michael Giamellaro
Oregon State University

ECOLOGICAL LITERACY IN FIELDWORK — TEACHING LEARNING AND MATERIALITY

Kristin Persson; Maria Andrée; Cecilia Caiman
MND, Stockholm University

STUDENTS ENGAGING IN A CONTROVERSY-BASED EDUCATIONAL PROGRAMME ABOUT BACTERIAL RESISTANCE IN A SCIENCE CENTRE

Ingrid Eikeland¹; Merethe Frøyland²
¹Norwegian University of Life Sciences; ²Norwegian Centre for Science Education

15:00 - 16:30 **OP77 - STRAND 9 - LEARNING AT SCIENCE MUSEUMS** **Room B5**

Chairperson(s): Patricia Patrick

THE IMPACT OF SCHOOL VISITS TO A SCIENCE MUSEUM ON STUDENT SCIENCE IDENTITY: A LONGITUDINAL STUDY

Neta Shaby¹; Dana Vedder Weiss²
¹Ben Gurion University of the Negev; ²Ben Gurion university of the Negev

DEVELOPMENT AND EVALUATION OF A NON-FORMAL ENVIRONMENTAL EDUCATION PROGRAM AT THE LOCAL PALEONTOLOGICAL MUSEUM

Marianna Kalaitzidaki; Nektaria Karagianni
University Of Crete, Primary Education

A RESEARCH ON SCIENCE LEARNING EXPERIENCE OF ADULTS IN THE CONTEXT OF SCIENCE MUSEUM

Songyi Heo¹; Sung-Won Kim²
¹Ewha Womans University, Seoul Science Center; ²Ewha Womans University

FAMILIES TALKING ABOUT STINGRAYS: DETERMINING THE LEVEL OF CONVERSATION COMPONENTS AT A STINGRAY TOUCH TANK

Patricia Patrick
Columbus State University

15:00 - 16:30 **OP78 - STRAND 12 - VIEWS ABOUT SCIENTISTS** **Room B6**

Chairperson(s): Katrin Hochberg

MIDDLE SCHOOL GIRLS IN A SCIENTIFIC CONTEXT AND THEIR CONCEPTION ABOUT SCIENTISTS: WHAT CAN BE LEARNED?

Maria Inês Ribas Rodrigues¹; Diana Ribas Rodrigues²; Camila Sgnori³
¹Federal University of ABC; ²Federal University of ABC - UFABC; ³University of São Paulo - USP

THE ANALYSIS OF THE IMAGE OF SCIENTISTS PORTRAIT IN THE TURKISH BIOLOGY TEXTBOOKS IN TERMS OF GENDER BIAS

cicek dilek Bakanay
Istanbul Aydin University

INTERACTION BETWEEN INTEREST AND SELF-CONCEPT IN PREDICTING SCIENCE CAREER ASPIRATIONS

Jingoo Kang; Ilpo Jäppinen; Anssi Salonen; Tuula Keinonen
University of Eastern Finland

WHAT DO SCIENTISTS DO? – INCREASING AWARENESS OF SOCIAL AND NETWORKING ASPECTS IN EVERYDAY ACTIVITIES OF SCIENTISTS TEACHING SPIN AND MAGNETISM PHENOMENA IN SCHOOL LABS

Katrin Hochberg; Jochen Kuhn
TU Kaiserslautern

15:00 - 16:30 **OP79 - STRAND 12 - EXPLORATIONS OF PRIVILEGE AND CULTURE** **Room B7**

Chairperson(s): Silvija Markic

MULTICULTURAL ENVIRONMENTAL EDUCATION - INSIGHTS FROM A PIONEERING ULTRAORTHODOX CITY IN ISRAEL

Daphne Goldman¹; Iris Alkaber²
¹Beit Berl College; ²Kibbutzim College of Education, Technology and The Arts

SCIENCE EDUCATION FOR REFUGEE STUDENTS – IMPLEMENTATION, PERCEPTION AND IMPLICATIONS

Mario Schmiedebach; Claas Wegner
Bielefeld University

MAKING PRIVILEGE THROUGH STEM EDUCATION

Majd Zouda
OISE, University of Toronto

TEACHERS' BELIEFS ABOUT THE ROLE OF CULTURE IN CHEMISTRY LEARNING

Silvija Markic¹; Lilith Rüschenpöhler¹; Marlon Schneider²
¹Ludwigsburg University of Education; ²University of Bremen

15:00 - 16:30 **OP80 - STRAND 7 - EXPERIMENTATION, DATA EVALUATION, AND ARGUMENTATION** **Room C1**

Chairperson(s): Jorunn Grip

STUDENTS' RESPONSES TO ANOMALOUS DATA AND CONCEPTUAL UNDERSTANDING

Ana Elisa Montebelli Motta¹; Caio Castro Freire²; Marcelo Tadeu Motokane²
¹Postgraduate Program in Science Teaching, University of São Paulo; ²Faculty of Philosophy, Sciences and Letters of Ribeirão Preto, University of São Paulo

STUDENTS' EXPLANATIONS AND ARGUMENTS WHEN USING FIRST OR SECOND-HAND DATA

Maíra Batistoni e Silva; Silvia Frateschi Trivelato
Universidade de São Paulo

GROUP DIALOGUES IN NORWEGIAN PHYSICS CLASSROOMS

Jorunn Grip; Arne Stormo
NTNU - Norwegian University of Science and Technology

15:00 - 16:30 **OP81 - STRAND 4 - INTERACTIVE MATERIALS AND GAMES IN PHYSICS AND CHEMISTRY** **Room D1**

Chairperson(s): Sandhya Krishnan

LEARNING CHEMISTRY THROUGH CONCEPT MAP WITH CLICKABLE DIGITAL RESOURCES (HYPERMEDIA MAP)

Joana Aguiar; Paulo Correia
Universidade de São Paulo

THE DESIGN AND EVALUATION OF DIGITAL MATERIALS TO INTRODUCE QUANTUM PHYSICS AT UPPER SECONDARY SCHOOL

Tim Bouchée; Lesley de Putter-Smits; Marieke Thurlings; Birgit Pepin
Eindhoven University of Technology

APPROACHING MODERN PHYSICS THROUGH A VIDEOGAME

Maria Guida¹; Alessia Giampaoli²; Lisa Lazzarato³
¹INDIRE; ²LNGS-INFN; ³Formicablu srl

PRODUCTIVE NEGATIVITY UNDERLYING FORMATIVE ASSESSMENT IN GAME-BASED LEARNING OF SCIENCE

Sandhya Krishnan; Georgia Hodges
The University of Georgia

15:00 - 16:30 OP192 - STRAND 11 - ASSESSING STUDENTS' INTEREST Room D3

Chairperson(s): Daniel Morin Ocampo

STUDENTS' CONTEXTUAL INTERESTS IN DIFFERENT SCIENCE SUBJECT-BASED CONTENT

Moonika Teppo; Regina Soobard; Miia Rannikmäe
University of Tartu

IDENTIFICATION OF CHEMISTRY CONTEXTS THAT INTEREST GREEK STUDENTS

Katerina Salta¹; Dionysios Koulougliotis²
¹National and Kapodistrian University of Athens; ²Ionian University

BOOSTING ENJOYMENT AND INTEREST BUT NOT NECESSARILY ACHIEVEMENT: THE EFFECTS OF INQUIRY-BASED SCIENCE EDUCATION ON STUDENT OUTCOMES

Christian Bertsch¹; Silvia Salchegger²; Christina Wallner-Paschon²
¹University of Teacher Education Vienna; ²BIFIE - Bundesinstitut für Bildungsforschung, Innovation & Entwicklung des österreichischen Schulwes

THE DIFFERENT TYPOLOGIES DESCRIBING THE INTEREST OF BRAZILIAN YOUTH IN SCIENCE

Daniel Morin Ocampo¹; Eliziane da Silva Dávila²; Luiz Caldeira Brant Tolentino-Neto¹; Cirlande Cabral da Silva³
¹UFSM; ²IFFAR; ³IFAM

15:00 - 16:30 OP38 - STRAND 1 - SCIENTIFIC UNDERSTANDING AND LEARNING WITH CHILDREN Room E2 - Italia

Chairperson(s): Ala a Samarapungavan

FOSTERING DIVERSITY AND CULTURAL AWARENESS EMANATED FROM LEARNING ONE'S CONTEXT

Lamprini Chartofylaka; Thomas Forissier
Université des Antilles

USING A COGNITIVE SCIENCE FRAMEWORK TO EXPLAIN ACHIEVEMENT EFFECTS RESULTING FROM INTEGRATING LITERACY WITHIN SCIENCE IN GRADES 1-2

Nancy Romance; Michael Vitale
Florida Atlantic University

NEW PERSPECTIVES ON STUDENTS' MODELS OF AN ABSTRACT CONCEPT: THE CASE OF THE 'ABSENT' LIGHT

Kalliopi Paridi
University of Cyprus

KINDERGARTENER'S EMERGING PARTICLE MODELS OF MATTER TO EXPLAIN MATERIAL PHENOMENA

Ala Samarapungavan; Lynn Bryan
Purdue University

15:00 - 16:30 IW01 - Invited Workshop - GETTING YOUR IDEAS INTO PRINT: PLANNING, DEVELOPING AND PUBLISHING A BOOK IN THE ESERA SERIES Room F1

Chairperson(s): Claudia Acuna, Robin Millar

15:00 - 16:30 OP83 - STRAND 1 - ECOLOGICAL AND ENVIRONMENTAL EDUCATION Room F2

Chairperson(s): Barnd Unger

STUDENTS' MEANING MAKING IN ECOLOGY EDUCATION

Hanna Wanselin; Brita Johansson Cederblad; Lena Wennersten; Mats Lindahl; Susanne Wikman
Linnaeus

THE WATER CYCLE: AQUIFERS AND UNDERGROUND WATERS POLLUTION MODELLING.

Maria Roser Nebot; Conxita Márquez
Universidad Autónoma de Barcelona

STUDENT' CONCEPTIONS ABOUT THE DRIVERS AND CONSEQUENCES OF GLOBAL CHANGE

Irene Lampert; Kai Niebert
University of Zurich

GRANDMA JOHNSON REVISITED — PRE-SERVICE TEACHERS METAPHORICAL UNDERSTANDING OF DECOMPOSITION

Barnd Unger
Leibniz Universität Hannover

15:00 - 16:30 OP84 - STRAND 15 - EMOTIONAL ENGAGEMENT, INTEREST AND MOTIVATION IN EARLY CHILDHOOD SCIENCE Room F3

Chairperson(s): Maria Kallery

DRAMATIC INQUIRY, ENGINEERING DESIGN CHALLENGES AND INTEGRATED STEAM: EFFECTS ON EARLY CHILDHOOD COGNITION AND INTEREST IN ENGINEERING AND TECHNOLOGY

Kathy Malone¹; Karen Irving²; Vinta Tiarani²; Rachel Kajfez²; Hochieh Lin²; Trudy Giasi²; Brian Edmiston²
¹Nazarbayev University; ²The Ohio State University

EMOTIONAL ENGAGEMENT IN THE APPLICATION OF EXPERIMENTAL ACTIVITIES WITH EARLY CHILDRENS

Kellys Saucedo; Mauricio Pietrocola
 Faculty of Education - University of Sao Paulo

FOSTERING ENJOYMENT IN SCIENCE EDUCATION THROUGH DRAMA ACTIVITIES IN SCIENCE BIRTHDAYS

Jaakko Turkkka; Maija Aksela
 University of Helsinki, Department of Chemistry

COGNITIVE STYLE AND MOTIVATION AND LEARNING IN INQUIRY BASED EARLY-YEARS SCIENCE ACTIVITIES

Maria Kallery¹; Agelos Sofianidis¹; Popi Patonioti²; Kaliopi Tsialma³; Xristina Katsiana²
¹Aristotle University of Thessaloniki; ²Pre-primary Education; ³Primary Education

15:00 - 16:30 OP85 - STRAND 13 - METHODS OF SCIENCE TEACHING - COURSES AND SKILLS Room G1

Chairperson(s): Jan Schröder

PRACTICE TEACHERS' VIEWS AND EXPERIENCES OF RESEARCH-BASED SCIENCE TEACHER EDUCATION — A CASE WITHIN INITIAL TEACHER EDUCATION IN NORWAY

Katarina Pajchel; Kirsti Jegstad; Gunilla Eklund; Siv G. Aalberg^{sjo}; Per Øyvind Dokken Sollid
 OsloMet - Oslo Metropolitan University

DEVELOPMENT OF AN ASSESSMENT OF ATTENTIVENESS FOR SCIENCE TEACHER PROGRAM EVALUATION

Leslie Atkins; Michele Carney; Sara Hagenah; Tatia Totorica
 Boise State University

EFFECT OF INTERACTIVE PRACTICUM COURSE ON SCIENCE TEACHING PRACTICES OF PRE-SERVICE SCIENCE TEACHERS

IYAD DKEIDEK¹; IYAD DKEIDEK²
¹Al-Qasimi Academic College for teachers; ²Al-Quds University

ASSESSING STUDENT TEACHERS' SKILLS TO PLAN PHYSICS LESSONS

Jan Schröder¹; Christoph Vogelsang²; Josef Riese¹
¹RWTH Aachen University; ²Universität Paderborn

15:00 - 16:30 OP86 - STRAND 13 - PEDAGOGICAL CONTENT KNOWLEDGE V Room G2

Chairperson(s): Vesna Ferk Savec

TEACHING KNOWLEDGE RELATED TO SCIENTIFIC PRACTICES: A REFLECTION FROM THE HISTORY OF PCK

Stefannie Ibraim¹; Rosária Justi²
¹Universidade de Brasília; ²Universidade Federal de Minas Gerais

DEVELOPMENT OF PROSPECTIVE PHYSICS TEACHERS' PCK WHILE PREPARING TO A TEACHING PRACTICE

Ann-Kathrin Joswig; Josef Riese
 RWTH Aachen University

TRACKING EFFECT OF PEDAGOGICAL TRANSFORMATION OF CONTENT KNOWLEDGE ON LEARNER PERFORMANCE: A JOURNEY FROM TSPCK INTERVENTION TO LEARNER PERFORMANCE

Olutosin Solomon Akinyemi; Elizabeth Mavhunga
 University of the Witwatersrand

THE IMPLEMENTATION OF TPACK AND SAMR MODELS IN SCIENCE TEACHER TRAINING PROGRAMS AT THE UNIVERSITY OF LJUBLJANA

Vesna Ferk Savec; Spela Hrast
 University of Ljubljana, Faculty of Education

15:00 - 16:30 OP87 - STRAND 13 - PERCEPTIONS OF STEM

Room G3

Chairperson(s): **Mónica Baptista**

SINGAPOREAN PRE-SERVICE TEACHERS' PERCEPTIONS ON STEM EDUCATION

Dominic Koh; Aik Ling Tan
National Institute of Education

PERCEIVED RELEVANCE OF PHYSICS CONTENT KNOWLEDGE - PERSONAL CONSTRUCTS

Joost Massolt; Andreas Borowski
University of Potsdam

REVEALING PRE-SERVICE TEACHERS' MIND MAPS ON STEM EDUCATION THROUGH STEM IMAGES

Aslı Koçulu; Şefika Girgin; Ünsal Umdü Topsakal
Yıldız Technical University

PROSPECTIVE PHYSICS AND MATHEMATICS TEACHERS' PERSPECTIVES ABOUT STEM INTEGRATION

Mónica Baptista; Ana Henriques; Hélia Oliveira
Instituto de Educação da Universidade de Lisboa

15:00 - 16:30 OP88 - STRAND 14 - DESCRIBING AND ASSESSING TEACHING PERFORMANCE

Room G4

Chairperson(s): **Simon Taylor**

WHAT MAKES A GOOD PHYSICS TEACHER? THE SHARED VISION OF FINNISH TEACHER EDUCATORS.

John Airey¹; Lotta Jons¹; Mats Braskén²
¹Department of Mathematics and Science Education, Stockholm University; ²Åbo Akademi University

EVOLVING NATURE OF TEACHING PRACTICES OF AN EXPERIENCED PRIMARY SCHOOL SCIENCE TEACHER

Deya Chakraborty¹; Saroj Kumar Sanyal²; Gillian Kidman¹; Niranjana Casinader¹
¹Monash University; ²Ichamati Government Primary School

SCIENCE AND MATH TEACHERS PERFORMANCE ASSESSMENT TO DEVELOP PERSONALIZED PROFESSIONAL LEARNING

Dace Namsonē¹; Pavels Pestovs¹; Ilze Saleniece²; Liga Cakane¹
¹University of Latvia; ²National Center for Education

ADOPTING KNOWLEDGE BUILDING PEDAGOGY TO SUPPORT EPISTEMIC AGENCY AND COLLABORATIVE CONTRIBUTION IN SCIENCE CLASSES: A CASE STUDY IN NEW ZEALAND SCHOOLS

Simon Taylor
University of Waikato

15:00 - 16:30 OP89 - STRAND 14 - INSTITUTIONAL CONTEXT AND SUPPORT FOR TEACHING

Room G5

Chairperson(s): **Paulo Sérgio Garcia**

TEACHERS' WORKING CONTEXT AND INQUIRY-BASED LEARNING DESIGN WORK DURING PROFESSIONAL DEVELOPMENT

Shani Zur; Rachel Levin Peled; Tali Tal
Technion - Israel Institute of Technology

TOWARDS A COGNITIVE BEHAVIOURAL INTERVENTION TO SUPPORT SCIENCE TEACHER WELLBEING

Richard Brock; Alex Manning; Emma Towers
King's College London

TEACH TO LEAD ... TO STAY?: EXAMINING THE IMPACT OF THE STRUCTURE AND NATURE OF NOYCE MASTER TEACHER FELLOWS' PROGRAM ON STEM TEACHER RETENTION

Brett A. Criswell¹; Gregory T. Rushton²; Katherine Sharp¹
¹Department of STEM Education, University of Kentucky; ²Tennessee STEM Education Center, Middle Tennessee State University

THE IMPACT OF LARGE SCALE ASSESSMENTS ON PROFESSIONAL DEVELOPMENT OPPORTUNITIES FOR ELEMENTARY SCIENCE TEACHERS IN BRAZIL AND CANADA

Paulo Sérgio Garcia¹; Xavier Fazio²
¹Universidade Municipal de São Caetano do Sul; ²University of Brock

15:00 - 16:30 **OP90 - STRAND 16 - CHILDREN IDEAS ABOUT SCIENCE AND SCIENTISTS/EPISTEMIC-EVERYDAY KNOWLEDGE** **Room G6**

Chairperson(s): Stephane Cyr

A SERIOUS GAME TO TEACH EPISTEMIC KNOWLEDGE: THE PLEASURE OF LEARNING TO THINK AND ACT LIKE A SCIENTIST

Angel Vazquez-Alonso¹; María-Antonia Manassero-Mas²; Antoni J. Bennàssar Roig²
¹University of Balearic Islands; ²University of the Balearic Islands

ELEMENTARY SCHOOL STUDENTS PLANNING AND CARRYING OUT INVESTIGATIONS: EPISTEMIC THINGS AND EXPERIMENTAL CONDITIONS

Lucia Sasseron
 University of São Paulo

'A SCIENTIST KNOWS WHAT S/HE'S DOING': EXPLORING THE EFFECT OF SCIENTIST-LED OUTREACH ON PRIMARY CHILDREN'S SCIENCE SELF-EFFICACY BELIEFS

Sarah Carroll¹; Veronica McCauley²; Muriel Grenon¹
¹School of Natural Sciences, National University of Ireland Galway; ²School of Education, National University of Ireland Galway

INTERDISCIPLINARITY MODEL FOR MATHEMATICS AND SCIENCE IN PRIMARY SCHOOL

Stephane Cyr¹; Simon Langlois²; Guillaume Poliquin³; Patrick Charland¹; Nathan Béchar¹; Andréane St-Hilaire⁴
¹Université du Québec à Montréal; ²Cégep Marie-Victorin; ³Collège Ahuntsic; ⁴Collège Maisonneuve

15:00 - 16:30 **OP91 - STRAND 17 - INTERACTIVE LEARNING ENVIRONMENTS AT UNIVERSITY LEVEL** **Room G7**

Chairperson(s): Nadja Belova

SUPPORTING THE UNDERSTANDING OF THE KEY CORE CONCEPTS OF ENGINEERING MECHANICS BY THE HELP OF INTERACTIVE ONLINE MODULES

Marcel Pelz¹; Martin Lang¹; Yasemin Özmen¹; Jörg Schröder¹; Felix Walker²; Ralf Müller²; Christopher Klupak²
¹University of Duisburg-Essen; ²Technical University of Kaiserslautern

EMERGENT LEARNING OF STEREOCHEMISTRY DURING ACTIVE ENGAGEMENT WITH MULTIMODAL SEMIOTIC RESOURCES

Susanne Wikman¹; Anne Linder²; Cedric Linder²
¹Linnaeus university; ²Uppsala University

DO GAMIFIED VIRTUAL LABORATORY SIMULATIONS LEAD TO AN INCREASE IN STUDENT KNOWLEDGE AND INTRINSIC MOTIVATION TO LEARN IN AN INTRODUCTORY BIOLOGY COURSE FOR NON-MAJORS?

Bina Rai; Chen Huei Leo
 Singapore University of Technology and Design

INNOVATING HIGHER EDUCATION VIA GAME BASED LEARNING ON MISCONCEPTIONS

Nadja Belova; Christian Zowada
 University of Bremen

15:00 - 16:30 **OP196 - STRAND 2 - CULTURAL DIFFERENCES, LANGUAGE AND ADULT EDUCATION** **Room G8**

Chairperson(s): Angela Stott

INTERNATIONAL STUDENTS' SOCIAL AND INTELLECTUAL INTEGRATION IN A STEM INITIAL TEACHER EDUCATION COURSE IN ENGLAND

Catarina Correia; Arthur Galamba
 King's College London

A TASK-SPECIFIC WARNING INTERVENTION IMPROVES ADULTS PERFORMANCE IN OVERCOMING INTUITIVE INTERFERENCE

Genevieve Allaire-Duquette; Reuven Babai; Ruth Stavv
 Tel Aviv University

A WORD-LEVEL ANALYSIS OF BARKING AT PRINT FOR ENGLISH SECOND LANGUAGE SCIENCE TEXTS

Angela Stott¹; Tanya Beelders²
¹University of the Free State South Campus; ²University of the Free State

ARE WE AFRAID OF INTERNATIONAL INSTRUCTORS? : EXAMINING EXPERIENCES OF INTERNATIONAL INSTRUCTORS AND THEIR STUDENTS' PERCEPTIONS ABOUT THEM

Banu Avsar Erumit¹; Valarie L. Akerson²; Gayle A. Buck²
¹Recep Tayyip Erdogan University; ²Indiana University

THURSDAY 17:00 - 18:30

17:00 - 18:30 OP117 - STRAND 13 - RESEARCH METHODS

Room A1

Chairperson(s): Tanwarat Pinthong

USING EYE TRACKING TECHNIQUES TO INVESTIGATE RESPONSE PROCESSES TO MULTIPLE-CHOICE ITEMS OF A SCIENTIFIC REASONING TEST

Sabrina Mathesius¹; Annette Upmeier zu Belzen²; Dirk Krüger¹
¹Freie Universität Berlin; ²Humboldt-Universität zu Berlin

THE USE OF A PERSPECTIVE-BASED GENERIC QUESTIONING TOOL TO SCAFFOLD BIOLOGY TEACHER QUESTIONING

Eveline de Boer¹; Fred Janssen¹; Michiel Dam¹; Jan van Driel²
¹CLON; ²UoM

A SEMANTICS PERSPECTIVE FOR THE ANALYSIS OF KNOWLEDGE BUILDING IN TLSS DESIGNED BY PRE-SERVICE SECONDARY SCIENCE TEACHERS

Sylvia Moraga¹; Mariona Espinet²
¹Universidad de Playa Ancha; ²Universitat Autònoma de Barcelona

A MIX-METHODS STUDY FOR IDENTIFYING COMPONENTS AND INDICATORS CONTRIBUTING TO SCIENCE TEACHER IDENTITY

Tanwarat Pinthong¹; Chatree Faikhamta¹; Weeyawat Jaitrong²; Jeerawan Ketsing¹
¹Kasetsart University; ²Natural History Museum, National Science Museum

17:00 - 18:30 OP180 - STRAND 13 - TEACHER NOTICING AND PROFESSIONAL VISION IN PRE-SERVICE TEACHER EDUCATION

Room A2

Chairperson(s): Adriana Zaragoza

DEVELOPMENT AND VALIDATION OF AN INSTRUMENT FOR IDENTIFYING PRE-SERVICE PHYSICS TEACHERS' PROFESSIONAL VISION

Carina Wöhlke; Dietmar Höttecke
 University of Hamburg

EXPLORING PRE-SERVICE TEACHERS' VIEWS AND EXPERIENCES ABOUT INTERCULTURAL LEARNING IN SCIENCE DURING AN INTERNATIONAL SUMMER SCHOOL

Anne Bonnevie Lund¹; Maria Evagorou²; Ragnhild Lyngved Staberg¹; Maria I.M. Febri¹; Jardar Cyvin¹; Marta Ariza³; Antonio Quesada Armentoros³
¹NTNU - Norwegian University of Science and Technology; ²University of Nicosia; ³University of Jaén

PRE-SERVICE SCIENCE TEACHERS' CONCEPTIONS ON SCIENTIFIC INQUIRY: A PRACTICAL EXPERIENCE

Juan Jimenez¹; Soraya Hamed²
¹Illinois Institute of Technology; ²Universidad de Sevilla

KNOWLEDGE TRANSFER TO THE TEACHING PRACTICE IN SCIENCE EDUCATION: EXPLORING PRE-SERVICE TEACHERS' PROFESSIONAL VISION IN THE CONTEXT OF TEACHER PLANNING

Adriana Zaragoza; Martina Alles; Tina Seidel
 Technische Universität München

17:00 - 18:30 OP119 - STRAND 6 - CULTURAL-HISTORICAL APPROACHES TO PHYSICS TEACHING

Room B1

Chairperson(s): Seth Chaiklin

CLASSICAL MECHANICS IN THE NEW AGE TEACHING — BREAKING WITH THE OLD CURRICULAR PERSPECTIVE

Ehud Goren; Igal Galili
 The Hebrew University of Jerusalem

FOR THE PLURALITY OF THE HISTORY AND NATURE OF SCIENCE IN CLASSROOM: EXPLORING THE 1919 SOLAR ECLIPSE EXPEDITION AND THE GENERAL RELATIVITY

Sofia Basilio¹; Flávia Polati²; Danilo Cardoso¹
¹Universidade de São Paulo; ²Universidade Federal do Rio Grande do Norte

THE PERIODIC TABLE AND THE NATURE OF SCIENCE IN THE TEACHING CONTEXT: RETHINKING THE HISTORICAL NARRATIVES ON THE CLASSIFICATIONS OF THE ELEMENTS IN SECONDARY EDUCATION TEXTBOOKS IN NORWAY AND SPAIN

Luis Moreno Martinez¹; Annette Lykknes²

¹López Piñero Institute for Science Studies, University of València; ²Norwegian University of Science and Technology

A CULTURAL-HISTORICAL APPROACH TO PHYSICS TEACHING: THE CASE OF ELECTROMAGNETISM

Seth Chaiklin

University College Copenhagen

17:00 - 18:30 OP120 - STRAND 8 - COMPETENCIES AND CAREERS

Room B2

Chairperson(s): Kathryn Garthwaite

SECONDARY SCHOOL STUDENTS' SCIENCE-RELATED CAREER AWARENESS: AN EXPLORATORY STUDY

Tormi Kotkas; Miia Rannikmäe; Jack Holbrook

University of Tartu

A STUDY ON STEM HUMAN RESOURCES COMMUNITY ABILITY; FOCUS ON HIGHER EDUCATION STUDENTS IN JAPAN AND AFRICA

Tomotaka KURODA

Graduate School of Science & Technology, Shizuoka University

EFFECTS OF THE USE OF REAL-TIME DATA WITH SSI INSTRUCTION ON PROMOTING MIDDLE SCHOOL STUDENTS' SCIENTIFIC CORE COMPETENCIES

Suhi Kwon¹; Yohan Hwang²; Hyunju Lee¹

¹Ewha Womans University; ²Chungnam National University

A QUALITATIVE RISK ANALYSIS FRAMEWORK IN ACTION

Sally Birdsall; Kathryn Garthwaite; Bev France

University of Auckland

17:00 - 18:30 OP121 - STRAND 8 - DECISION-MAKING AND SOCIOSCIENTIFIC ISSUES

Room B3

Chairperson(s): Kohei Maruyama

USING SOCIOSCIENTIFIC ISSUES TO PRACTICE DECISION-MAKING IN AUSTRALIAN DISADVANTAGED SCHOOLS

Vaile Dawson

The University of Western Australia

DECISION-MAKING ABOUT SOCIOSCIENTIFIC ISSUES IN A LARGE POSTSECONDARY STEM COURSE: DESCRIBING STUDENTS' USE OF EVIDENCE

P. Citlally Jimenez; Jenny Dauer

University of Nebraska-Lincoln

QUALITY OF THE SSI DECISION-MAKING STAGES DESIGNED BY SCIENCE STUDENT TEACHERS

Kari Sormunen; Anu Hartikainen-Ahia

University of Eastern Finland

JUNIOR HIGH SCHOOL SCIENCE LESSONS FOR FOSTERING DECISION MAKING: A FOCUS ON ORGAN TRANSPLANTATION

Kohei Maruyama; Hiroki Fujii

Graduate School of Education, Okayama University

17:00 - 18:30 OP122 - STRAND 9 - SCIENCE AND ENVIRONMENTAL EDUCATION: POLICY, PROGRAMME AND PRACTICE

Room B4

Chairperson(s): Kristine Bakkemo Kostøl

A CRITICAL ANALYSIS OF ENVIRONMENTAL EDUCATION RELATED POLICY IN ENGLAND

Melissa Glackin; Heather King

King's College London

IS THERE A DISCONNECT BETWEEN THEORY AND PRACTICE IN ENVIRONMENTAL EDUCATION?

Peta White¹; Sally Birdsall²; Fabian Sack³

¹Deakin University; ²Auckland University; ³Sustainably Pty Ltd

USING SOCIAL NETWORK ANALYSIS TO IMPROVE A COMMUNITY OF PRACTICE: A CASE STUDY OF ENVIRONMENTAL EDUCATION CENTERS

K.C. Busch; Kathryn Stevenson; Kathryn Green; Danielle Lawson
North Carolina State University

“FELT IN A WAY THAT I WAS PART OF SOMETHING BIG” — THE INFLUENCE OF A STEM PARTNERSHIP PROGRAM ON STUDENTS

Kristine Bakkemo Kostøl¹; Kari Beate Remmen²; Shelley Stromholt¹; Anette Braathen¹
¹Norwegian Centre for Science Education, University of Oslo, Norway; ²Department of teacher education and school research, University of Oslo, Norway

17:00 - 18:30 OP123 - STRAND 9 - ENVIRONMENTAL EDUCATION AND CHALLENGING TOPICS Room B5

Chairperson(s): Gonzalo Guerrero

OBSERVING EXTREME ENVIRONMENTAL EVENTS IN THE HIMALAYAS AND STATUS OF ENVIRONMENTAL EDUCATION AND ATTITUDE OF THE DOWNSTREAM COMMUNITY

Shakil Regmi¹; Bodo Bookhagen²; Bruce Johnson³; Bed Mani Dahal⁴
¹Martin Luther University Halle-Wittenberg; ²University of Potsdam; ³University of Arizona; ⁴Kathmandu University

SCIENCE LESSON IN JUNIOR HIGH SCHOOL FOCUSED ON THE RELATIONSHIP BETWEEN GLOBAL WARMING AND HEAVY RAINFALL

Kenta Namba; Hiroki Fujii
Graduate School of Education, Okayama University

COLLABORATIVE SCIENCE TEACHER EDUCATION THROUGH INQUIRY ON CLIMATE ISSUES: A CASE STUDY

Franz Rauch¹; Diana Radmann¹; Bernhard Schmöler²
¹Alpen-Adria-University Klagenfurt; ²University of Teacher Education Klagenfurt

INTERDISCIPLINARY SCIENCE OUTDOORS': EXPLORING OPPORTUNITIES FROM RESEARCH-PRACTICE PARTNERSHIPS

Gonzalo Guerrero
Universidad de Santiago de Chile

17:00 - 18:30 OP124 - STRAND 12 - GENDER ISSUES AND FEMINISM Room B6

Chairperson(s): Kathryn Scantlebury

GRADUATE WOMEN'S LEADERSHIP DEVELOPMENT IN SCIENCE AND ENGINEERING: A WORKSHOP MODEL

Angela Kelly; Christine O'Connell; Jennifer Gatz; Monica Bugallo
Stony Brook University

A CRITICAL ANALYSIS OF CONTENT IN SEX- AND RELATIONSHIP CHAPTERS IN BIOLOGY TEXTBOOKS

Hannele Junkala
Umeå University

REPOSITIONING GENDER INEQUALITY IN UK BIOSCIENCE: WHAT SUCCESSFUL PATHWAYS REVEAL

Jaimie Miller-Friedmann
University of Oxford

DO THEY KNOW WHAT THEY ARE MISSING? CHEMISTRY EDUCATION'S FAILURE TO ENGAGE WITH MATERIALISM FEMINISM

Kathryn Scantlebury¹; Anita Hussenius²; Catherine Milne³
¹University of Delaware; ²Uppsala University; ³New York University

17:00 - 18:30 OP125 - STRAND 12 - LINGUISTIC DIVERSITY IN SCIENCE Room B7

Chairperson(s): Greses Perez

INCREASING THE ATTITUDES TOWARD SCIENCE WITH TEACHING STRATEGY IN A BILINGUAL COURSE

David Gonzalez Gomez; Jin Su Jeong; J. Samuel Sánchez Cepeda
University of Extremadura

CAPACITY BUILDING IN MULTILINGUAL SCIENCE CLASSROOMS: A FRAMEWORK FOR COLLECTIVE EXPANSIVE LEARNING

Saouma BouJaoude¹; Saouma BouJaoude¹; Sara Salloum²
¹American University of Beirut; ²Balamand University

INTERTEXTUALITY IN SCIENCE TEXTBOOKS AS VEHICLE FOR CONCEPTUAL LEARNING IN MULTILINGUAL SETTINGS

Sara Salloum
University of Balamand

TRANSLANGUAGING IN THE SCIENCE CLASSROOM: LEARNING ENGINEERING IN MULTILINGUAL CONTEXTS

Greses Perez
Stanford University

17:00 - 18:30 **OP126 - STRAND 1 - CONCEPT MAPS AND NETWORKS** **Room C1**

Chairperson(s): Richard Taylor

NETWORK CARTOGRAPHY OF STUDENTS' DECLARATIVE KNOWLEDGE: FINDING ABSTRACT KEY CONCEPTS

Ismo Koponen; Maija Nousiainen
University of Helsinki, Department of Physics

VISUALISING THE STRUCTURE OF WRITTEN EXPLANATIONS

Steffen Wagner; Burkhard Priemer
Humboldt-Universität zu Berlin

EXPLORATION OF MIDDLE SCHOOL STUDENT' UNDERSTANDING ON FIND DUST ISSUE USING ISSUE CONCEPT MAP(IC-MAP) IN COMMUNITY BASED SOCIOSCIENTIFIC ISSUES

Gahyoung Kim¹; Kongju Mun²; Hyunju Lee³
¹Kangwon National University; ²Seoul National University; ³Ewha Womans University

HUB-WORDS IN SCIENTIFIC SEMANTIC NETWORKS

Richard Taylor; Ann Childs; Judith Hillier
University of Oxford

17:00 - 18:30 **OP127 - STRAND 11 - ASSESSMENT OF HIGH-ACHIEVING STUDENTS** **Room D1**

Chairperson(s): Magnus Oskarsson

A STUDY ON THE BIOGRAPHIES OF FORMER PARTICIPANTS OF A SCIENTIFIC ENRICHMENT-PROGRAMME FOR GIFTED PUPILS

Maria Sophie Schäfers; Claas Wegner
Bielefeld University

CAN WRITTEN EXAMINATION QUESTIONS EFFECTIVELY DISCRIMINATE BETWEEN STUDENTS' WHO HAVE EXPERIENCED DIFFERENT TYPES OF PRACTICAL WORK?

Judith Bennett¹; Chris Harrison²; Catarina Correia²; Alistair Moore¹; Peter Fairhurst¹; Katherine Aston²
¹University of York; ²King's College London

DIVERGENT THINKING OF STUDENTS TAKING PART IN SCIENCE COMPETITIONS

Swantje Müller; Verena Pietzner
University of Oldenburg

EVERYDAY KNOWLEDGE IN TIMSS2015

Magnus Oskarsson; Nina Eliasson
Mid Sweden University

17:00 - 18:30 **OP128 - STRAND 11 - INNOVATIVE APPROACHES TO STUDENT ASSESSMENT** **Room D2**

Chairperson(s): Radu Bogdan Toma

TOWARDS AN INTERDISCIPLINARY SYSTEMS THINKING FRAMEWORK

Justin Lefarth; Sophia Mambrey; Jana Landskron; Philipp Schmiemann
University of Duisburg-Essen; Biology Education II

DRAW-A-SCIENCE-COMIC: AN ALTERNATIVE TO DAST

Jaakko Lamminpää; Veli-Matti Vesterinen; Katja Puutio
University of Turku

DEVELOPMENT AND VALIDATION OF THE NEGATIVE APPRAISALS OF STUDYING SCHOOL SCIENCE (NASS) SCALE

Radu Bogdan Toma¹; Norman G. Lederman²; Jesús Ángel Meneses Villagrá¹
¹Universidad de Burgos; ²Illinois Institute of Technology

17:00 - 18:30 **OP129 - STRAND 11 - ASSESSMENT OF CONCEPTUAL UNDERSTANDING** **Room D3**

Chairperson(s): **Fernanda Regebe**

EVALUATION OF LEARNING PROGRESSIONS ON CHEMICAL CONCEPTS IN SECONDARY SCHOOLS

Kübra Nur Celik
University of Duisburg-Essen

LEARNING PROGRESSIONS VS. LEARNING FLUCTUATIONS: DEVELOPMENTAL PATTERNS OF STUDENTS' UNDERSTANDING OF CORE CHEMISTRY CONCEPTS

Sascha Bernholt; Lars Höft
Leibniz Institute for Science and Mathematics Education (IPN) at Kiel University

MEASURING CONCEPTUAL UNDERSTANDING: LINKING CONCEPT TESTS, EXPLICIT, AND IMPLICIT ASSOCIATIVE METHODS

Marine Delaval; Andreas Müller
University of Geneva

PERFORMANCE ANALYSIS OF STUDENTS REGARDING THE COMPLEXITY AND CONTENT DIMENSIONS OF ITEMS IN LEARNING OF PROGRAMMING LOGIC

Fernanda Regebe¹; Amanda Amantes²
¹IFBA / UFBA; ²UFBA

17:00 - 18:30 **OP190 - STRAND 4 - DIGITAL AIDS FOR PLANNING AND DESIGNING TEACHING** **Room E2 - Italia**

Chairperson(s): **Antonio-Joaquín Franco-Mariscal**

GAME OF THRONES TO LEARN SCIENCE. AN EXPERIENCE WITH SPANISH PRE-SERVICE SCIENCE TEACHERS

Antonio-Joaquín Franco-Mariscal¹; María-José Cano-Iglesias²; José Manuel Hierrezuelo-Osorio²
¹University of Málaga; ²University of Málaga

AN INTEGRATED DATABASE OF COMMON CHEMICALS AND CHEMISTRY LABORATORY EXPERIMENTS USED IN HUNGARY

Lajos Kovács¹; Gábor Betyár²
¹University of Szeged, Dept. Med. Chem. and MTA-SZTE Science Education Research Group; ²MTA-SZTE Science Education Research Group

DESIGN OF THE INFORMATION SCIENCE DICTIONARY BY SIGN LANGUAGE

Miki Namatame
Tsukuba University of Technology

PROMOTING SELF-REGULATED LEARNING BY DESIGNING A CHEMISTRY ONLINE BLENDED LEARNING ENVIRONMENT

Yael Shwartz¹; Rachel Rosanne Eidelman²
¹Weizmann Institute of Science; ²The Davidson Institute

17:00 - 18:30 **OP130 - STRAND 15 - PLAY AND INQUIRY IN EARLY CHILDHOOD SCIENCE** **Room F1**

Chairperson(s): **Inés Mosquera Bargiela**

PLAYING WITH SCIENCE: CHILDREN'S PLAYFUL MEANING-MAKING IN THE CONTEXT OF SCIENTIFIC LITERACY PRACTICES

Jenni Vartiainen; Kristiina Kumpulainen
University of Helsinki

WHY WE SHOULD TAKE CHILDREN'S PLAYFUL INQUIRY SERIOUS

Lara Weiser; Annette Scheerso
Biology Education, University of Bonn

ADVANCING THE DEVELOPMENT OF EARLY CHILDHOOD SCIENCE DATA COLLECTION INSTRUMENTS

Cristina Guarrella; Caroline Cohrssen; Jan van Driel
The University of Melbourne

SCIENTIFIC REASONING IN AN INQUIRY-BASED TASK. A CASE STUDY RESEARCH IN EARLY AGE

Inés Mosquera Bargiela
Universidade de Santiago de Compostela, Spain
Blanca Puig¹; Paloma Blanco-Anaya¹; Lucy Avraamidou²
¹Universidade de Santiago de Compostela; ²University of Groningen

17:00 - 18:30 OP131 - STRAND 15 - SUPPORT FOR EARLY CHILDHOOD SCIENCE LEARNING OUTSIDE THE CLASSROOM Room F2

Chairperson(s): Karen Barfod

LONGITUDINAL IMPACT OF EARLY CHILDHOOD SCIENCE INSTRUCTION ON 5TH GRADE SCIENCE ACHIEVEMENT

Charlene Czerniak¹; [Joan Kaderavek](#)¹; Peter Paprzycki²; Susanna Hapgood¹; Gale Mentzer³; Scott Molitor¹; Robert Mendenhall⁴
¹The University of Toledo; ²University of Southern Mississippi; ³Acumen, LLC; ⁴Toledo Public Schools

SATISFYING CURIOUS YOUNG MINDS: VOLUNTEERING TO TEACH STEM IN EARLY CHILDHOOD CENTRES

[Coral Campbell](#); Christopher Speldewinde
 Deakin University

BUILDING SCIENCE CAPITAL AND HABITUS OF YOUTH THROUGH FAMILY STEM PROGRAMMING

Megan Ennes¹; [M. Gail Jones](#)¹; Emily Cayton²; Katherine Chesnutt³; Pamela Huff³; Elizabeth Baird⁴
¹North Carolina State University; ²Campbell University; ³NC State University; ⁴NC Museum of Natural Sciences

INQUIRY BASED SCIENCE AND MATHEMATIC TEACHING OUTSIDE THE CLASSROOM, PUPILS CHOICES AND LEARNING OPTIONS

[Karen Barfod](#); Peer Daugbjerg
 VIA University College

17:00 - 18:30 OP132 - STRAND 1 - DEVELOPING UNDERSTANDING IN EVOLUTION AND GENETICS Room F3

Chairperson(s): Victoria Hollmann

HOW CAN LEARNERS EXPLAIN PHENOMENA IN ECOLOGY USING EVOLUTIONARY EVIDENCE FROM INFORMAL LEARNING ENVIRONMENTS AS RESOURCES?

[Dina Agadi](#); Orit Ben Zvi Assaraf
 Ben-Gurion University of the Negev

GENETIC CONCEPTS, REPRESENTATIONS AND MODELS IN STUDENTS' AND EDUCATORS' CONCEPTIONS

[Despina Tsopoglou-Gkina](#); Penelope Papadopoulou
 University of Western Macedonia, Greece

STEPPING ON THE THRESHOLD – VISUALIZATION DESIGN AND LEARNERS CAUSAL MODELS OF NATURAL SELECTION

[Andreas Göransson](#)
 Department of science and technology, Linköping University

CONCEPTS USED BY STUDENTS IN EXPLAINING NATURAL SELECTION

[Victoria Hollmann](#); Jörg Großschedl
 University of Cologne

17:00 - 18:30 OP133 - STRAND 13 - COLLABORATIVE LEARNING IN PRE-SERVICE TEACHER EDUCATION Room G1

Chairperson(s): Marie Ståhl

APPLYING ARGUMENTATION IN PRIMARY PRE-SERVICE TEACHER EDUCATION. A TEACHING-LEARNING SEQUENCE USING COLLABORATIVE VIDEO ANNOTATIONS

[Jose Hierrezuelo](#); Teresa Lupión-Cobos; Cristina García-Ruiz
 Department of Science Education, University of Málaga

NEW COLLABORATIVE AND PROJECT-BASED COURSE MODEL FOR RELEVANT PRE-SERVICE SCIENCE TEACHER EDUCATION

[Outi Haatainen](#); Topias Ikävalko; Maija Aksela
 University of Helsinki

TEACHERS' COLLABORATION AS A POTENTIAL TOOL TO DEVELOP PEDAGOGICAL CONTENT KNOWLEDGE OF PRE-SERVICE PHYSICS' TEACHERS: AN EXPLORATORY STUDY OF AN INITIAL TEACHING PRACTICE EXPERIENCE IN THE CITY OF VALPARAÍSO.

[Germán Ahumada Aballay](#)¹; Betzabe Torres Olave²
¹Pontificia Universidad Católica de Valparaíso; ²University of Bristol

OPPORTUNITIES FOR PROGRESSION IN SUBJECT-MATTER DIDACTICS

[Maria Åström](#); [Marie Ståhl](#); Maria Svensson; Björn Friis Johannsen; Git Börjesson
 Department of Pedagogical, Curricular and Professional Studies, University of Gothenburg, Sweden

17:00 - 18:30 OP134 - STRAND 13 - LEARNING AND TEACHING PROBLEM SOLVING Room G2

Chairperson(s): Moritz Krell

FINNISH TEACHER STUDENT'S CONCEPTS ABOUT CREATIVE PROBLEM SOLVING BEFORE AND AFTER A METHODOLOGY COURSE

Merike Kesler; Kalle Juuti; Anna Uitto
University of Helsinki

ADDRESSING THE CONCEPT OF DENSITY IN A PROBLEMATIZED WAY: APPLICATION TO PRE-SERVICE PRIMARY TEACHERS' EDUCATION

Ruben Limiñana; Sergio Rosa-Cintas; Carolina Nicolás-Castellano; Asuncion Menargues; Alexandra Rey-Cubero; Juan Francisco Álvarez-Herrero; Joaquín Martínez-Torregrosa; Isabel Lujan
University of Alicante

EXAMINATION OF PRE-SERVICE PHYSICS TEACHERS' PROBLEM SCOPING IN ENGINEERING DESIGN PROCESS OF A STEM PROJECT

Fatma Caner; Feral Bekiroglu
Marmara University

IMPACT OF CONTRIBUTING FACTORS ON THE DEVELOPMENT OF SCIENTIFIC REASONING COMPETENCIES

Moritz Krell¹; Samia Khan²; Sabrina Mathesius¹; Claudia Vergara³; Dirk Krüger¹
¹Freie Universität Berlin; ²University of Dundee; ³Alberto Hurtado University Santiago, Chile

17:00 - 18:30 OP135 - STRAND 14 - CONTENT KNOWLEDGE IN TEACHER EDUCATION Room G3

Chairperson(s): Martie Sanders

RETHINKING REVIEWS — HOW TO DESIGN REVIEWS ABOUT COMPLEX BIOLOGY FOR TEACHERS

Birgitta Mc Ewen
Dept of Health, Karlstad University

TEACHER KNOWLEDGE IN A PROFESSIONAL DEVELOPMENT COURSE IN A CURRICULAR REFORM IN BRAZIL

Daniela Scarpa¹; Maíra Batistoni Silva¹; Danusa Munford²; Renata de Paula Orofino²
¹University of São Paulo, Brazil; ²Federal University of ABC

SUPPORTING PROFESSIONAL LEARNING COMMUNITIES TO DEVELOP CONTENT KNOWLEDGE FOR TEACHING AND LEARNING PHYSICS AT LOWER SECONDARY LEVEL

Deirdre O'Neill; Eilish McLoughlin
Dublin City University

IMPROVING TEACHER'S GUIDES TO SUPPORT EVOLUTION TEACHERS: MULTIPLE STAKEHOLDER PERCEPTIONS

Martie Sanders
University of the Witwatersrand

17:00 - 18:30 OP136 - STRAND 14 - PROFESSIONAL LEARNING AND MENTORING Room G4

Chairperson(s): Sonja M. Mork

NOVICE TEACHERS LEARNING TO TEACH OUT-OF-FIELD

Linda Hobbs
Deakin University

ASSESSING NOVICE AND EXPERIENCED STEM TEACHERS' PROFESSIONAL GROWTH

Effrat Akiri; Yehudit Judy Dori
Technion, Israel Institute of Technology

IN-SERVICE TEACHER MENTORING FOR THE IMPLEMENTATION OF MODULES ON CUTTING-EDGE RESEARCH TOPICS

Emily Michailidi; Dimitris Stavrou
University of Crete

EDUCATING THE EDUCATORS: CREATING A KNOWLEDGE DOMAIN FOR SCIENCE TEACHER EDUCATORS THROUGH PROFESSIONAL DEVELOPMENT

Sonja M. Mork, Berit S. Haug, Ellen K. Henriksen, Doris Jorde, Merethe Frøyland
Norwegian Centre for Science Education, University of Oslo

17:00 - 18:30 OP137 - STRAND 16 - TEACHING APPROACHES AND PRACTICES Room G5

Chairperson(s): Odilla Finlayson

TEACHING AND LEARNING SCIENCE IN GRADE 4 OF PRIMARY SCHOOL BY PEER INSTRUCTION APPROACH

Jerneja Pavlin; Tina Čampa
University of Ljubljana, Faculty of Education

COLLABORATIVE APPROACHES IN PRIMARY SCHOOL SCIENCE

Lena Danaia¹; Emma Bylsma²; Rebecca Whiteley²; Susan Cameron³
¹Charles Sturt University; ²Kinross Wolaroi School; ³STEM Teacher Enrichment Academy- Consultant

INVESTIGATING SCIENTIFIC MODELING IN PRIMARY SCIENCE: A COMPARATIVE STUDY OF THE UNITED STATES AND GERMANY

Florian Böschl¹; Kim Lange-Schubert¹; Cory Forbes²
¹University of Leipzig; ²University of Nebraska, Lincoln

LEARNER MOTIVATION CASE STUDY IN STEM EDUCATION TECHNOLOGY ENHANCED LEARNING

Diana Bogusevschi; Odilla Finlayson; Gabriel-Miro Muntean
Dublin City University

17:00 - 18:30 OP138 - STRAND 17 - UNIVERISTY STUDENTS' REASONING AND EXPLANATIONS Room G6

Chairperson(s): Kathryn Green

NAVIGATING CULTURAL BORDERS: AN EVOLUTION INTERVENTION IN AN UNDERGRADUATE BIOLOGY CLASS

Kathryn Green; Cesar Delgado
North Carolina State University

THE IMPACT OF INSTRUCTIONAL SCAFFOLDING ON STUDENTS' EVIDENTIARY REASONING IN THE CONTEXT OF AN EVOLUTIONARY TREE-THINKING UNDERGRADUATE BIOLOGY LABORATORY INVESTIGATION

Nancy Pelaez; Shiyao Liu; Stephanie Gardner; Chaonan Liu; Sharleen Flowers; Kari Clase; Ala Samarapungavan
Purdue University

EXTENDING THE CONCEPTUAL BLENDING FRAMEWORK TO REPRESENT DYNAMICS IN STUDENT REASONING

Sofie Van den Eynde¹; Mieke De Cock¹; Johan Deprez¹; Martin Goedhart²
¹KU Leuven; ²University of Groningen

SURFACE REASONING DOMINATES POSTSECONDARY GROUP DISCUSSIONS DURING COMPUTATIONAL MODELING

Joseph Dauer; Gretchen King; Tomas Helikar
University of Nebraska-Lincoln

17:00 - 18:30 OP195 - STRAND 2 - SELF-CONCEPT, AGENCY AND MOTIVATION Room G7

Chairperson(s): Heesoo Ha

DESIGNING A TEACHING-LEARNING SEQUENCE ABOUT SOUND FOR PRE-SERVICE PRIMARY TEACHERS

Arantza Rico¹; Aritz Ruiz-Gonzalez¹; Oier Azula²; Jenaro Guisasola¹
¹University of the Basque Country (UPV/EHU); ²Tknika: Centre for Innovation in Vocational Training

NOTHING MORE THAN THAT - STUDENTS' MOTIVATIONS ENTERING HIGHER BIOLOGY EDUCATION

Katerina Pia Günter
Uppsala University - Centre for Gender Research

THEORETICAL INVESTIGATION OF AGENCY IN STUDENT-CENTRED LEARNING COMMUNITIES IN STUDIES OF SCIENCE EDUCATION

Heesoo Ha; Heui-Baik Kim
Seoul National University

IS MECHANICS OR WAVE MORE CHALLENGING FOR STUDENTS? SELF-CONCEPTS AND STYLES OF SCIENTIFIC REASONING

Roy K.H. Sin¹; Maurice M.W. Cheng²
¹Yuen Long Merchants Association Secondary School; ²The University of Waikato

17:00 - 18:30 OP193 - STRAND 12 - STEM PROGRAMS

Room G8

Chairperson(s): Kathleen Schenkel

PROJECT CLIC!: IMPROVING PRIMARY STUDENTS' SCIENCE LEARNING BY EXPANDING THEIR ACADEMIC LANGUAGE AND SCIENCE INQUIRY SKILLS

Alejandra Meneses¹; Maximiliano Montenegro¹; Nicolás Bedrossian²; Marcela Ruiz³; Andrea Valenzuela¹
¹Pontificia Universidad Católica de Chile; ²Lycée Antoine de Saint-Exupery; ³Universidad Alberto Hurtado

LET THE CHURCH SAY "AMEN" TO STEM: NEGOTIATING THE ROLES OF THE FAITH-BASED COMMUNITY ON EDUCATIONAL PROGRAMS FOR YOUTH

Natalie King; Natalie King
 Georgia State University

HIGH ACHIEVING STUDENTS' SCIENCE IDENTITY PERFORMANCES WITHIN STEM DISCIPLINARY CULTURES IN NORWAY

Maria Vetleseter Boe
 University of Oslo, Dept. of Physics

"WE HAVE TO CHANGE THINGS. OH, WE HAVE TO DO THIS.": ENGINEERING SOLUTIONS WITH COMMUNITY

Kathleen Schenkel¹; Angela Calabrese Barton¹; Edna Tan²
¹Michigan State University; ²The University of North Carolina at Greensboro

FRIDAY 9:00 - 11:00

09:00 - 11:00 OP139 - STRAND 1 - CONCEPTUAL CHANGE IN SCIENCE LEARNING

Room A1

Chairperson(s): Sefika Girgin

DO MISLEADING THERMAL SENSATIONS UNDERLIE SOME HEAT AND COLD MISCONCEPTIONS?Ivan Ezquerro-Romano¹; Angel Ezquerro²; Federico Agen²¹University College London; ²Universidad Complutense de Madrid**ENHANCING CONCEPTUAL CHANGE IN SCIENCE EDUCATION THROUGH DRAMATIC INQUIRY**

Carolyn Swanson

Auckland University of Technology

EXPLORING MISCONCEPTION AS A TRIGGER FOR ENHANCING STUDENTS' CONCEPTUAL UNDERSTANDINGAllen Espinosa¹; Heather Verkade²; Terrence Mulhern²; Jason Lodge³¹The University of Melbourne (Current Address: Philippine Normal University); ²The University of Melbourne; ³The University of Melbourne (Current Address: The University of Queensland)**CONCEPTUAL CHANGE REGARDING LIVING/NONLIVING THINGS RELIES ON INHIBITORY CONTROL: RESULTS FROM REACTION TIMES AND EEG**Lorie-Marlène Brault Foisy¹; Yannick Skelling-Desmeules²; Emmanuel Ahr³; Jérémie Blanchette Sarrasin²; Grégoire Borst³; Patrice Potvin²; Steve Masson²; Patrick Charland²¹Université du Québec à Montréal (UQAM); ²Université du Québec à Montréal; ³LaPsyDÉ**A META SYNTHESIS STUDY: EXPLORING STUDENTS' CONCEPTIONS ON CONDENSATION, EVAPORATION AND BOILING CONCEPTS**

Şefika Girgin; Aslı Koçulu; Bayram Coştu

Yildiz Technical University

09:00 - 11:00 OP140 - STRAND 1 - THE ROLE OF REPRESENTATIONS IN SCIENCE LEARNING

Room A2

Chairperson(s): Andreas Larsson

FROM WATCHING VIDEOS TO HAPTIC FEEDBACK: LEARNING ABOUT FORCES & ENERGY IN CHEMICAL BONDING

Asnat Zohar; Sharona T. Levy

University of Haifa

HOW CAN DRAWINGS HELP TO CONCEPTUALIZE BIOLOGICAL OBJECTS? — EXAMPLE OF BEETLES.Eliza Rybska¹; Jelle Boeve-dePauw²¹Adam Mickiewicz University; ²Department of Training & Education Sciences, Edubron Research Unit, University of Antwerp, Belgium**PHOTOGRAPHS IN BRAZILIAN CHEMISTRY TEXTBOOKS: A STUDY INVOLVING CHEMICAL KINETIC**

Wilmo Francisco Junior; Flávia Alves; Miyuki Yamashita

Federal University of Alagoas

CHOOSING AN EXTERNAL REPRESENTATION TO EXPLAIN A CHEMICAL PHENOMENON - A MIXED-METHODS STUDY

Perihan Akman; Sabine Fechner

Paderborn University

TALKING CODE OR TYPING CODE - UNPACKING A METAPHORICAL STRUCTURE IN THE PROGRAMMING CLASSROOM

Andreas Larsson; Karin Stolpe

Linköping University

09:00 - 11:00 OP74 - STRAND 6 - NATURE OF SCIENCE IN SCIENCE TEACHING

Room B1

Chairperson(s): Aysegul Cilekrenkli

ADDRESSING NATURE OF SCIENCE ASPECTS ON A PD PROGRAM FOR GREEK SCIENCE TEACHERS: DESIGN, IMPLEMENTATION AND VALIDATION

Anna Koumara; Katerina Plakitsi

University of Ioannina

TENTATIVENESS AND SOCIOCULTURAL EMBEDDEDNESS - RESISTANT MYTHS ABOUT NATURE OF SCIENCE?

Stefan Mueller; Christiane S. Reiners
University of Cologne

PRE-SERVICE SCIENCE TEACHERS' PERCEPTIONS OF NATURE OF SCIENCE: FOCUS GROUP DISCUSSION

Busra Aksoz¹; Ebru Kaya¹; Sibel Erduran²; Selin Akgun¹; Aysegul Cilekrenkli¹
¹Bogazici University; ²University of Oxford

BRINGING THE DEBATES ON THE ROLE OF CULTURE IN SCIENCE INTO THE SCIENCE CLASSROOM

Hagop A. Yacoubian
Education Department, Lebanese American University

TEACHING WITH RECONCEPTUALISED FAMILY RESEMBLANCE APPROACH TO NATURE OF SCIENCE IN 5TH GRADE CLASSROOM: AN EXPERIMENTAL STUDY

Aysegul Cilekrenkli; Ebru Kaya
Bogazici University

09:00 - 11:00 **OP142 - STRAND 8 - REASONING AND CONCEPTIONS IN SSI** **Room B2**

Chairperson(s): Sybille Hűfner

SECONDARY MATHEMATICS AND SCIENCE TEACHERS' REASONING ABOUT A SOCIO-SCIENTIFIC ISSUE

David Owens¹; Ben Herman²; Tanner Oertli²; Amy Lannin²; Troy Sadler³
¹Georgia Southern University; ²University of Missouri; ³University of North Carolina Greensboro

ENABLING STUDENTS TO PRODUCE EVIDENCE-BASED ARGUMENTS RELATED TO SSI: TWO CASE STUDIES

Stein Dankert Kolsto
University of Bergen

BALANCING EMOTION AND REASON IN SOCIO-SCIENTIFIC ISSUES : NEW TEACHING APPROACH AND DESIGNING INSPIRED BY RECENT BRAIN RESEARCH

Francois Lombard; Marie Merminod; Daniel Schneider
University of Geneva

PROGRESS ON CLIMATE CHANGE PERCEPTIONS AFTER NGSS ADOPTION: A US, UK AND AUSTRALIA COMPARISON

Tina Cartwright¹; Deb Hemler²; Paula Magee³
¹Marshall University; ²Fairmont State University; ³Indiana University Indianapolis

ENERGY TRANSITION TO RENEWABLES: HOW STUDENTS' AND SCIENTISTS' METAPHORS (MIS) LEAD THE DEBATE

Sybille Hűfner¹; Kai Niebert²; Simone Abels³
¹University of Hildesheim; ²University of Zurich; ³Leuphana University Lűneburg

09:00 - 11:00 **OP143 - STRAND 8 - DEMOCRACY, SOCIAL JUSTICE AND POLITIC OF SCIENCE** **Room B3**

Chairperson(s): Lynne Zummo

THE ROLE OF SCIENCE EDUCATION IN THE DINAMICS OF PRODUCTION OF DEMOCRATIC POLITICAL CULTURE

Rita Vilanova¹; Edgar Miranda²
¹Federal University of Rio de Janeiro; ²Pedro II School

SCIENCE FOR DEMOCRACY AND SOCIAL JUSTICE

Brian Matthews; Arthur Galamba
King's College London

DOES AND SHOULD SCIENCE EDUCATION STAND AGAINST THE RISE OF FASCIST-RELATED VIEWS IN THE 21ST CENTURY?

Arthur Galamba; Brian Matthews
King's College London

ECOJUST ENGINEERING ASSEMBLAGES IN SCHOOL SCIENCE

John Bencze¹; Dave Del Gobbo²; Sarah El Halwany¹; Minja Milanovic¹; Nadia Qureshi¹; Zoya Padamsi¹; Majd Zouda¹
¹OISE, University of Toronto; ²Peel District School Board

YOUTH VOICE IN POLARIZED AMERICA: THE POLITICS AND SCIENCE OF CLIMATE CHANGE

Lynne Zummo; Emma Gargroetzi
Stanford University

09:00 - 11:00 **OP144 - STRAND 8 - TEACHERS' VIEWS AND ATTITUDES** **Room B4**

Chairperson(s): Athanasia Kokolaki

PRE-SERVICE SCIENCE TEACHERS' ATTITUDES TOWARDS CLIMATE CHANGE IN NORWAY - REGIONAL DIFFERENCES AND THE ROLE OF TEACHER EDUCATION

Frode Skarstein
University of Stavanger

PRE-SERVICE ELEMENTARY TEACHERS' MODEL-EVIDENCE LINK DESIGNS TO ENHANCE THEIR STUDENTS' CRITICAL EVALUATION SKILLS

Deniz Saribas¹; Deniz Saribas¹; Zeynep Gonca Akdemir²
¹Istanbul Aydin University; ²Purdue University

PROSPECTIVE TEACHERS' PERCEPTION OF THE RELEVANCE OF SCHOOL - INDUSTRY COLLABORATION

Spela Hrast; Vesna Ferk Savec
University of Ljubljana, Faculty of Education

DIDACTIC MODELS AND MODELLING FOR SUSTAINABILITY

Jesper Sjöström¹; Ingo Eilks²
¹Malmö University - Faculty of Education and Society; ²University of Bremen - Institute for Science Education (IDN)

PRE-SERVICE PRIMARY TEACHER TRAINING ON RESPONSIBLE RESEARCH AND INNOVATION FRAMEWORK

Athanasia Kokolaki; Dimitris Stavrou
University of Crete

09:00 - 11:00 **OP145 - STRAND 9 - HEALTH LITERACY, CONCEPTIONS, VALUES AND BELIEFS** **Room B5**

Chairperson(s): Gizell Green

ELEMENTARY SCHOOL STUDENTS' HEALTH CONCEPTIONS: SOCIAL SEMIOTIC ANALYSIS OF MULTIMODAL TEXTS

Miriam Struchiner¹; Judith Bustamente Bautista²; Jhenifer Kely de Oliveira²
¹Federal University of Rio de Janeiro - UFRJ; ²UFRJ

INFUSING PRO-ENVIRONMENTAL VALUES IN SCIENCE EDUCATION: A MULTIMODAL ANALYSIS OF ECOLOGY ANIMATIONS FOR CHILDREN

William Feng¹; Len Unsworth²
¹The Hong Kong Polytechnic University; ²Australian Catholic University

INFORMAL EDUCATORS' ENVIRONMENTAL HEALTH KNOWLEDGE AND TEACHING BELIEFS: IMPLICATIONS FOR COMMUNICATING FISH CONSUMPTION ADVISORIES

Kathleen Gray¹; Margaret Blanchard²; Catherine LePrevost²
¹University of North Carolina at Chapel Hill; ²North Carolina State University

RESUSCITATION AS A HEALTH ISSUE: BIOLOGY TEACHERS' COMPETENCY AND ITS ASSOCIATION WITH THE SUBJECT

Rico Dumcke¹; Claas Wegner¹; Niels Rahe-Meyer²
¹Bielefeld University; ²Franziskus Hospital Bielefeld

EXAMINING PROFESSIONAL VALUES AMONG NURSING STUDENTS DURING TRAINING CHARACTERIZED BY DIFFERENT LEARNING METHODS

Gizell Green
Ariel university

09:00 - 11:00 **OP146 - STRAND 12 - EQUITY, VALUES AND SCIENCE PARTICIPATION** **Room B6**

Chairperson(s): Lucy Yeomans

MAPPING NETWORKS OF SUPPORT FOR UNDER-REPRESENTED STUDENTS IN PHYSICS

Allison Gonsalves; Hannah Chestnutt; Abigail Spilkevitz
McGill University

USING INSTITUTIONAL HABITUS TO UNDERSTAND INEQUALITIES IN PHYSICS PARTICIPATION IN UK SECONDARY SCHOOLS

Sandra Takei
King's College London

FOR SCIENCE, FOR THE INSTITUTION OR FOR YOUTH: MAPPING PRACTITIONER DISCOURSE AROUND EQUITY & INFORMAL SCIENCE LEARNING

Emily Dawson; Uma Patel
UCL

SCIENCE PARTICIPATION: IS IT MORE IMPORTANT TO BE STUDIOUS THAN 'SCIENCEY'?

Lucy Yeomans
University of Bath

09:00 - 11:00 OP147 - STRAND 12 - STEM PARTICIPATION AND ASPIRATIONS Room B7**Chairperson(s): Jeanna Wieselmann****ROSES - THE RELEVANCE OF SCIENCE EDUCATION SECOND**

Magnus Oskarsson¹; Anna-Karin Westman¹; Anders Jidesjö²
¹Mid Sweden University; ²Linköping University

ANALYZING SCIENCE ASPIRATIONS AND BELIEFS OF BRAZILIAN HIGH SCHOOL STUDENTS USING SCIENCE CAPITAL AS A THEORETICAL BACKGROUND

JOAQUIM FERNANDO MENDES DA SILVA; PAULO ROGÉRIO ABRÃO MILEO Jr
Federal University of Rio de Janeiro

CHEMISTRY TEACHERS' KNOWLEDGE ABOUT CHEMISTRY PROFESSIONS

Verena Pietzner; Anna Kotwica
University of Oldenburg

SMALL GROUP STEM ACTIVITIES AND GROUP GENDER COMPOSITION

Jeanna Wieselmann¹; Emily Dare²; Elizabeth Ring-Whalen³; Gillian Roehrig¹
¹University of Minnesota; ²Florida International University; ³St. Catherine University

09:00 - 11:00 OP148 - STRAND 1 - COGNITIVE AND METACOGNITIVE FACTORS IN SCIENCE LEARNING Room C1**Chairperson(s): Eunhee Kang****ATOMIC STRUCTURE - THE EFFECTS OF TWO COGNITIVE FACTORS ON SECONDARY STUDENTS' UNDERSTANDING OF THE 'ORBITAL' AND 'ELECTRON CLOUD' CONCEPTS**

Nikolaos Zarkadis; George Papageorgiou; Angelos Markos
Democritus University of Thrace

THE POSSIBILITY OF LUCKY BELIEFS IN THE SCIENCE CLASSROOM: GETTIER CASES AND THE VALUE OF RELIABLE BELIEF-FORMING PROCESSES

Richard Brock
King's College London

FACTORS ASSOCIATED WITH STUDENTS' ENGAGEMENT AND PARTICIPATION IN YEAR 11 AND YEAR 12 SCIENCE CLASSROOMS

Hye-Eun Chu¹; Sonya Martin²; Dayeon Kang²; Faisal Sudrajat²; Nathaniel Lewis¹
¹Macquarie University; ²Seoul National University

STUDENTS' VIEWS ON THE "CATEGORICAL IMPERATIVE" OF AVOIDING CONTRADICTION

Cesar Delgado; Cesar Delgado
North Carolina State University

EMPOWERING STUDENTS THROUGH ENCOURAGING THEIR EPISTEMIC AUTHORITY FOR CONTENTS, PRACTICE AND CLASSROOM MANAGEMENT

Eunhee Kang; Kum-Bok Ryu
Seoul National University

09:00 - 11:00 OP149 - STRAND 4 - ANALYSIS OF LEARNING USING NOVEL DIGITAL TECHNOLOGY Room D1**Chairperson(s): Janice Gobert****COLLABORATING PRIMARY STUDENT TEACHERS IN DESIGNING SCIENCE EXPERIMENTS WITH THE USE OF ICT**

Argyris Nipyrakis; Dimitris Stavrou
University of Crete

INVESTIGATING ONLINE OPEN FORUMS AS EDUCATIONAL SPACES FOR HAZARDS LITERACY LEARNING

Kathryn Rende; M. Gail Jones
North Carolina State University

ONLINE NANOTECHNOLOGY COURSES FOR TEACHERS: LEARNING EVALUATION AND LEARNING PATTERNS

Yael Feldman-Maggor¹; Inbal Tuvi-Arad²; Ron Blonder¹
¹The Weizmann Institute of Science; ²The Open University of Israel;

AUTOMATIC NETWORK ANALYSIS OF PHYSICS TEACHER TALK

Daniela Caballero¹; Toni Pikkarainen²; Jouni Viiri²; Roberto Araya¹; Catalina Espinoza¹
¹ CIAE Universidad de Chile; ² University of Jyväskylä

TEACHER SCAFFOLDS MEDIATED BY A SCIENCE INQUIRY DASHBOARD

Rachel Dickler¹; Janice Gobert¹; Michael Sao Pedro²; Haiying Li¹
¹Rutgers University; ²Apprendis

09:00 - 11:00 **OP194 - STRAND 18 - REPRESENTATIONS AND MODELS** **Room D2**

Chairperson(s): **Guilherme Marson**

TO PAIR MENTOR, OR NOT TO PAIR MENTOR, THAT IS THE QUESTION?

Ian Abrahams; Rachael Sharpe; Nikolaos Fotou
 University of Lincoln

DESIGN BASED RESEARCH AND THE MODEL OF EDUCATIONAL RECONSTRUCTION — A COMBINED APPROACH TO DESIGN SUCCESSFUL SCIENCE INSTRUCTION

Floor Kamphorst¹; Magdalena Kersting²
¹Utrecht University; ²University of Oslo, The University of Western Australia

MANIPULATING VIRTUAL 3D MODELS: THE ROLE OF INTERACTIVITY

Guilherme Marson¹; Rodrigo Consoli¹; Cláudia Ayres¹; Eduardo Colli¹; Camila Cicuto²; Gustavo Cruz³
¹University of São Paulo; ²UNIPAMPA; ³Inst. Silvio Passareli

THEORISING THE REPRESENTATION OF SCIENTIFIC KNOWLEDGE IN STUDENTS' MULTIMODAL ASSESSMENTS

Helen Georgiou; Wendy Nielsen; Annette Turney
 University of Wollongong

09:00 - 11:00 **OP150 - STRAND 5 - TEACHING AND LEARNING IN BIOLOGY AND PHYSICS** **Room D3**

Chairperson(s): **Debra McGregor**

ENHANCING STUDENTS' EPISTEMOLOGICAL BELIEFS ABOUT MODELS IN SCIENCE THROUGH A MODEL-BASED TLS ABOUT THE OPTICAL PROPERTIES OF MATERIALS

Stavros Koukioglou; Dimitrios Psillos
 Aristotle University of Thessaloniki Faculty of Education School of Primary Education

CLIMBING A 'LADDER OF LEARNING' — EFFECTS OF STRUCTURING DIFFERENTIATED LEARNING ENVIRONMENTS IN SCIENCE EDUCATION

Helena van Vorst; Marie-Therese Hauerstein
 Duisburg-Essen University

TEACHING EVOLUTION IN INDIGENOUS MEXICAN COMMUNITIES USING SITUATED LEARNING

Paulina Guerrero-Gutiérrez
 King's College London (Waterloo Campus)

DESIGN AND EVALUATION OF A TEACHING UNIT TO IMPLEMENT STUDENTS' QUESTIONS IN CHEMISTRY EDUCATION

Lisa Schmitz; Sabine Fechner
 Paderborn University

STORYTELLING AND INQUIRY PRACTICAL WORK IN SCHOOL SCIENCE : WHY BOTHER?

Debra McGregor; Sarah Frodsham
 Oxford Brookes University

09:00 - 11:00 **OP49 - STRAND 1 - INQUIRY, LAB REPORTS AND COLLABORATIVE LEARNING IN SCIENCE** **Room E2 - Italia**

Chairperson(s): **Matthias Stadler**

IMPACT OF PROCESS ORIENTED GUIDED INQUIRY LEARNING (POGIL) ON MIDDLE SCHOOL STUDENTS' PERFORMANCE

Leman ALAKOYUN; Özgecan TAŞTAN KIRIK
 Çukurova University

STUDENTS' PROCEDURAL KNOWLEDGE OF SCIENTIFIC PRACTICES AND ITS DEVELOPMENT—A VIDEO-BASED ANALYSIS

Jörn J. Hägele; Andreas Vorholzer; Claudia von Aufschnaiter
Justus-Liebig-Universität Gießen

THE EFFECTS OF A COLLABORATIVE LEARNING ENVIRONMENT ON 7TH GRADERS' INTEREST IN SCIENCE AND TECHNOLOGY AND ON CONCEPTUAL CHANGE.

Eric Durocher; Patrice Potvin
Université du Québec à Montréal (UQAM)

SIGNS FOR UNDERSTANDING CHEMISTRY IN LABORATORY REPORTS

Matthias Stadler¹; Sigrun Eggereide²
¹University of Bergen; ²Wang Toppidrettsgymnas

09:00 - 11:00 **OP152 - STRAND 7 - WRITING, METACOGNITIVE SCAFFOLDS AND ARGUMENTATION** **Room F1**

Chairperson(s): Mari Sjoeborg

DIPPING INTO THE ART OF WRITING SCIENCE: LINGUISTIC NEEDS OF AUSTRIAN HIGH SCHOOL LEARNERS IN SCIENCE EDUCATION

Corinna Pieber; Johanna Taglieber; Suzanne Kapelari; Wolfgang Dür; Barbara Hinger
University of Innsbruck, Department of subject-specific Education

FACILITATE STUDENT SCIENTIFIC ARGUMENTATION WITH METACOGNITIVE SCAFFOLDS

Qingna Jin
University of Alberta

WRITING SCIENTIFICALLY: SIMILARITIES BETWEEN READERS' WRITING AND THE LANGUAGE OF THE TEXTS THEY HAVE READ

Rogério Nigro
Gepec

MULTIMODAL SCIENTIFIC REASONING IN UNDERGRADUATE BIOLOGY; A SOCIAL SEMIOTIC APPROACH

Mari Sjoeborg; Erik Knain
Department of Teacher Education and School Research, University of Oslo

09:00 - 11:00 **OP58 - STRAND 7 - ARGUMENTATION, LANGUAGE AND SCIENTIFIC INQUIRY** **Room F2**

Chairperson(s): Melanie Williams

WHAT MAKES YOU ARGUE? THE INPUT OF EXERCISES' STATEMENTS IN STUDENTS' ARGUMENTATION SKILLS

Jenifer Virgino dos Santos Xavier¹; Renata de Paula Orofino²; Melina de Souza Leite¹; Daniela Lopes Scarpa¹
¹University of Sao Paulo; ²Federal University of ABC

THE PRODUCTION OF LITERARY INSCRIPTIONS BY STUDENTS OF HIGHER EDUCATION IN THE HEALTH AREA WHEN CONDUCTING AN IMMUNOLOGY INQUIRY-BASED LEARNING ACTIVITY

Bruno Sipavicius, K.A.¹; João Rodrigo Santos da Silva²; Daniel Manzoni-de-Almeida¹
¹Escola de Ciências Biológicas e da Saúde, Centro Universitário das Faculdades Metropolitanas Unidas; ²Universidade Federal do ABC

AN ANALYTICAL TOOL TO EVALUATE ARGUMENTATION IN INQUIRY DIDACTIC SEQUENCE (IDS) ABOUT BIODIVERSITY

Marcelo Tadeu Motokane
University of São Paulo

THE ROLE OF METALANGUAGE IN UNDERSTANDING AND ADDRESSING THE LANGUAGE DEMANDS OF SCIENCE LEARNING

Lay Hoon Seah
National Institute of Education, Nanyang Technological University, Singapore

GESTICULATIONS AND PANTOMIME REDUCE THE LANGUAGE GAP FOR CHINESE EMERGENT BILINGUALS IN SCIENCE

Melanie Williams
Edith Cowan University

09:00 - 11:00 **OP154 - STRAND 7 - STUDENTS' SCIENTIFIC EXPLANATIONS** **Room F3**

Chairperson(s): Mai Lill Suhr Lunde

HOW PRIMARY SCHOOL STUDENTS EXPLAIN SCIENTIFIC PHENOMENA

Jennifer Krupinski; Sarah Rau-Patschke; Stefan Rumann
Universität Duisburg-Essen

ON THE CONSTRUCTION OF "SCIENCE STORIES": THE VALUE OF HISTORICAL NARRATIVES FOR SCIENCE EDUCATION

Agustín Adúriz-Bravo¹; Andrea Revel Chion²
¹Universidad de Buenos Aires/CONICET; ²Universidad de Buenos Aires

POSSIBILITIES AND CHALLENGES WITH VISUAL REPRESENTATIONS AS PROMPTS FOR STUDENT MEANING-MAKING ABOUT CONSEQUENCES OF CLIMATE CHANGE

Tobias Fredlund; Erik Knain; Mai Lill Suhr Lunde
University of Oslo

CONDENSING MEANING: INTERMODAL AGGREGATION IN SECONDARY SCHOOL SCIENCE EXPLANATIONS

Len Unsworth; Len Unsworth
Australian Catholic University

FROM JELLY BEANS TO MITOCHONDRIA — USING STUDENT-CONSTRUCTED REPRESENTATIONS OF CELLS TO COMMUNICATE UNDERSTANDING OF CELL STRUCTURE AND CELLULAR PROCESSES

Mai Lill Suhr Lunde
Department of Teacher Education and School Research, University of Oslo

09:00 - 11:00 **OP155 - STRAND 10 - EDUCATION POLICY STUDIES** **Room G1**

Chairperson(s): Pavels Pestovs

ACCESS TO ELITE PUBLIC SCIENCE HIGH SCHOOLS IN THE U.S.: OPPORTUNITY DISPARATE IMPACT, AND EQUAL PROTECTION

Angela Kelly; Keith Sheppard
Stony Brook University

THE IMPACT OF AUTHORITARIAN THINKING ON PUBLIC POLICIES AND SCIENTIFIC EDUCATION: A BRAZILIAN CASE

Michel Carnio; Marcos Cesar Danhoni Neves
Universidade Estadual de Maringá

BETWEEN NATIONAL POLICY AND CHILDREN'S IMAGINATION: CONCEPTUALIZING SCIENCE EDUCATION CURRICULA AND PRACTICES THROUGH A HISTORICAL LENS

Christina Siry; Kerstin te Heesen
University of Luxembourg

50 YEARS OF POLICY INFLUENCES ON UPPER SECONDARY PHYSICAL SCIENCES CURRICULA IN IRELAND

Damienne Letmon; Odilla Finlayson; Eilish McLoughlin
CASTel, School of Physical Sciences, Dublin City University, Ireland;

CHALLENGES TO IMPLEMENTATION OF REVISED SCIENCE AND MATH CURRICULUM IN LATVIA

Pavels Pestovs¹; Dace Namsone¹; Ilze Saleniece²; Liga Cakane¹; Gatis Narvaiss³
¹University of Latvia; ²National Center for Education; ³EduRio Director

09:00 - 11:00 **OP156 - STRAND 11 - METHODOLOGIES TO ASSESS SKILLS, VIEWS AND SELF-CONCEPT** **Room G2**

Chairperson(s): Maria Berge

WHAT MAKES STUDENTS FAIL WHEN SOLVING CHEMISTRY PROBLEM-TASKS: AN EYE-TRACKING ENHANCED STUDY

Martin Rusek; Martina Tóthová
Charles University, Faculty of Education

VOSAL: A QUESTIONNAIRE TO ASSESS PRE-SERVICE TEACHERS' VIEWS OF SCIENTISTS, THEIR ACTIVITIES, AND LOCATIONS

Bianca Reinisch; Moritz Krell
Freie Universität Berlin

COMPARISON OF A PICTORIALLY-AIDED LIKERT SCALE AND A VISUAL DISCRETE SCALE TO ASSESS SELF-CONCEPT IN SCIENCEDaniel Solis¹; Nancy Longnecker¹; David A. W. Hutchinson²¹Centre for Science Communication, University of Otago; ²The Dodd-Walls Centre for Photonic and Quantum Technologies, Department of Physics, University of Otago**PEER-ASSESSMENT AS A TOOL FOR REFLECTIVE FEEDBACK IN PRE-SERVICE TEACHER TRAINING**Lukas Rokos; Jan Petr; Radka Zavodska

University of South Bohemia in Ceske Budejovice, Faculty of Education

NORMS IN SUPERVISION: JOKES IN LIFE SCIENCEMaria Berge¹; Sofie Kobayashi²¹Umeå University; ²University of Copenhagen**09:00 - 11:00 OP157 - STRAND 3 - TEACHER STRATEGIES II****Room G3****Chairperson(s): Mekbib Alemu****HOW CAN EARTHQUAKES GET INTO A 5TH GRADE CLASSROOM?**Jérôme Santini¹; Tracy Bloor²; Serge Quilio¹; Gérard Sensevy³¹University of Côte d'Azur, France; ²University of Aix-Marseille, France; ³University of Western Brittany, France**USING CLASSROOM MANAGEMENT TO SUPPORT INCLUSIVE CHEMISTRY LEARNING**Felix Pawlak¹; Katharina Groß²¹University of Cologne; ²University of Vienna**THE PROMOTION OF SCIENTIFIC THINKING THROUGH LOCATION-BASED QUESTIONS**Shadi Asakle; Miri Barak

Technion - Israel Institute of Technology

DESIGN AND DEVELOPMENT OF A CRITICAL AND CREATIVE THINKING SKILLS SCALE (EHCCT) FOR TEACHING THE SCIENCES IN SECONDARY SCHOOLDiana Prado; Mercè Junyent

Universitat Autònoma de Barcelona

CHANGING PRIMARY SCHOOL (11-14S) TEACHER EDUCATION PEDAGOGY TO ENHANCE LEARNING OF STEM SUBJECTS: THE CASE OF ETHIOPIAVanessa Kind¹; Mekbib Alemu²; Mesfin Tadesse²; Taha Rajab³¹University of Durham; ²Addis Ababa University; ³Durham University**09:00 - 11:00 OP158 - STRAND 13 - INTEGRATED SCIENCE AND STEM EDUCATION****Room G4****Chairperson(s): Lydia E Carol-Ann Burke****PRE-SERVICE SCIENCE TEACHERS' IMPLEMENTATION OF ENGINEERING DESIGN INTEGRATED SCIENCE UNITS IN SCHOOLS**Frackson mumba; Vivien Chabalengula

University of Virginia

FINDINGS FROM A TRANSDISCIPLINARY AND CRITICAL CROSS-CULTURAL STEM (TC3-STEM) APPROACH FOR PREPARING PRE-SERVICE TEACHERSAlberto J Rodriguez

Purdue University

INFUSING STEM INTO ORIENTATION PROGRAM FOR PRE-SERVICE PHYSICS TEACHERNurul Sulaeman; Yoshisuke Kumano

Graduate School of Science & Technology, Shizuoka University

INTERFACULTY INTERPRETATIONS OF STEM EDUCATION: ENGINEERING EDUCATORS AND TEACHER EDUCATORS WORK TOGETHER TO GENERATE STEM WORKSHOPSLydia E Carol-Ann Burke; Christina Phillips; Zoya Padamsi

OISE, University of Toronto

09:00 - 11:00 OP159 - STRAND 14 - PEDAGOGICAL CONTENT KNOWLEDGE VI**Room G5****Chairperson(s): Hernan Cofre****SCIENCE TEACHING THROUGH THE EYES OF STUDENTS.**Eva Pennegård¹; Nils Ekelund²¹Lund University; ²Malmö University

DEVELOPING SCIENCE TEACHER TRAINEES' GRADUATE ATTRIBUTES ALONGSIDE SUBJECT CONTENT KNOWLEDGE (CK) AND PEDAGOGICAL CONTENT KNOWLEDGE (PCK): VIEWS FROM SCIENCE-TEACHER EDUCATORS

Festo Kayima¹; Selina Mkimbili²

¹NTNU - Norwegian University of Science and Technology; ²Mkwawa University College of Education, Tanzania

EXAMINING THE MASTER MODEL AS TOOL FOR SUPPORTING TEACHERS TO TRANSLATE RESEARCH EXPERIENCES INTO PRACTICES-BASED CURRICULUM

Kathleen Hill¹; Matthew Johnson²; Amanda Smith²

¹Pennsylvania State University Main Campus; ²Pennsylvania State University

CAPTURING PEDAGOGICAL CONTENT KNOWLEDGE (PCK) FOR EVOLUTION IN BIOLOGY TEACHERS: A DESCRIPTION OF A NEW PAPER AND PENCIL INSTRUMENT

Hernan Cofre¹; David Santibañez²; Paola Nuñez¹; Beatriz Becerra³; Claudia Vergara⁴

¹Universidad Católica de Valparaíso; ²Universidad Católica Silva Henríquez; ³Universidad Católica de Valparaíso; ⁴Universidad Alberto Hurtado

09:00 - 11:00**OP160 - STRAND 14 - ELEMENTARY AND PRIMARY SCHOOL TEACHERS PROFESSIONAL DEVELOPMENT****Room G6****Chairperson(s): Alison Mercier****FOSTERING LANGUAGE SKILLS IN PRIMARY SCHOOL SCIENCE CLASSROOMS: PRELIMINARY EVALUATION RESULTS OF A PROFESSIONAL DEVELOPMENT PROGRAMME**

Rosa Hettmannsperger¹; Christine Sontag²; Ilonca Hardy¹; Susanne Mannel¹; Katrin Gabler²; Sofie Henschel³; Birgit Heppt²; Petra Stanat³

¹Goethe-Universität Frankfurt; ²Humboldt-Universität zu Berlin; ³Institut zur Qualitätsentwicklung im Bildungswesen Wissenschaftliche Einrichtung der Länder an der H;

A NANOSCALE SCIENCE AND TECHNOLOGY TRAINING COURSE: PRIMARY TEACHERS' LEARNING ON THE LOTUS AND GECKO EFFECTS

Leonidas Manou¹; Anna Spyrtou¹; Euripides Hatzikraniotis²; Petros Kariotoglou¹

¹University of Western Macedonia, Greece; ²Aristotle University of Thessaloniki

DISTRIBUTED EXPERTISE AND RELATIONAL AGENCY: EXAMINING THE WORK OF A SCIENCE TEACHER PROFESSIONAL DEVELOPMENT TEAM

Sara Wilmes; Christina Siry; Kerstin te Heesen; Nora Kneip; Sandy Heinericy
University of Luxembourg

A STEM PROJECT USING COLLECTIVE ARGUMENTATION

Barbara Crawford¹; AnnaMarie Conner¹; Tim Foutz¹; Roger Hill¹; ChanMin Kim²; David Jackson¹; Sidney Thompson¹

¹The University of Georgia; ²Pennsylvania State University

ENHANCING SCIENCE'S THINKABILITY FOR ELEMENTARY TEACHERS: A SCIENCE CAPITAL APPROACH

Alison Mercier; Heidi Carlone; Dearing Blankmann
University of North Carolina at Greensboro

09:00 - 11:00**OP161 - STRAND 14 - DEEPENING TEACHERS' ENGAGEMENT WITH SCIENCE CONTENT****Room G7****Chairperson(s): Ana Martins****"I DIDN'T KNOW HOW THAT COULD COME TO THIS CURRICULUM": TEACHER GROWTH THROUGH THE DEVELOPMENT OF MATERIALS ABOUT NATURE OF SCIENCE**

Haira Gandolfi

UCL Institute of Education

EVIDENCED-BASED TEACHER OWNERSHIP OF AN EDUCATION THROUGH SCIENCE PHILOSOPHY AND APPROACH TO SCIENCE TEACHING AT THE SECONDARY LEVEL

Valdmann Ana; Miia Rannikmäe; Jack Holbrook

Tartu University

THE IMPACT OF A STEM UNDERGRADUATE RESEARCH EXPERIENCE ON INSERVICE TEACHER CAREERS

Molly Fisher; Jennifer Wilhelm

University of Kentucky

SCIENCE TEACHERS' METAVISUAL STRATEGIES FOR SCIENTIFIC MODELING

Jung-Yi Hung¹; Hsin-Yi Chang²; Chin-Chung Tsai²

¹National Kaohsiung Normal University; ²Program of Learning Sciences & The Institute for Research Excellence in Learning Sciences, National

BRINGING BIOINFORMATICS TO SECONDARY EDUCATION: A WORKSHOP FOR SCIENCE TEACHERSAna Martins¹; Leonor Lencastre²; Fernando Tavares¹¹Faculty of Sciences of University of Porto; Research Center in Biodiversity and Genetic Resources; ²Faculty of Psychology and Educational Sciences of the University of Porto

09:00 - 11:00 **OP162 - STRAND 17 - IMPROVING UNIVERSITY SCIENCE EDUCATION** **Room G8****Chairperson(s): Marissa Rollnick****UNDERGRADUATE SCIENCE WRITING: FACULTY MEMBERS' BELIEFS AND EXPERIENCES**Annelotte Lammers; Martin Goedhart

Institute for Science Education and Communication, University of Groningen

LEARNING ASSISTANTS' TRANSFORMED VIEWS ON TEACHING AND THE TEACHER ROLE AFTER A TRAINING PROGRAMMEAnders Lauvland; Tor Ole Odden; Maria Vetleseter Bøe; Ellen Karoline Henriksen

University of Oslo, Dept. of Physics

A "TRICKLE-UP" APPROACH TO IMPROVING UNIVERSITY SCIENCE EDUCATION: EVALUATION OF A PCK-BASED PROFESSIONAL DEVELOPMENT COURSE FOR GRADUATE STUDENTSSara Petchey; Kai Niebert

University of Zurich

A SOCIOLOGICAL BASED INQUIRY TO ACCESS SCIENCE EDUCATION SUPERVISOR'S PREPARATION AND ACTIONSLuciana Massi¹; Marcelo Giordan²¹Universidade Estadual Paulista; ²Universidade de São Paulo**THE RELATIONSHIP BETWEEN PCK AND CK FOR TEACHING CHEMICAL BONDING: THE EXCLUSIVE DOMAIN OF TEACHERS?**Marissa Rollnick¹; Bette Davidowitz²; Frackson Mumba³; Rene Toerien⁴¹University of the Witwatersrand; ²University of Cape Town; ³University of Virginia; ⁴Rondebosch Boys' high School



General Information

BANKS & CURRENCY

The Euro (€) is the currency in use in Italy
Visa and Master Card are all widely accepted in shops and restaurants throughout the country.

Bank Opening Hours Mon Mon to Fri
8.30-12.30 14.30-16.30

CLIMATE

August weather is hot in Bologna but showers can occur.

Average temperatures range from 25 – 30 °C.

ELECTRICITY

Electric Current: 220 Volts AV

EMERGENCY CONTACT DETAILS

During the meeting, in case of an emergency of any kind, please contact the Registration Desk.

If you require medical services while resident in your hotel/accommodation, please contact your hotel/accommodation reception who will be able to arrange a doctor on call.

Calling the following numbers from a fixed line is free of charge:

118: Ambulance

115: Fire-brigade

113: Polizia (Police)

112: Carabinieri (military police)

SHOPPING

General opening hours are Monday-Saturday from 09.30-19.30. Most major stores/shops open on Sunday

SMOKING

Italy has introduced a ban on smoking. Smoking is prohibited in public areas including all bars, nightclubs and restaurants. If required you should enquire whether your accommodation bedroom is a smoking or non-smoking room. Please use the smoking areas designated outside venues.

TAXIS

A licensed taxi must display a "TAXI" display panel on the top of the car's roof.

Average prices

Center / Station - Fiera (P.zza Costituzione) and vice versa: € 15.00 / 18.00

Airport - Fair (P.zza Costituzione) and vice versa: € 20.00 / 25.00

The use of the collective taxi, pre-organized, provides some facilitated rates in the presence of certain requirements:

- from a single point of departure to a single destination and is activated with a minimum number of 3 users. The discount provided is 60% (ie each user pays 40% of the trip) and the amount displayed on the taximeter is per passenger;
- from central station to the Congress center (P.zza Costituzione) and vice versa: fixed rate of € 4.00 / person (minimum 3 people).

To facilitate access to the service there is the possibility of using Taxiclick Easy application, which also allows you to pay for rides in the app upon registration of your credit card ([http: / www.cotabo.it/clienti/servizi/taxi-click/](http://www.cotabo.it/clienti/servizi/taxi-click/)).

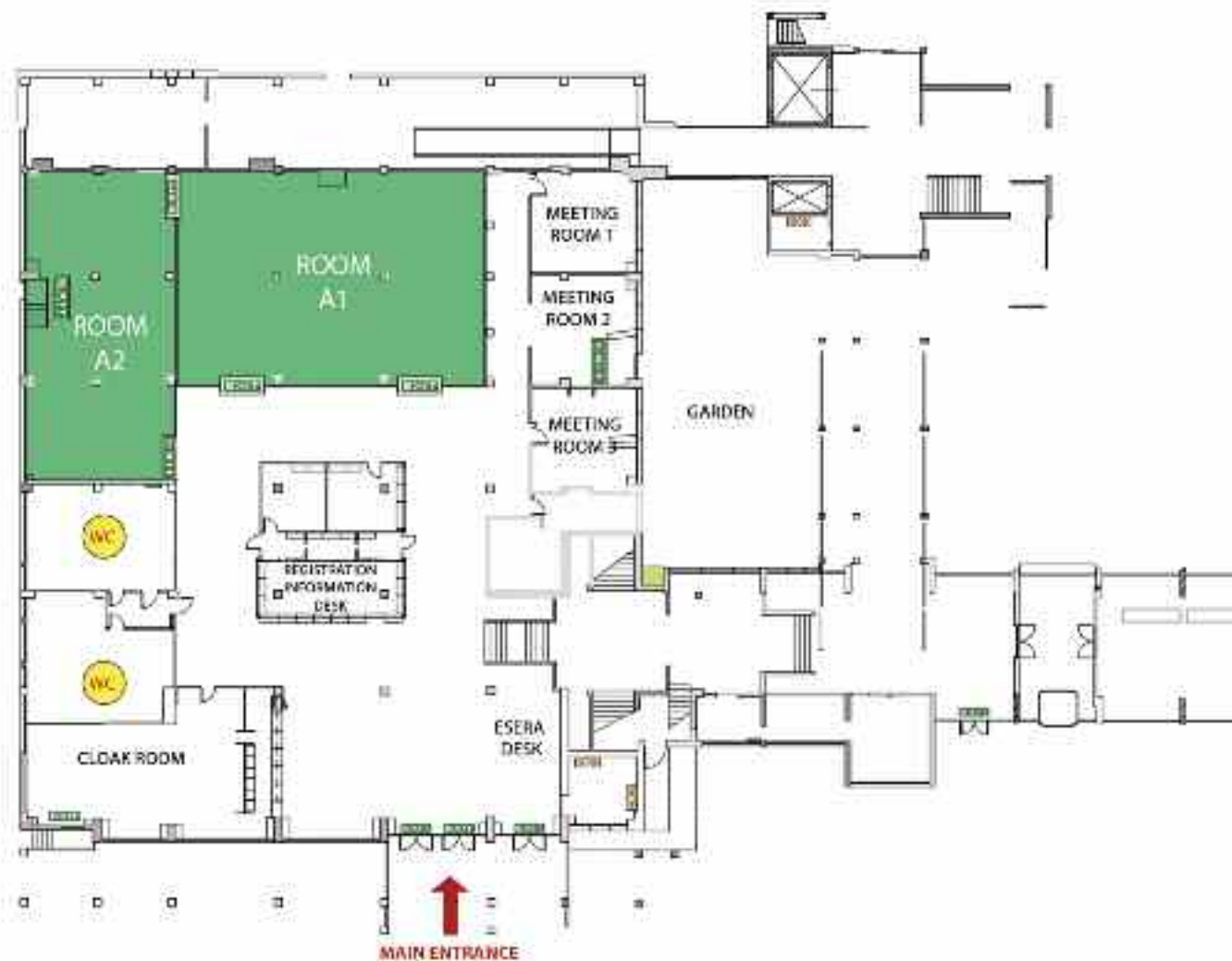
TIPPING

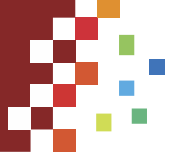
Tipping is a generally accepted practice in restaurants, bars, taxis and hotel porters. A service charge may be included in some restaurants and should be stated on the menu, but otherwise this is a discretionary item.



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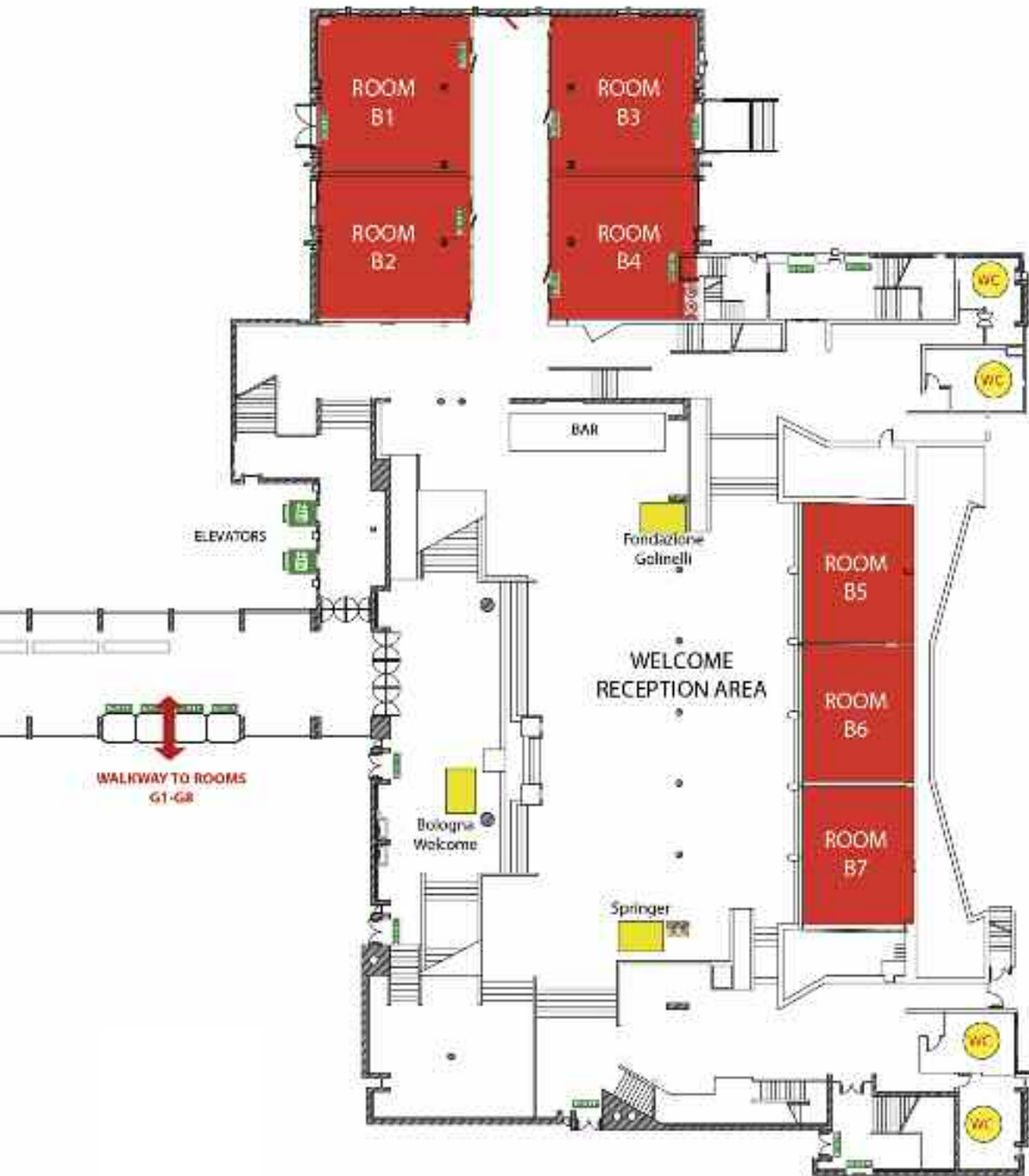
Sala Maggiore - Ground Floor





Congress Center Map

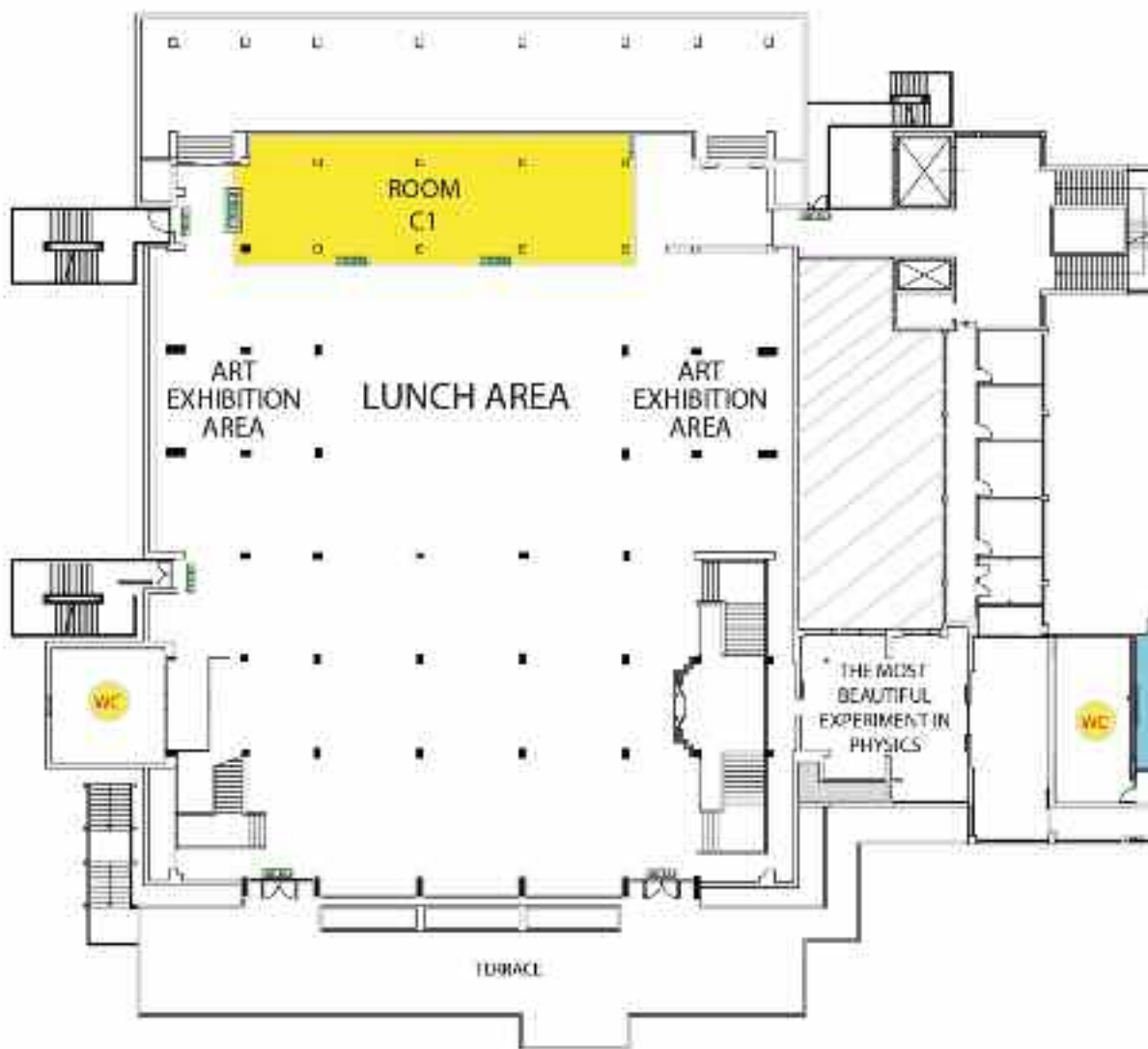
Centro Congressi - Ground Floor

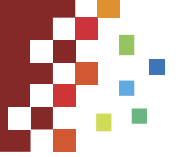




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Sala Maggiore - First Floor





Congress Center Map

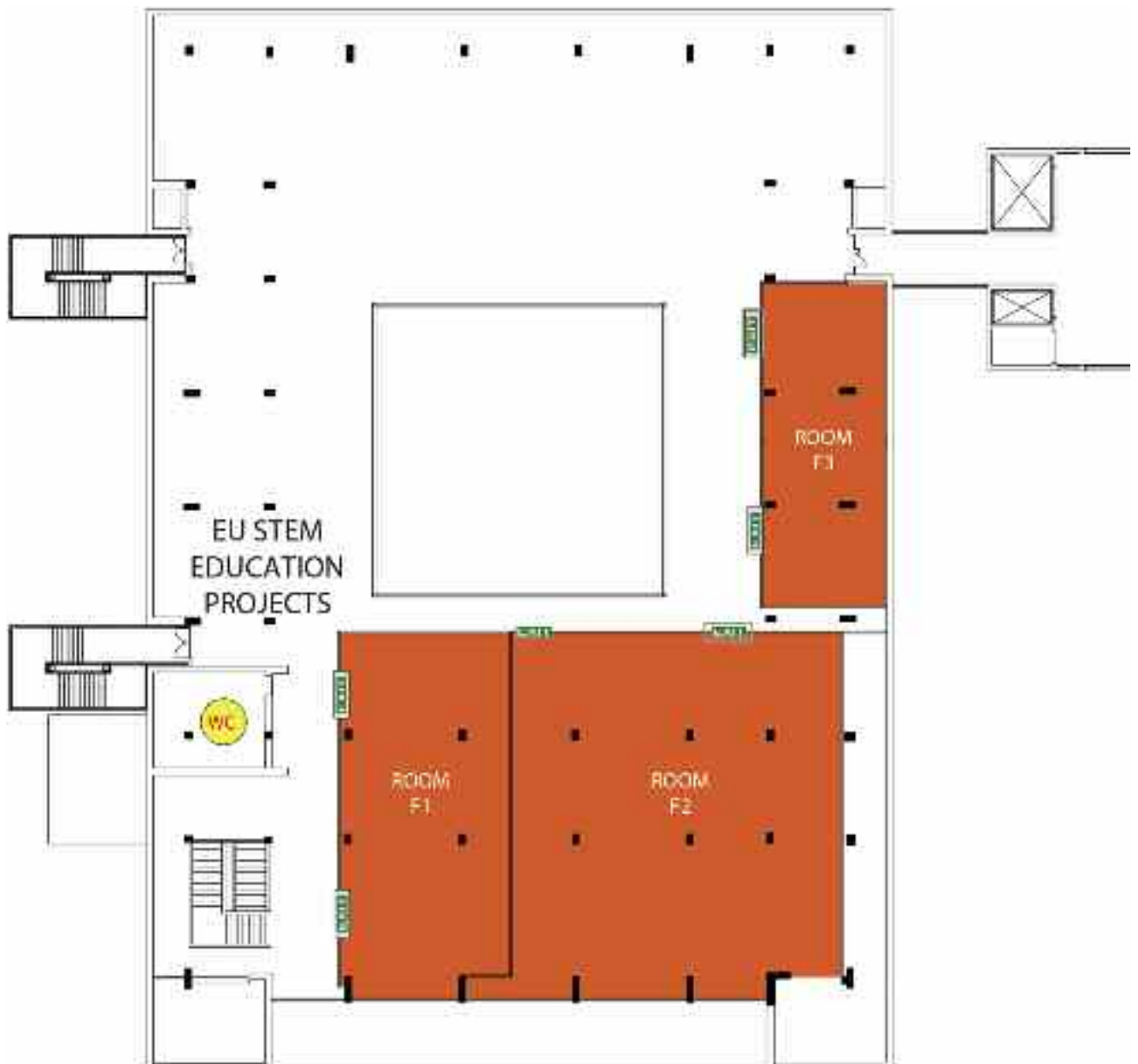
Centro Congressi - First Floor





Congress Center Map

Sala Maggiore - Second Floor





Esera 2019 Programme Conference Overview

	MONDAY 26	TUESDAY 27	WEDNESDAY 28	THURSDAY 29	FRIDAY 30
09.00-11.00	Pre-conference Workshops	Parallel sessions (Symposia)	Parallel sessions (Symposia)	Parallel sessions (Symposia)	Parallel sessions (Papers)
11.00-11.30		coffee break	coffee break	coffee break	coffee break
11.30-12.45		Plenary (1h 1/4)	Plenary (1h 1/4)	Plenary (1h 1/4)	Plenary (1h 1/4)
12.45-13.00	free break	Lunch (1h)	Lunch (1h)	General Assembly (1h 1/4)	Closing Ceremony (1h)
13.00-13.15	Opening Ceremony (1h)				
13.15-13.30					
13.30-13.45					
13.45-14.00					
14.00-15.00	Opening Plenary (1h)	Parallel session (Summer School Posters 2017-2018-2019/ Workshop)	Parallel session (Posters)	Lunch (45 mins)	
15.00-16.30	Parallel session (Papers)	Parallel session (Papers)	Parallel session (Papers)	Parallel session (Papers)	
16.30-17.00	break	break		break	
17.00-18.30	Parallel session (Papers)	Parallel session (Papers)	FREE TIME	Parallel session (Papers)	
18.30-19.30	Welcome Party	Meetings Strand Chairs & SIG coordinators		SIG business meetings	FREE TIME
19.30-20.00		ECR reception (20.00-late)			
20.00-21.30				Social Dinner (20.00-late)	



Sponsors and exhibitors



SPRINGER NATURE
