CASE

SCHOOL 4.0

STEAM Approach in Science Education

Conference Programme

December 1-3 2020

http://www.project-case.eu/case-conference

STEAM Approach in Science Education

Welcome to the International Conference "STEAM Approach in Science Education". The Conference is jointly organised by the CASE (http://www.project-case.eu) and GSO4SCHOOL (http://gso4school.eu/) ERASMUS+ projects.

The conference is an international meeting point for educators, scientists, artists, researchers and policy-makers during which cutting-edge perspectives on creativity in school education will be presented and further developed. The conference is an exciting and enjoyable occasion for educators to gain valuable experience with specific Professional Development approaches to science-and-art (STEAM) methodologies through hands-on experiences, lectures and intensive, interactive workshops.

In the following pages you will find all the details for the conference programme as well as the abstracts all the presentations and workshops.

Our vision for STEAM Approach in Science education is the development of the innovative and creative classroom of tomorrow, where science education will be taught using an interdisciplinary methodology via arts activities and at the same time the integration of other disciplines such as entrepreneurship and design thinking.

Enjoy the Conference!

On behalf of the Conference Organising Committees,

Oddgeir Randa Heggland, *Western Norway University of Applied Sciences* – Norway

Menelaos Sotiriou, *Science View* – Greece

Oded Ben Horin, *Western Norway University of Applied Sciences* – Norway

Conference Committees

International Organising Committee

Grethe Lønning Grimsbø, *Western Norway University of Applied Sciences* - Norway
Oddgeir Randa Heggland, *Western Norway University of Applied Sciences* - Norway
Menelaos Sotiriou, *Science View* - Greece
Oded Ben Horin, *Western Norway University of Applied Sciences* - Norway
Petros Stergiopoulos, *Ellinogermaniki Agogi* - Greece
Valentina Tudisca, *National Research Council* - Italy
Angelos Lazoudis, *Ellinogermaniki Agogi* – Greece

Scientific Committee

Menelaos Sotiriou, *Science View* - Greece
Oddgeir Randa Heggland, *Western Norway University of Applied Sciences* - Norway
Bernard Foing, *European Space Agency* - The Netherlands
Kerry Chappell, *University of Exeter* - United Kingdom
Sofoklis Sotiriou, *Ellinogermaniki Agogi* - Greece
Rosa Doran, *NUCLIO* - Portugal
Rūta Girdzijauskienė, *Klaipėda University* - Lithuania
Vassilis Koulountzos, *Aristotle University of Thessaloniki* – Greece

Local Organising Committee

Oddgeir Randa Heggland, *Western Norway University of Applied Sciences* - Norway
Grethe Lønning Grimsbø, *Western Norway University of Applied Sciences* - Norway
Oded Ben Horin, *Western Norway University of Applied Sciences* - Norway
Helene Oestreich, *Western Norway University of Applied Sciences* - Norway
Janne Robberstad, *Western Norway University of Applied Sciences* - Norway

Programme in a nutshell

DAY 1: December 1st	DAY 2: December 2nd	DAY 3: December 3rd	Poster Presentations
14:00 – 14:10: Welcome	14:00 – 14:05: Icebreaker	14:00 – 14:05: Icebreaker	Videos with poster presentations will be available during the whole duration of the Conference
14:10 – 14:30: Keynote Speech	14:05 – 14:25: Keynote Speech	14:05 – 14:25: Keynote Speech	
14:30 – 15:15: Workshop *Design Thinking in Education*	14:25 – 15:10: Workshop *Learning Science Through Dance*	14:25 – 15:25: Oral Presentations	
15:15 – 15:25: Coffee-break	15:10 – 15:40: Oral Presentations	15:25 – 15:35: Coffee-break	
15:25 – 19:20: GSO4SCHOOL Workshop	15:40 – 15:50: Coffee-break	15:35 – 16:20: Workshop *Learning Science Through Humoristic Stories*	
	15:50 – 16:50: Oral Presentations	16:20 – 16:50: Oral Presentations	
	16:50 – 17:05: Coffee-break	16:50 – 17:05: Coffee-break	
	17:05 – 17:50: Workshop *Learning Science Through Puppetry*	17:05 – 17:20: Oral Presentations	
	17:50 – 18:20: Oral Presentations	17:20 – 18:05: Workshop *Using Real Astronomical Data in the (virtual) Classroom*	
	18:20 – 18:30: Coffee-break	18:05 – 18:20: Oral Presentations	
	18:30 – 19:30: Oral Presentations	18:20 – 18:30: Coffee-break	
		18:30 – 19:15: Oral Presentations	
19:20 – 19:25: Closing of 1st Day	19:30 – 19:35: Closing of 2nd Day	19:15 – 19:20: Closing Ceremony	

Detailed Conference Programme

STEAM Approach
in Science Education

DAY 1: December 1st

	14:00 – 14:10 **Welcome** Assoc. Prof. Oded Ben Horin, HVL
KEYNOTE	**14:10 – 14:30** **Keynote Speech** **Assoc. Prof. Kerry Chappell,** *From Wise Humanising Creativity to (posthumanising) creativity*
WORKSHOPS	**14:30 – 15:15** **Workshop** **Dr. Rosa Doran & Priscila Doran – NUCLIO,** *Design Thinking in Education*
	15:15 – 15:25 ***Coffee-break***
WORKSHOPS	**15:25 – 19:20** **GSO4SCHOOL Workshop** Organized by the GSO4SCHOOL Project, Moderated by Oded Ben Horin, HVL
	19:20 – 19:25 ***Closing of 1st Day***

You can find the description of all the presentations and the abstracts in the Abstract Sesction of the programme

DAY 2: December 2nd

	14:00 – 14:05 **Icebreaker** By Irma Smegen
	14:05 – 14:25 **Keynote Speech** **Dr. Sofoklis Sotiriou,** *Open Schools for Open Societies*
	14:25 – 15:10 **Workshop** **Magdalena From Delis and Anne-Beate Ulveseth Lilletvedt,** *Learning Science Through Dance*
	Oral Presentations – Chair: Menelaos Sotiriou **15:10 – 15:25: Dr. Vassilis Koulountzos, Aristotle University of Thessaloniki** *Learning Science Through Slow-Mation* **15:25 – 15:40: Maria Seroglou, Anna Letsi and Eleni Gentzi, Teachers.** *CASE Slowmation Teaching Applications in Greece*
	15:40 – 15:50 ***Coffee-break***
	Oral Presentations – Chair: Menelaos Sotiriou **15:50 – 16:05: Dr. Padraig Murphy, Assis. Prof., Dublin City University,** *Using CASE as a space pioneer concept* **16:05 – 16:20: Dr. Angelos Lazoudis, Ellinogermaniki Agogi,** *Learning Science Through Digital Storytelling* **16:20 – 16:35: Thalia Tsaknia, Teacher,** *Implementing Learning Science Through Digital Storytelling* **16:35 – 16:50: Dr. Padraig Murphy, Assis. Prof., Dublin City University – Dr. Vassilis Koulountzos, Aristotle University of Thessaloniki,** *Applications of CASE in Greek schools and teacher attitudes to creative science education*
	16:50 – 17:05 ***Coffee-break***

You can find the description of all the presentations and the abstracts in the Abstract Sesction of the programme

DAY 2: December 2nd

	17:05 – 17:50 **Workshop** **Irma Smegen, SPEEL JE WIJS,** *Learning Science Through Puppetry*
	Oral Presentations – Chair: Dr. Padraig Murphy **17:50 – 18:05: Geesje Alders Veenstra and Tatiana Lenferink, Teachers,** *Implementing Learning Science Through Puppetry* **18:05 – 18:20: Menelaos Sotiriou, Science View,** *Learning Science Through Theatre*
	18:20 – 18:30 ***Coffee-break***
	Oral Presentations – Chair: Dr. Padraig Murphy **18:30 – 18:45: Theodora Blakou, School Head, 4th Primary School of Tyrnavos, Greece,** *Implementing Learning Science Through Theatre* **18:45 – 19:00: Dr. R0ta Girdzijauskienė, Klaipeda University,** *Pupil Engagement in Arts-Based Science Learning* **19:00 – 19:15: Ioanna Dratsiou, Medical Physics Laboratory, School of Medicine, Faculty of Health Sciences, AUTH,** *The effects of creative use of Technology and Drama on primary school students' attitude towards science and science careers* **19:15 – 19:30: Natalija Budinski, Petro Kuzmjak school Ruski Krstur Serbia,** *Use of 3d Printing as support to STEAM Education*
	19:30 – 19:35 ***Closing of 2nd Day***

You can find the description of all the presentations and the abstracts in the Abstract Sesction of the programme

DAY 3: December 3rd

	14:00 – 14:05 **Icebreaker** *By Oded Ben Horin*
	14:05 – 14:25 **Keynote Speech** **Prof. Bernard Foing,** *Together on the Moon and Mars with Learning and Teaching*
	Oral Presentations - Chair: Assis. Prof. Oddgeir Randa Heggland **14:25 – 14:40: Assoc. Prof. Oded Ben Horin, HVL,** *Improvising Creativity* **14:40 – 14:55: Dr. Rosa Doran, NUCLIO,** *Innovation in science education* **14:55 – 15:10: Petros Stergiopoulos, Ellinogermaniki Agogi,** *Distant Music, Ways of constructing modular sound design* **15:10 – 15:25: Stefanos Giagtzoglou, Science View,** *Learning Science Through improvisational comedy theatre*
	15:25 – 15:35 *Coffee-break*
	15:35 – 16:20 **Workshop** **Stefanos Giagtzoglou – Science View,** *Learning Science Through Humoristic Stories*
	Oral Presentations - Chair: Assis. Prof. Oddgeir Randa Heggland **16:20 – 16:35: Joana Latas, *University of Coimbra,*** *Eddington@Sundy: bringing All together* **16:35 – 16:50: Prof. Magne Espeland, HVL,** *Creative Pedagogies in Education as Craft: From John Dewey's "The nature of method" to where?*
	16:50 – 17:05 ***Coffee-break***

You can find the description of all the presentations and the abstracts in the Abstract Sesction of the programme

DAY 3: December 3rd

	Oral Presentation - Chair: Dr. Rosa Doran **17:05 – 17:20: Šmitienė Gražina, Klaipeda University,** *The Notion of Arts in STEAM Concept*
	17:20 – 18:05 **Workshop** **Fraser Lewis – Faulkes Telescope Project and the National Schools' Observatory,** *Using Real Astronomical Data in the (virtual) Classroom*
	Oral Presentation - Chair: Dr. Rosa Doran **18:05 – 18:20: Maria Barouta, *Kanalia Primary School, Corfu, Greece,*** *Coding through art: engaging computational thinking in primary education*
	18:20 – 18:30 ***Coffee-break***
	Oral Presentations - Chair: Dr. Rosa Doran **18:30 – 18:45: Panagiota Argyri, Evangeliki Model High School of Smyrna, Greece** *Digital Cultural Heritage in STEM lessons: The case study of Geometry* **18:45 – 19:00: Foteini Dolianiti, Lab of Medical Physics, School of Medicine, Faculty of Health Sciences, Aristotle University of Thessaloniki,** *Socio-Educational Needs for the design of an Internet of Things enabled and AI powered educational robotics platform* **19:00 – 19:15: Elisa Butali, Institute for Research on Population and Social Policies of the National Research Council of Italy,** *Up-side down drawing during math lesson to promote self-esteem and lateral thinking*
	19:15 – 19:20 ***Closing Ceremony*** *Assoc. Prof. Oded Ben Horin, HVL*

You can find the description of all the presentations and the abstracts in the Abstract Sesction of the programme

Virtual Posters

Videos with poster presentations will be available during the whole duration of the Conference.

You can find more following the link:

http://www.project-case.eu/case-conference/conference-programme/#1606230421709-78567bb9-dbc4

STEAM Approach
in Science Education

Abstracts per session category

KEYNOTE

December 1st, 14:10 – 14:30

Assoc. Prof. Kerry Chappell

Keynote Abstract:

From Wise Humanising Creativity to (posthumanising) creativity

In this presentation, Kerry will demonstrate that existing concepts of creativity in education only go so far in addressing rapid, unpredictable 21st century changes and accompanying policy and practice challenges. She will explain, critique and shift away from humanist conceptualisations such as 'Wise Humanising Creativity' and argue that (posthumanising) creativity as a new articulation, allows us to consider and action creativity to meet these challenges. This new idea can overcome problems of humanistic conceptualisations, as it includes a fuller range of creative 'actants', incorporates a different, emergent ethics and allows the future too to emerge, rather than 'be-designed'. Kerry will offer practice-based examples of (posthumanising) creative education from STEAM and dance contexts, as well as from teaching in Higher Education, bringing alive how this theory and practice can address the challenges we face.

Short CV of the Speaker:

Kerry Chappell is an Associate Professor in the Graduate School of Education at University of Exeter, where she leads the MA Education Creative Arts Programme and the Creativity and Emergent Educational futures Network. She is co-convenor of the British Educational Research Association Creativities Special Interest Group and Associate Editor of the *Thinking Skills and Creativity* journal. Her research focuses on creativity in education, specifically in the arts and transdisciplinary settings, and how creativity contributes ethically to educational futures. Kerry is currently PI on projects investigating creative pedagogy in Higher Education transdisciplinary intensives (EU Erasmus +) and creative methodologies in Dance and Health settings (Wellcome Trust). She has also just produced an ESRC-funded Science Arts Creative Teaching Resource for UK teachers. She is a visiting lecturer at the Danish National School of Performing Arts, an Adjunct Associate Professor at the Western Norway University of Applied Sciences and a Dance in Devon board member. All of her work is informed by her ongoing practice as a dance artist with Devon-based Dancelab Collective.

December 2nd, 14:05 – 14:25

Dr. Sofoklis Sotiriou

Keynote Abstract:

Open Schools for Open Societies

Open Schools for Open Societies (OSOS) initiative has demonstrated an extremely successful journey in the diffusion of innovation and Open School Culture in school settings. An Open School Culture requires schools, in cooperation with other stakeholders, to become agents of community well-being. In this framework, families are encouraged to become real partners in school life and activities; professionals from enterprises and civil and wider society are actively be involved in bringing real-life projects in the classroom. These projects developed by school that forms successful networks with a taste for responsible innovation. The OSOS School Hubs created communities of practice to implement their innovative projects, involving numerous schools that progressively adopt the open school culture. **100 OSOS School Hubs have managed to set in motion a network of 1162 schools in 15 EU countries.** As proved by the OSOS results the young students that participated to OSOS projects have improved their STEM skills. This has been achieved by: a) simulating in the classroom, the work of the scientist, researcher and entrepreneur, b) promoting a better understanding of: "how science works"; "how knowledge and technology is developed"; "how these impact society", c) enhancing students' STEM related career aspirations and d) implementing and promoting project-based and inquiry-based science teaching and learning. Altogether, participation in OSOS supported students very well in science motivation, intrinsic motivation and state emotions. All motivation sub-scales correlated significantly with all state emotions sub-scales (well-being, interest, boredom; positive significant correlations with well-being and interest as well as negative ones with boredom). Similarly, significant correlations appeared of the intrinsic motivation sub-scales with the emotion ones. High science motivation scores showed students interested and feeling good during the OSOS project. Thus, the OSOS initiative is a promising way to support important STEM competencies and seemingly brings motivation, interest or competence back to science classrooms successfully. OSOS needs dissemination in order to multiply such positive efforts into all European classrooms.

Short CV of the Speaker:

Dr. Sofoklis Sotiriou has worked at CERN, at the National Center for Scientific Research "DEMOKRITOS" in Athens and in the Physics Laboratory of Athens University. He holds a PhD in High Energy Neutrino Astrophysics and a PhD in Science Education. He is the Head of R&D Department of Ellinogermaniki Agogi, one of the biggest educational institutions in Greece, where has been active in the co-ordination and development of research projects on implementation of advanced technologies (e.g. mobile applications, wearable computers, VR and AR applications, robotics) in science education and training. Since 2001 he is the Director of the Ellinogermaniki Agogi Center for Teachers Training. His main research field is the design, application, and evaluation of virtual and digital media environments that could bridge the gap between formal and informal science learning. He has been involved in a long series of EU joint research and technology funded projects. He is a member of the European Academy of Sciences (since 2003), member of the board of ECSITE (since 2004) and has served as Expert Evaluator to the European Commission FP5 & FP6 Programmes. He has also act as a consultant to the development of the FP7's Science in Society Work programme. He is author of numerous articles and publications on the use of ICT in science education. He is also author of the Science Textbooks that are used in all primary Greek schools since 2003.

December 3rd, 14:05 – 14:25

Prof. Bernard Foing

Keynote Abstract:

Together on the Moon and Mars

EuroMoonMars is an ILEWG programme following up ICEUM declarations as a collaboration between ILEWG, space agencies, academia, universities and research institutions and industries. The ILEWG EuroMoonMars programme includes research activities for data analysis, instruments tests and development, field tests in MoonMars analogue, pilot projects, training and hands-on workshops, and outreach activities. EuroMoonMars includes a programme of grants for Young Professional Researchers. EuroMoonMars field campaigns have been organised in specific locations of technical, scientific and exploration interest. Field tests have been conducted in ESTEC, EAC, at Utah MDRS station, Eifel, Rio Tinto, Iceland, La Reunion, LunAres base at Pila Poland, and HiSEas base in Hawaii. These were organised by ILEWG in partnership with ESTEC, VU Amsterdam, NASA Ames, GWU in Utah MDRS (EuroGeoMars 2009, and then yearly for EuroMoonMars 2010-2013). EMMIHS campaigns (EuroMoonMars-IMA International Moonbase Alliance- HiSEAS) in 2018-2020 took place on Mauna Loa volcano in Hawaii.

Short CV of the Speaker:

Prof. Bernard H. FOING, ESA Senior Scientist, executive director of ILEWG, SMART-1 Lead scientist, EuroMoonMars manager, Prof VU Amsterdam. At ESA ESTEC since 1989, as ESTEC staff committee chair (2012-2017), Chief scientist, Head of Research Division, study lead (SIMURIS, MORO lunar orbiter, EuroMoon lander), staff, visiting scientist fellow. Co-Investigator of SOHO, XMM, BIOPAN, SMART-1, Mars Express, COROT, ISS/Expose, ExoMars. Chair IAF ITACCUS, member IAA, COSPAR, MVA, EGU. Publications: >800 articles, including 225 refereed papers (cosmic fullerene $C60^{+}$, first super-Earth, tropical Mars glaciars, 8000 citations, H47), 16 books, organiser 70 symposia. Academics: Habilitation 1990, CNRS, astronomer ESO Chile, PhD astrophysics & space techniques (CNRS, Lockheed, SacPeak, Boulder, Harvard), Prof agrégé Physics, Ecole Normale Supérieure ENSET. https://en.wikipedia.org/wiki/Bernard_Foing https://scholar.google.com/citations?user=_fTVp0kAAAAJ&hl=en

WORKSHOPS

December 1st, 14:30 – 15:15

Design Thinking for Education – A GSO4SCHOOL's Tale

By Dr. Rosa Doran & Priscila Doran, NUCLIO – *Núcleo Interativo de Astronomia*

This workshop intends to present to the audience the Design Thinking model that is being adopted for the Global Science Opera for Schools project. Design Thinking is a methodology, initially embraced by business in general, that intends to provide products' designers with the necessary background information about their final target audience. The model has been recently more widely adopted in the field of education as a mean to help educators get a better understanding about their students and the communities where they live. A series of success stories will be shared, namely the ones related to the integration of design thinking to the support of the open schooling movement. The model used for instance in the project Open Schools for Open Societies, an EC project that reached over 1000 schools and more than 2300 teachers, went one step ahead and equipped students with the necessary skills to use the DT model to address problems prevailing in their own communities. By using the four steps of the design thinking methodology for education, students were able to better understand the sources of the problems and create possible solutions, while engaging relevant stakeholders in the community. The four steps: FEEL, IMAGINE, CREATE and SHARE will be presented along with a vision for its integration for STEAM learning opportunities.

December 1st, 15:25 – 19:20

GSO4SCHOOL Workshop

This workshop will provide an overall view of the GSO4SCHOOL project as well as a collaborative arena in which the scientific theme of the 2021 Global Science Opera (GSO) production will be developed as an integral and inter-related foundation of the opera's artistic processes and expressions. During the workshop, participants will alternate between plenary and break-out sessions. Plenary sessions will be dedicated to an overall plan and mutual presentations of what emerged in the break-out sessions. Break-out sessions (science, drama, music) will be dedicated to the development of content for the opera. That content will provide the main story-line, scientific perspectives and musical elements for the 2021 production. Organised by the GSO4SCHOOL Partnership.

The detailed programme of the GSO4SCHOOL workshop.

15:25 - 15:45
Assoc. Prof. Oded Ben Horin & Assis. Prof. Oddgeir Randa Heggland (HVL)
Intro to GSO4SCOOL concept

15:45 - 15:55
GSO4SCHOOL Partnership
Introduction of each partner and its role in the project

15:55 - 16:25
Assoc. Prof. Oded Ben Horin, *HVL*; Petros Stergiopoulos, *Ellinogermaniki Agogi*; Menelaos Sotiriou, *Science View*
Presenting the pedagogical framework and the creative approaches that GSO4SCOOL introduces

16:25 - 16:40
Coffee-break

16:40 - 16:55
Moderated by Assoc. Prof. Oded Ben Horin, *HVL*
Preparations for opera production – Task 1: Developing the opera's synopsis

16:55 - 17:25
Task 1: Breakout Sessions
Breakout Session 1: Drama
Moderated by Accoc. Prof. Oded Ben Horin, *HVL*
Breakout Session 2: Music
Moderated by Petros Stergiopoulos, *Ellinogermaniki Agogi*
Breakout Session 3: Science
Moderated by Priscila Doran, *NUCLIO*

17:25 - 17:40
Moderated by Assoc. Prof. Oded Ben Horin, *HVL*
Presentation of Task 1 Results (from each one of the breakout sessions)

17:40 - 17:50
Coffee-break

17:50 - 17:55
Moderated by Assoc. Prof. Oded Ben Horin, *HVL*
Task 2: Explanation

17:55 - 18:20
Task 2: Breakout Sessions
Breakout Session 1: Drama
Moderated by Accoc. Prof. Oded Ben Horin, *HVL*
Breakout Session 2: Music
Moderated by Petros Stergiopoulos, *Ellinogermaniki Agogi*
Breakout Session 3: Science
Moderated by Priscila Doran, *NUCLIO*

18:20 - 18:35
Moderated by Assoc. Prof. Oded Ben Horin, *HVL*
Presentation of Task 2 Results (from each one of the breakout sessions)

18:35 - 18:50
Dr. Rosa Doran, *NUCLIO*
Implementation. How to realise the GSO4SCHOOL activities in the school setting

18:50 - 19:05
Valentina Tudisca, Claudia Pennacchiotti and Adriana Valente – *National Research Council of Italy*
Evaluation and participation: insights from the Italian contribution to the UNESCO Futures of Education initiative

19:05 - 19:20
GSO4SCHOOL Partners
The road ahead and summary

December 2nd, 14:25 – 15:10

Learning Science Through Dance

By Magdalena From Delis and Anne-Beate Ulveseth Lilletvedt

This workshop will be a 45 minutes explanation from our training material- Learning Science Through Dance (LSTD).

The material has been made by multi- artist Magdalena from Delis and drama/dance lecturer and artist Anne-Beate Ulveseth Lilletvedt.

During our verbal online presentation, we will also show some movement example as well.

In the start/introduction of the training material we want a science teacher to start the process by showing a scientific experiment to the student. This experiment work as a main-base and starts the processes connecting science with dance. In the workshop we will not show a science experiment, but in the training material manual you will find links to some basic experiments done by science teacher Trine Gravdal. One of these examples will be explained as our starting point in the workshop.

We have written our LSTD- training material as detailed as possible, so that science teachers should feel comfortable doing it without having any dancing experience. One of our biggest focus in the LSTD is how the teacher constantly can open up for the students to use their creativity and work with their bodies by making movements and shapes they relate to their science question and experiment. This means that creative dance is the form we use rather than any classical dancing styles when working with LSTD. Also drawing shapes is a tool we have added as a way of making the students think of shapes and movements in a different and creative way. In the workshop we will show and explain this, and take the participants through a short-version of all the steps in the process: Question- Evidence- Analyse – Explain – Connect - Communicate - Reflect.

In the end we will open up for question related to the workshop and our work with the training- material- manual

December 2nd, 17:05 – 17:50

Learning Science Through Puppetry

By Irma Smegen – Speel je *Wijs*

Hand-puppets can be a wonderful tool to motivate and inspire young children during scientific activities. Hand-puppets connect science to the fantasy world which children love. With hand-puppets you can create curiosity and interest for science in a playful way

During their research, children think of solutions and answers, make hypothesis, brainstorm, connect ideas, search for the right material to use, try and fail, retry and improve, design and develop, and by doing so, they help the puppets. On the other hand, the puppets help the children, they deepen their research by asking questions and stimulating them. This way Science and Puppetry leads to an interesting cooperation.

As part of the CASE Erasmus+ project, eight primary school teachers in the Netherlands implemented Science and Puppetry in their schools. In 2015 Irma's book about this same topic was published in Dutch language. Over 500 books are sold, approximately 200 teachers were trained and even more visited congresses to get inspiration. Since then many schools and preschools in The Netherlands and Flanders use Puppetry connected to STEAM as part of their curriculum.

In 2018 Irma was invited as a speaker and workshop leader at STEAM congresses in China. All schools and preschools she visited made a start with combining Puppetry and STEAM and since this year Irma's book is available in Mandarin language as well. STEAM-puppetry has an educational effect that is so large, even the puppets can´t count that high!

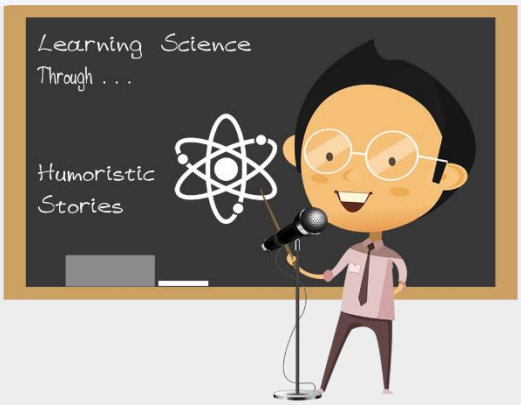
In the workshop we will share and show some examples. Of course, this will be a hands-on workshop in which you will get tools which can be used in your classrooms the following day. Please bring your own hand-puppet if you have. If not available, please bring a lonely sock.

As Einstein said: "Because playing is the highest form of research."

December 3rd, 15:35 – 16:20

Learning Science Through Humoristic Stories

By Stefanos Giagtzoglou, *Science View*



In this 45-minute team-taught, immersive science communication workshop, participants will build skills to passionately communicate in a way that excites and encourages audiences to want to learn more about their work. Participants will discover how to develop humoristic science-based stories that educate, engage and at the same time entertain their audience (e.g. school/university students). By the end of the workshop, participants will be able to understand the science of laughter, gain insight into the joke mechanics, develop a science-related joke, and get familiarized with joke formulas and formats for writing humoristic science-based stories that will create a positive learning environment.

December 3rd, 17:20 – 18:05

Using Real Astronomical Data in the (virtual) Classroom

By Fraser Lewis, *Faulkes Telescope Project and the National Schools' Observatory*

I will present several examples of projects for students and teachers using data and resources from the Faulkes Telescope Project and the National Schools' Observatory. Both projects have recently celebrated their 15th anniversary and both provide free access via the internet to 2-metre robotic telescopes. Each project contains supporting material on several aspects of astronomy.

I will show examples of IBSE (Inquiry-Based Science Education) type activities, designed to be 'teacher-free', as extended projects for students interested in aspects of astronomy and space science. These include the study of, and background to, open clusters and population studies of exoplanets. As a recent addition to these projects, I will discuss a Citizen Science project, initially using data from Type Ia supernovae discovered by Gaia Alerts. Users are instructed how to perform browser-based photometry on these images using their data to add additional datapoints to the Hubble Plot, enabling them to measure the expansion rate and age of the Universe.

These projects use real data and allow students to explore the science of these objects as well as associated STEM topics such as graph plotting and measuring uncertainties. These projects allow exploration of data archives from the Faulkes Telescope Project and National Schools' Observatory. I will also include examples of successful student work from these activities.

Other simpler activities are suitable for younger pupils and all are intended to further students' knowledge of science and mathematics, while also improving computer literacy and communications skills, strengthening critical thinking and allowing them to experience real-world applications in science and technology. Activities around image processing encourage students to use e.g. Photoshop (or free alternatives) to produce colour images of spectacular cosmic objects such as supernova remnants, star forming regions and galaxies.

Based in South Wales, the Faulkes Telescope Project provides free access, via both queue-scheduled and real-time observations, to a global network of 2-metre, 1-metre and 0.4-metre telescopes. The National Schools' Observatory (NSO) is located at Liverpool John Moores University. It has a mission to enable "Access to the Universe for All" and provides access to the 2-metre Liverpool Telescope on La Palma.

PRESENTATIONS

December 2nd, 15:10 – 15:25

Learning Science through Slowmation

Dr. Vassilis Koulountzos & Assis. Prof. Fanny Seroglou

Aristotle University of Thessaloniki

Nowadays there is an accelerating demand for new instructional material and teaching methods in order to support the development of cognitive, meta-cognitive, social and emotional skills both for the classroom and for teacher training. Therefore, the target skills developed in schools and teacher-training courses need a transformation towards students' expectation to learn and teachers to train.

A creative learning environment where students and teachers produce their own slowmation films about science may contribute to the teaching and learning of science, the nature of science, allowing them to present their ideas, to improve their self-esteem, to take an active part, to use and develop electronic e-materials. A spread of information, collaboration, contribution, codependence and team spirit occurs, to shift the knowledge and information transformation from single-dimensional and limited to multi-dimensional.

When creating slowmation movies, non-experts can make their first steps as scientific literate citizens learning a series of science concepts and phenomena, representing them and their personal perspective about the nature of science in their multimedia productions. Participants in slowmation case studies attempt to handle knowledge from science in society, present attitudes and values illustrated by science and affect their life in and out of the school. Participants create digital narratives using the technique of slowmation and "animate" science concepts and phenomena through inspired heroes and their adventures in scripts that they develop re-contextualizing science teaching and

learning. Simplifying the complicated animation technique, the slowmation narratives contribute to the comprehension of abstract science concepts as they acquire image and sound developed by non-experts.

Quantitative and qualitative analysis of data gathered from our students' involvement in slowmation CASE implementation across many of Thessaloniki's Metropolitan area schools during the past two years is made using two research models:

a) GNOSIS research model for pointing out the various aspects of the nature of science presented in the pupils' science films (GNOSIS - Guidelines for Nature of Science Introduction in Scientific literacy) and

b) STARS research model (STARS - Science Teaching from Abstract to Representation Slowmation) to specify the audiovisual characteristics of the films.

A discussion growth during and post Covid-19 quarantine period about the needed educational material transformation in order to achieve and improve pupils' distance learning and science understanding. Encouraging creative learning in science, art helps us develop new innovative learning environments that lead to the understanding of science concepts activating a variety of knowledge and experiences as well as multiple intelligences. Abstract science concepts presented with shape, sounds and meanings are activated by the creative learner's imagination. Our goal is to nurture creative, pleasant, motivating learning and the integration of art provides the transition bridge to transform science learning for the demanding learners of today.

December 2nd, 15:25 – 15:40

CASE Slowmation Teaching Applications in Greece

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For several weeks the CASE slowmation activities took place in classrooms changing in a positive way our school life. The implementation of CASE slowmation activities has been based on our experiences from the CASE Summer Schools that we attended in 2018 and 2019, as well as the help of members of the ATLAS Research Group who visited our classrooms for two hours every week. In the context of the CASE slowmation activities, science learning becomes an information exchange activity in society that follows the multimodality and flexibility in communication and interaction that characterizes our lives today. Science learning has to evolve and adapt otherwise it will lose touch with pupils' needs and expectations. The decrease in people choosing science studies and careers I believe is a first sign of alert. During the CASE slowmation activities, pupils develop pleasant and intriguing stories that although they are neither scientific nor didactic, make sense for them and embody a series of science education topics with elaborated inputs, such as: our solar system, global warming, climate change, pollution and contamination, recycling, energy resources and their management, technology, nature appreciation, environmental responsibility, individual and social responsibility, moral values, problem solving, taking action in the community. During and after the application and evaluation of CASE slowmation activities in the classrooms, the measured educational impact has been impressive and didactically intriguing. At the same time the development of the slowmation narratives and the use of e-learning and m-learning characteristics in the related activities makes students even more interested in sharing on the web their stories and ideas. The

slowmation narratives that children develop actually speak in the oral and visual language that children today use to communicate, creating educational material of non-experts for non-experts with high comprehensive impact. Pupils identify themselves with the characters in their narratives and participate actively in a secure learning environment where they feel confident enough to overpass any learning difficulties. The slowmation activities help children to transform difficult notions used in science into a more comprehensible and more conceivable form of language, while the involvement of pupils in the whole project provides them with the opportunity to learn about science and the nature of science, and encourages the development of attitudes and skills concerning scientific literacy. Pupils get both educated and entertained as they re-contextualize science concepts and theories, nature of science aspects, values and attitudes in the developed slowmation narratives.

December 2nd, 15:50 – 16:05

Using CASE as a space pioneer concept

Dr Padraig Murphy

DCU, Ireland

Space travel is fascinating to young people. It was a clear conclusion for the many primary school teachers who participated in the CASE project, exploring creative methods of teaching science. A large majority of the teachers used the CASE methods to look at the challenges, both scientific and social, of space travel. The impressive creativity of how space science was taught inspired a Science and Technology Studies approach to the learning events.

The theoretical framework drawn on here invokes materialist political art and critical pedagogy: how can the materiality of art connect to educating about humans moving off-planet? This conceptual approach also favours a materialist-art-human dialogue (Chappell et al 2019; Chappell and Craft, 2011) in a society that needs to be made more socially, sustainably and morally robust for the many risks and uncertainties ahead (European Commission 2012, Felt et al, 2013). In addition, if a more inclusive and collaborative approach is taken into science, technology and nature on Earth through, for example the Sustainable Development Goals (SDGs) and Responsible Research and Innovation (RRI), how solidly can the concept of the "pioneer", so embedded in Western popular culture for space travel and adventure, remain in space education and does it still have a role?

In this study, data was collected from teacher reflections in journals and surveys from the CASE project and combined with a mapping of the conceptual flows of ideas between classroom activities and the external environment of space in films, games and popular culture.

The study found three areas of conflict:

1) Is travelling to space the work of a pioneering team or a collective network?
2) Do we need a competition and a competitive edge to move to space, or is collaboration more important?
3) How human, posthuman or *extra*-human will space travel be?

These are questions of the *space humanities*, questions that creative science education can address. The ideas challenge not only educators talking to young people about space, but they may also inspire engineers how to think critically about space travel. The inevitability of space travel causes us to think about the existential leap needed to live in space, as expressed through teacher reflections on the children's travels to other worlds.

December 2nd, 16:05 – 16:20

Learning Science Through Digital Storytelling

Dr. Angelos Lazoudis

Ellinogermaniki Agogi

The main concept applied in this activity is the use of creativity as a mean to achieve innovative learning in STEM subjects, based on the use of storytelling and the example of a journey to Mars (*this could be any scientific issue that a teacher could use but, in this document, we have this example in order to demonstrate how this activity should be implemented*). When implementing the Digital Storytelling case to its full extent (at least 40 hours), a great variety of learning objectives can be achieved, such as:

- Students learn how to develop models and work with scales/analogies.
- Students represent the orbital paths of Earth and Mars through group demonstrations and make scale models of the planets and the Solar System.
- Students explore drawing, visual communication and image making to develop their ideas and concepts.
- Students learn how to make calculations and graphical representations. Students create storyboards and flipbook-style animations with paper and pencils that depict life in the first Martian community.
- Students learn how to solve complex problems.
- Students learn how to collaborate to solve a complex problem. Students learn how to collaborate over distance (for example while they are at home through the platform).
- Students work with scientists and engineers to learn about the Martian environment, and the challenges it would pose to the first inhabitants.

- Students explore the planet geology and identify good spots for establishing a human colony.
- Students understand the effects of the lower gravity in our body and identify solutions to handle these problems.
- Students work with 3D design software to create a community on Mars.
- Students propose solutions on how they will select the first settlers in terms of gender, age, profession etc.
- Students design and construct models of the spaceships, buildings on Mars, landers and rovers using 3D printers.
- Students plan and understand the challenges of a trip to Mars and its return to the earth by a spaceship.
- Students work with scientists, engineers, garden experts, artists and designers to provide food for the Martian community.
- Students perform experiments and tests to make sure that the Mars communities are going to last for extended periods on the planet.
- Students are developing their own models of spaceships and Martian infrastructure (rovers, landers) using 3D printer software.
- Students learn how to collaborate with external experts to provide guidance and support.

This list of learning objectives can be enriched or adapted to the needs of the teachers, students and curriculum, depending on the focus of the students' needs and curriculum demands of the respective grade.

December 2nd, 16:35 – 16:50

Applications of CASE in Greek schools and teacher attitudes to creative science education

Dr. Vassilis Koulountzos[1] and Dr. Padraig Murphy[2]

[1] Aristotle University of Thessaloniki

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The Creativity, Arts and Science in primary Education (CASE) project studied the unique value of the arts as a mode of inquiry. The CASE project aimed to engage students in creative thinking using artistic tools at key stages of the scientific process in a seven-step plan. CASE focused on enhancing teacher skills and strengthening their power to motivate innovation and creativity. In the implementation phase of the project, the objective was to take four archetypal types of creative and artistic activities for primary school science education and facilitate their use by teachers and map their creative approach to science. These four

activities, or “cases”, were theatre, puppetry, “slowmation” video film creation and digital storytelling.

For impact assessment, the CASE approach used the pre- and post-test survey instruments as well as a supplementary qualitative analysis at the key stages where teachers implanted the cases in classrooms, and to capture creative and artistic sensibilities within these interdisciplinary settings over the two years 2018-19. The objective was to capture how teachers managed a creative, artistic science when facilitating young learners, as “creative agents”.

One CASE partner, Aristotle University of Thessaloniki, and their associated schools, carried out an analysis of 27 teachers during CASE implementation over these two years. As a sub-study, the AUTH experiences provides a valuable insight into possible trends of creative practice among a group of primary teachers who teach science in a specific country - in this case Greece - as well as their self-assessed skills, and their motivations and expectations for teaching creativity in science.

A great majority of the teachers responded positively to the CASE methods. While most teachers found teaching a stressful profession, one source of frustration was resolved by CASE: traditional science education does not always connect with students’ lives, according to teachers, but the use of creative methods of teaching and learning increased this connection. Most teachers found professional development training involving creative methods to be useful, such as cinema, role-play, theatre and digital narratives. The concept of the science teacher as “creative agent” was one used by CASE, and results demonstrated teachers’ uncertainty about this role. However, there was significant teacher confidence that creativity and art are important for teaching and learning in science.

December 2nd, 18:05 – 18:20

Engagement interdisciplinary approaches in STEAM: Learning Science Through Theater

Menelaos Sotiriou

Science View

How can we leverage students understanding on STEM concepts and at the same time guarantee their cheerful engagement? How can we transform school to a hub of connecting with both the scientific world and the local community? The ‘Learning Science Through Theater’ is an initiative that strongly promotes the above principles by creatively merging STEM with Art in a dialogic – Inquiry process. To do so, theater is used as a means of deliberation, a vehicle around which the whole team of stakeholders builds relationships that favor the transfer of scientific knowledge.

In the context of the initiative, students build their understanding on scientific concepts applying and developing knowledge from the whole curriculum (multidisciplinary approach) and become acquainted with the concept of learning science creatively. This way they manage to develop creative skills in a spirit of cooperation and teamwork in which various groups will create a 'cognitive object' such as script, scenography, costumes, music or even a video composition. This process, engages students in a highly motivating environment where they learn to recognize, analyze and imagine alternative explanations and models and communicate a scientific argument or issue in a creative and alternative way. This enculturation in the scientific discourse can subsequently lead to epistemic improvement in pupils' knowledge. The argumentation process in this case might be the exchange of ideas and dialogue when the script of the theatrical performance is developed.

In 2016 the Learning Science Through Theater initiative has been officially set as one of the demonstrators of the EU H2020 project CREATIONS, since 2017 Malta is officially implementing the initiative as well and in 2018 LSTT has been granted as one of the accelerators of the EU H2020 project Open Schools for Open Societies (OSOS) plus a case of implementation for the EU ERASMUS+ project Creativity Art and Science in primary Education (CASE) thus widening the outreach of the initiative to a total of 12 EU countries.

With 6 years of implementation background and a framework strongly aligned to the most recent EU demands for shaping the scientific literate citizens of the future, **LSTT achieved a remarkable engagement of the target groups set and important results in the field of Science Education by involving 4500 students, 350 teachers, 10000 parents and 1500 stakeholders.**

The paper will present results from 1000 students and 100 teachers about the effectiveness of the initiative as well as the raise of student's interest in Science.

Keywords: Creativity, Science Education, Art and Science, STEAM, interdisciplinary approaches

December 2nd, 18:45 – 19:00

Pupil Engagement in Arts-Based Science Learning

Rūta Girdzijauskienė

Klaipėda University

Search for ways to promote pupil engagement in learning is one of the most important research focuses in contemporary education (Whitton and Moseley, 2014). Involvement can be defined as a high level of interest expressed through behavioural, cognitive, and emotional categories (Hoffman, Nadelson, 2010) or as a set of elements of focus, inner

interest, interactivity, motivation, and functionality (O'Brien, Toms, 2008). Pupil engagement in learning can be examined by exploring specific contexts and be measured using different instruments.

In the present study, Inquiry Based Science Education (IBSE) was purposefully applied in the 2nd form of a Lithuanian school for two months, when 24 students learned science in a creative way. At the end of the project implementation period, students created and performed a theatrical story related to scientific issues. One of the methods of visual research, photo voice, was chosen as the main method of data collection. Throughout the project, students took photos of what they considered to be the most significant moments of their own participation in the project; at the end of the project, they selected and described the photos that best revealed how the project was implemented. Group interviews with pupils – project participants who had taken photos enabled us to identify the following characteristics of pupil engagement in the arts-based science learning process: learning as a challenge, communication and collaboration, experience of success, and creativity.

Keywords: arts- based science learning, engagement, photo voice

December 2nd, 19:00 – 19:15

The effects of creative use of Technology and Drama on primary school students' attitude towards science and science careers

Styliani Siouli[1], Evanthia Stefa[1], Ioanna Dratsiou[2], Panagiotis D. Bamidis[2]

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STEM education is crucial in successfully shaping future technology-driven societies. Nurturing these interests at a young age is critical because studies have shown that student interest in science decreases in middle school. This work describes engaging educational activities in astronomy and solar system education for children of primary education. Students gradually discovered the solar system with the help of augmented reality (AR), participated in activities that linked technology with hands-on learning and also took part in creative drama activities about Space. The purpose of the present study is to identify possible changes in students' science career interest and in science-related attitude after the completion of the activities. The sample consisted of 60 6th-grade students in Greece who participated in a one-day activity and completed a validated questionnaire for assessing the learners' perceptions of science and science careers before and after the activities. The obtained results showed that learners improved their perceptions of science and science careers after the learning activities. This study initiates a greater endeavour for exploring the impact of technology and creative drama in science engagement.

Keywords. Augmented Reality, Creative Drama, STEM Education, Technology-Enhanced learning.

December 2nd, 19:15 – 19:30

Use of 3d Printing as support to STEAM Education

Natalija Budinski

Petro Kuzmjak school Ruski Krstur Serbia

3d printing is technological innovation that became applicable in many areas of life from medicine to architecture. In order to follow 3d printing real life application, it should be applied in the classrooms and become available to students. In this presentation we highlight different aspects of use of 3d printing in the classroom and present examples of 3d printing as a support to STEAM education. In school Petro Kuzmjak we have applied 3d printing in mathematical lesson from 2019 and derived many examples and lesson plans. Activities included about 30 students from primary school (13 yrs old) and 50 students of high school (15 yrs old). Some of them were awarded at national competitions. We have observed that 3d printing enables interdisciplinary approach and enrich educational process. With the 3d printer in the classroom students has an opportunity to observe how trough modelling process the abstract mathematical ideas they learn become reality. In those activities, students used gained knowledge, developed creativity and at the same time had access to modern technology.

Keywords. creativity**,** 3d printing, mathematical lessons

December 3rd, 14:25 – 14:40

Pedagogical Improvisation in the STEAM Educational Context

Oded Ben-Horin

Western Norway University of Applied Sciences

The British Educational Research Association's review of STEAM education in Europe specified several areas of future development necessary in order for Europe to maximize the potentials of STEAM. These included the need for new research and development within the "hybrid" educational context which STEAM constitutes. I argue that the interdisciplinary educational environment in STEAM requires teachers to accept a partially emergent curriculum. My presentation describes how intentional pedagogical improvisation builds relations between pupils, their peers and their educators in the context of a specific STEAM teaching approach, Write a Science Opera (WASO), and how those relations impact the pupils' ownership of learning processes. The presentation will exemplify a specific approach to the training of pedagogical improvisation, and address issues related to a potential professionalization of pedagogical improvisation as an integral element in Norwegian and European training of primary teachers. Finally, the case will be made for how these insights

may support "in-depth" learning, characterized by pupils recognizing common themes across disciplinary boundaries and becoming aware of their capacities for navigating and designing their own learning processes in STEAM.

Keywords. Pedagogical improvisation, STEAM, interdisciplinarity, in-depth learning.

December 3rd, 14:40 – 14:55

Eddington@Sundy: bringing All together

Joana Latas

Univ Coimbra, & NUCLIO – Núcleo Interativo de Astronomia

Local culture and the history of a place could operate on a way to promote Science Education. Based on an articulated action between the Regional Government, Schools and local and international Institutions, in the Island of Príncipe for the past seven years, science has been approached in a holistic way from the Nature around and the plural knowledge of students' and communities' daily life. The transdisciplinary work resulted in meaningful educational experiences in formal and non-formal settings for both students and teachers. Last year, 2019, a big event was the pinnacle of this educational work which opened new directions to other collaborations, projects and educational opportunities in this island.

One intersection between the History of Science and the history of the Island of Príncipe occurred in 1919. The tiny Island of Príncipe located on the west coast of Africa was the place chosen by a British team of astronomers led by Sir Arthur Eddington to observe the total solar eclipse of the 29th of May. Those observations, together with the ones made at Sobral, Brazil, are a relevant milestone for the vision of the Universe we now have, given that they allowed, for the first time, to experimentally confirm Einstein's Theory of General Relativity. One hundred years later, in 2019, the celebration of this milestone has been an opportunity to bring Science, itself, its History, Education and Communication to the Island of Príncipe, but also to bring local and cultural perspectives from the Island of Príncipe to the world. This initiative took place under the "Eddington@Sundy: 100 years later" project umbrella and STEAM was one the key-actions to design and implement an educational programme in a regional, national and international level.

As a cornerstone of the Eddington@Sundy legacy, the Sundy Science Space concept was created and developed. This non-formal setting on the island of Príncipe, marks the historical link with Science and encourages the development of initiatives related to Education, Science Communication and responsible tourist activity, in harmony with local development strategies. Namely the assembly of a planetarium inside the Space, the first one in the country and one the few on the west coast of Africa, is one of the strategies to promote local development. Beyond 2020, Sundy Science Space will offer opportunities to design and implement programmes through participatory methodologies with community and stakeholders to find proper solutions to specific issues related with context, moving on

to raise the education level in the Island of Príncipe and to become a reference for the country and the neighbouring countries.

In this presentation we intend to revisit some STEAM approaches in Science Education actions but also have a look at Sundy Science Space in the Island of Príncipe one year after the Eddington@Sundy. Some reflexions on how STEAM will be included on the educational programme of this place will be made.

More information about Eddington@Sundy is available at the official website esundy.org.

Keywords. Island of Príncipe, Local culture, Non-formal educational settings, Total solar eclipse 1919.

Acknowledgement. Joana Latas thanks the Foundation for Science and Technology, Portugal for financial support through the PhD scholarship SFRH/BD/14965/2019.

December 3rd, 14:55 – 15:10

Distant Music, ways of constructing modular sound design

Petros Stergiopoulos

Ellinogermaniki Agogi

The exchange of audio files between remote educational communities can be an excellent way of producing exciting soundscapes. A sound-canvas as a result of the collaboration of a science teacher with a music teacher can inspire the contribution of sound or even music excerpts that can produce a final musical mosaic of creativity. This brief presentation analyses the best practices used so far in the history of the Global Science Opera initiative.

The term "Distant Music" is not widely used in the literature. The literal meaning of the term refers to the acoustic experience that a person can have listening to music from afar. However, the term used for the widespread nowadays practice of digital audio preservation inevitably led to the richness of digital libraries that we use today. Free music from such open digital libraries, either without specialized content (such as YouTube) or with specialized content (such as https://soundcloud.com/nasa) can be used to set up Global Science Opera scene music. However, the approach we discuss in this study is the use of the internet as a tool for exchanging audio and music files to create a complete music investment with contributors from remote educational communities. The final scope of this practice is to create a soundscape or music soundtrack with sound design techniques in combination with the use of open DAW applications.

The methodology that has been developed for the above purpose, in the history of the Global Science Opera initiative is versatile and has been adapted to the respective needs imposed

by the conditions of implementation. These conditions are determined by the level of digital literacy of the teachers involved, the technical possibilities of digital recording available to students, the ease of internet access and the available time for in-school activities. Collaborative teaching of a science teacher along with a music teacher is the ideal scheme and its general characteristics can be summarized in the following terms: i) Teachers are able to complete with their class the steps of creating a GSO scene following the guidelines already described in various languages[1], ii) the classrooms have recording methods either simple (such as smartphones) or advanced (such as the use of special software, high quality microphones / recording infrastructure), iii) Teachers and students have access to the internet and intend to work in order to communicate with their collaborating remote classes from the GSO network, inside or outside school hours.

The musical background of the scene follows the logic of creating soundscapes. One of the collaborating classes can start by creating the background. This background can be an audio file that is freely available online or recorded by students for this purpose. This background audio file is the initial layer based on which students from the collaborating classes can add events, i.e. recordings of sound events that have been created to enrich it. Each new recording is a new layer in the audio production that accompanies the scene. The result can consist of several layers which are mixed with the help of Digital Audio Workstations (such as Audacity which is Open Source). An online community like OSOS[2], an online-diary or even a simple open document accessible to remote teachers and students can be used as a means for coordinating the students' efforts but also for keeping track of the progress of the soundtrack.

Teachers design a series of lesson plans based on the customization of learning content. In other words, depending on the content of the course, parameters are set that help students transform the scientific concepts into musical or sound stimuli. These parameters can be divided into three categories as they were generally described in previous GSO[3] practices: 1) Sonification of numerical data (Mathematical), 2) Adaptive music creation that stands in between sound and music synthesis (Adaptive), and 3) Music/Audio transformation of abstract concepts (Symbolic). The final soundtrack is a result of collaborative teaching and obeys the structure described above.

Following the symbolic approach in the first production of 2015 (Skylight), the storytelling of Icarus by students in Northern Greece, was included in the musical production of students from Athens and Thymaina (Ikaria) that had as its learning objective the heat from the Sun. Typical examples of sonification recordings were used in the soundtracks of the Greek scenes for the productions of 2017 (Moon Village), and 2019 (Gravity). In the 2017 production following the practice of the GSOrt demonstrator, as described in the CREATIONS project, remote students from Crete defined the cluster of musical notes used to sonify the

[1] https://globalscienceopera.com/resources-media/
[2] https://portal.opendiscoveryspace.eu/en/community/gso4school-gr-857470
[3] 10th ENEPHET Conference 2018, Volume 10, ISBN: 978-960-86978-3-6, page 960 (http://connect.ea.gr/enefet2017praktika/)

numerical data of the moon (dimensions, distance from the earth, etc.) which were recorded by students in Athens[4]. In the production of 2019, students from the Hellenic-German Education defined the cluster of sounds that were used to express the measurements from the solar eclipse of 1919 and were choreographed by students of the Athens Conservatory.

The possibilities of remote interaction with audio and video offer an inexhaustible field of experimental implementation. Remote learning communities can collaborate from a distance by exchanging their creativity in the form of digital files as described above. The GSO4School project designs the appropriate tooling environment in order to encourage such actions and to expand them into future productions.

Keywords. Distance-learning in Music, Soundscapes and sound design, Digital Audio Workstations, Audio recordings.

December 3rd, 15:10 – 15:25

Learning Science Through Improvisational Comedy Techniques

Stefanos Giagtzoglou

Science View

This presentation seeks to contribute to arts-integrated science education by exploring how it can strengthen the profile of the teaching profession, encourage scientific creativity in young people, and develop sustainable communities of creative science education practice. Improvisational comedy theatre-based techniques are combined with storytelling, enabling students to use strategy and spontaneity to execute powerful communication in any context through attentive listening, reading nonverbal cues, and responding freely without self-consciousness. The above techniques can be used either for assessing knowledge of content, deepen understanding of content, or for identifying student beliefs on a scientific concept.

Keywords. Agreement; attentive listening; creativity; improvisational comedy; pedagogical innovation; public speaking; science communication; science education; steam; team building.

[4] Best practice published at the "Open Book of Educational Innovation", European School Network, p.145-146. (http://connect.ea.gr/open_book_of_innovational_education_2017/)

December 3rd, 16:20 – 16:35

Innovation in Science Education

Dr. Rosa Doran

NUCLIO – Núcleo Interativo de Astronomia

Science is often understood as something that belongs only to the realm of skilled brains, capable of uncovering the mysteries of the Universe. In schools, science is spread across various disciplines such as Natural Sciences, Biology, Geology, Physics, Chemistry, etc. The delivery of this subjects in schools is frequently devoted to presentation of various contents and the development of its associated value to our daily lives. Students are engaged in learning paths that frequently requires the understanding of different concepts accompanied by hands-on experiments that help the memorization of the facts. A different approach to science education is necessary, a more holistic model, that requires not only hands-on experimentation but also the collaborative work of educators of the various disciplines in a strong interdisciplinary format.

STEAM stands for Science, Technology, Engineering, Arts and Mathematics. It is a strong learning approach that smooths the boundaries between the various science domains integrating the important components of arts and mathematics, the necessary language to help us understand the laws of nature and its importance and relevance to us. During this presentation a series of innovative actions will be presented including the integration of technology as a substructure that greatly enriches the learner experience. Innovation in science education is the investment in the science capital of individuals and the awareness that science is a building block of every person. Becoming a scientist is not a matter of being gifted or having a brilliant mind, is a matter of being able to develop the necessary skills and a matter of choice, not the lack of it.

Everyone can be a scientist!

Keywords. Innovation, Science Education, STEAM

December 3rd, 16:35 – 16:50

Creative Pedagogies in Education as Craft: From John Dewey's "The nature of method" to where?

Professor Magne I. Espeland

Western Norway University of Applied Sciences

Actor John Cleese, famous for his role in the British television show Monty Python starting more than 50 years ago once in a university talk defined creativity as "a way of operating". Such a way of operating in education is, I think, what we call "Creative Pedagogies" (CPs). Recently, and for some years actually, the OECD has been focusing on how to implement

creative pedagogies in schools (e.g. Vincent Lancrin, S. et al (2019). CPs are, as we all know, nothing new. In fact, we believe they should be at the center of the very projects we now have been sharing and discussing, but it would be a great exaggeration to suggest that they are well established in schools in any country.

Given the actuality of CPs, I find it timely in this talk to take a step back and ask whether one could think of CPs as a special "Craft" in education. In doing so I will begin by asking what could be meant by describing CPs as a craft and their teachers as craftsmen. I will continue by discussing what could be the "essence" of CPs by referring to John Dewey and parts of his Pedagogic Creed written more than 120 years ago, and finish off by reflecting on where post-modernity and post- humanism could be taking the trajectory of creative pedagogies in practice as well as its theoretical rationale.

December 3rd, 17:05 – 17:20

The Notion of Arts in STEAM Concept"

Šmitienė Gražina, Girdzijauskienė Rūta

Klaipėda University

Changes in the present-day education system are associated with the challenges of building a knowledge society, the rapid development of the digital environment, and the use of technology in many areas of public life. STEAM (Science, Technology, Engineering, Arts, and Mathematics) education has been developed in search of ways to prepare students to live and build their lives in the knowledge society of the future. As observed, both in STEAM practice and in scientific works on that system, ambiguous treatment of the purpose of the arts, a diversity of the arts integration models, and differences in the contexts of the STEAM programme implementation as well as result interpretation have been found. The paper aims to reveal the notion of arts in STEAM concept. Thirty-three articles published in the period of 2010 to 2019 were selected for the performance of a thematic analysis of the notion of arts in the concept of STEAM education in five aspects: Purpose of Arts, Notion and Inclusion of Arts, Arts Integration Process and Results, Arts Integration Models, and Arts Integration Contexts.

A review of the literature demonstrated that the inclusion of arts in STEAM education is ambiguous because of the diversity of both the notions of the arts and interpretations of the purpose of arts integration. Arts in STEAM education are associated with the improvement of students' academic performance, increasing students' involvement in the educational process, the development of students' creativity, critical thinking, and cooperation skills, and thus highlighting the instrumental significance of arts education. Meanwhile, less attention is paid to substantiating the in-depth value of arts integration into the STEAM curricula.

The instrumental and internal concepts of the purpose of the arts are to be related to the equivalent and arts-supplemented integrative STEAM models. In the first case, the arts are understood as equivalent to other STEAM disciplines, in the second case, the

purpose of the arts is compressed to the application of one or several methods or means of artistic education. The literature review also highlighted the inequalities in the inclusion of individual arts in STEAM projects. The highest intensity of arts inclusion was observed in the case of design and visual arts; meanwhile, performing arts were used much less frequently. Therefore, research with the aim of deepening the concept of interdisciplinary integration in terms of diversity of the arts inclusion, substantiating the effectiveness of arts-integrating STEAM programmes with the identification of the process and result evaluation variables, and analysing specific cases of the STEAM programme implementation through revealing forms and ways of arts inclusion are especially relevant.

Keywords. Arts, STEAM, Arts Integration Models.

December 3rd, 18:05 – 18:20

Coding through art: engaging computational thinking in primary education

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The last decade the educational world is experiencing huge changes due to the rapid development of science and technology. Therefore, it is necessary that every school should be an effective and engaging environment using innovative methodologies and tools in order to help students understand abstruse concepts and learn how to work in a scientific framework. Teachers need to acquire new skills and knowledge which will enable them to enrich their teaching methods and introduce an inquiry-based way of learning to their students.

Apart from that, another important element that should exist in every classroom, is creativity. Every scientific activity gets even more interesting and activates children's' imagination when it is combined with art. It is important that children realize that science is fun and is also an integral part of everyday life and not something locked in laboratories.

The project being described in the present paper was designed towards this direction and is about introducing coding and computational thinking in primary education through different types of art. It is being implemented, the current month, by 13 students of the 5th grade of Kanalia Primary School in Corfu, where I teach, as part of our first participation in the "European Code Week 2020". It refers to the theoretical background of the importance of coding and computational thinking in education and describes in detail the objectives, the methodology and the coding activities (using internet connection or not) combined with music, painting, dance and digital storytelling using "Scratch" tool.

Finally, this project points out the crucial element of collaboration among students in order to implement all activities, enhance their knowledge, and make them feel creative and confident while working in the amazing world of science and art.

Keywords. Coding, Computational Thinking, Art, Creativity, STEAM, collaboration, primary education, innovation.

December 3rd, 18:30 – 18:45

Digital Cultural Heritage in STEM lessons: The case study of Geometry

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Cultural heritage is a basic component of each country, as it includes all values from past to future. In other words, is treasure through the years. Science, Technology, Engineering and Mathematics (STEM) included in many subjects in curriculum. In the digital era the Europeana DSI-4 project (http://fcl.eun.org/europeana-dsi4), implemented and supported by the European School Network (www.eun.org) offered many opportunities for the integration the use of digital cultural heritage in teaching in STEM learning environments. Europeana's mission is to transform the world with culture, unlock cultural heritage treasures and make them available online so that all people can use them for recreational, professional or educational purposes.

This paper presents how STEM teachers could use Europeana collections for educational purposes in STEM classroom. Mostly it analyses the case study of teaching and learning geometrical concepts based on objects of collections of digital cultural heritage of Europeana (https://www.europeana.eu/en/collections).

The implementation (https://teachwitheuropeana.eun.org/stories-of-implementation/implementation-of-aesthetical-geometry-soi-ext-185/) took part by distance learning for 40 students aged 16-17 years of 1st and 2nd grade of Evangelika Model High School of Smyrna, in Athens Greece. The methodology based on the examination and analysis of the characteristics of the material objects of the digital cultural heritage Europeana. Specifically, the students explored their geometric properties in space and level, searched for the correlations and how they are presented on these basic theorems and propositions of geometry. Most importantly, students themselves, creators and solvers of geometry and algebra problems on the objects of digital heritage, express their creativity, use their innovative and critical thinking, and their ability to process and use information and the skill 'learning by doing'.

The learning outcomes highlight that the objects of cultural heritage could be used not only as teaching tools and include them in curricula of geometry, as students: i) recall prior knowledge ii) development visualization or imaging process for representing objects in the space, explaining a proposal, systematically investigating a complex state or verifying different geometric situations, or checking some cases using representations (e.g. numbers, images, diagrams, symbols). The results highlight that the teaching methodologies have to improve including connections with real world, as students had difficulties to expand their

knowledge. Mostly, art or in general cultural heritage objects in increased students' creativity and motivate them in in learning geometry.
Based on teaching outcomes the investigation of geometric properties in architectural creations, paintings, sculptures, famous mosaics we hope to eliminate the prejudice that mathematics has nothing to do with the real world. The historical tour of the world of geometry and its applications will present and reveal a world of unknown beauty where the accuracy of reasoning and surprises meet creativity and efficiency. The need to examine the connection between the concepts of art and mathematics is also highlighted by the growing interest in Europe, in museums and in education in general, on this subject.
The combination of cultural heritage with STEM lesson is a challenge for the educational community with many additional values in teaching and learning process. Cultivating a spirit of inquiry, promoting inclinations, strengthening interests, learning ways to organize strategies and methods to solve problematic situations, the ability to select and compose material, develop collaboration and engage in a constructive and fruitful dialogue between students are among the curriculum educational goals for all students, regardless of their performance.

Keywords. Digital Cultural Heritage, Europeana, Geometry, STEM.

December 3rd, 18:45 – 19:00

Socio-Educational Needs for the design of an Internet of Things enabled and AI powered educational robotics platform.

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Advances in Artificial Intelligence (AI) and the pervasiveness of the Internet of Things (IoT) transform both society and the educational needs of it to a ubiquitously connected, "smart" environment in which today's learners will be called to operate and thus need to be educated for. In that context there are not yet enough educational robotics platforms that can use the ubiquitous connectivity of IoT powered sensors and actuators, as well as power their educational scenarios with AI enabled pattern recognition capacities.
In this environment the TekTrain project designs and develops a contemporary affordable educational robotics platform that is going to be highly modular, with IoT sensor and actuator "plug and play" capacity. Additionally, the sensor capacities of it are going to be

incorporating, from the ground up, AI capacities like facial and voice recognition with subsequent potential responsiveness. This work describes the method and results of the socio-educational needs analysis that was conducted in the conceptualization phase of the design process.
In order to identify the socio-educational needs of the TekTrain educational robotics platform, a standard qualitative focus group setup was employed. In this focus group 6 teachers with classroom experience in educational robotics were presented with a series of engagement questions regarding the socio-educational aspects of the robotics platform. They were, then, given time to discuss and express their opinions in a 3-hour session. The meeting was facilitated by an educational expert in technology- enhanced learning, who then proceeded to analyse the audio logs of the meeting. From the analysis five (5) axes emerged. The core themes in the first axis, i.e. pedagogical methods and teaching approaches in Educational Robotics, encompassed inquiry, project-based learning, problem based-learning and gamification. Regarding the structuring of Educational Robotics activities (second axis), three types of robot building tasks (i.e., robot construction, decoration and programming) were suggested, transitioning from guided to open activities and escalating the level of difficulty. Differentiation between inputs and outputs was identified as a prominent goal, and object detection, colour detection and follow-line as typical programming problems. The role of teacher in Educational Robotics (third axis) was placed in the affective support of students and facilitation of the learning process. Student characteristics and diversity in the classroom (fourth axis) touched upon learners with intellectual or other disabilities, gender stereotypes and target age group. The last axis, i.e. factors affecting Educational Robotics integration into the Greek School, encompassed Greek Curriculum, lack of teacher training on Educational Robotics, costs, availability of teaching hours and infrastructure/facilities as the main drivers and barriers. These socio-educational needs are essential factors, informing the design process of this next generation educational robotics platform.

Keywords. Artificial Intelligence, Educational Robotics, IoT, Socio-educational needs

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December 3rd, 19:00 – 19:15

Up-side down drawing during math lesson to promote self-esteem and lateral thinking

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Convergent/vertical thinking, widely adopted within the current educational systems, if used as a unique mode of thought, risks to preclude the individual from "creating knowledge", from exploring various perspectives about reality and himself/herself, as it implicitly sets up "barriers" and "prejudices" that limit the field of action. This approach does not guarantee the future citizen those competences and awareness needed to face up to life in its complexity, addressing unforeseen situations. In this perspective, it is important to "re-discover" creativity as a transversal "human dimension" enabling students to think "out of the box" and find new routes, to develop new sensitivity, to become aware of conventional limits that bind individual's actions. Creativity is generally connected with lateral/divergent though, as De Bono and Guilford state; however, creative processes require lateral/divergent and vertical/convergent thoughts work in synergy. An adequate learning environment should therefore encourage lateral thought alongside the more popular vertical thinking to foster in the students the development of creative processes, that can be equally precious in the arts as in the sciences.

The aim of the research is to promote lateral thinking and key competence development through artistic expression. To this end, we propose educational scenarios with "unconventional" drawing exercises for scientific classes - commonly far from the creativity dimension -, as a means of accessing and unblocking the inhibited lateral thought; for instance, in one of the exercises, the teacher presents a "reverse" image and asks the students to copy it without turning the sheet to see the image "in the right direction". According to Betty Edwards, the American artist and scholar who invented this approach, drawing in this unconventional and "illogical" way permits to recall lateral thinking through artistic expression without the person being inhibited by rational and judgmental thought; in this way people usually draw better than expected. This strategy forces the student to go beyond standard conventions and freeing the mind from the imprisonment caused by already established concepts and patterns. In this way, "learning to draw" is not aimed at developing a good artist, but at helping the student to tap into a different way of seeing things. The modes of thought and complex reality perception activated by drawing, once "re-discovered", can be evoked also in other contexts for the resolution of complex problems in math classes as well as in life situations.

This learning approach was tested, in particular, at "Giovanni da Castiglione" Italian vocational school in Arezzo in 2018 during math and physics classes, involving around 180 students. This program has been further developed as an educational scenario to be tested in different European countries within the European Erasmus + project "INtegrated Content

and Language via a Unified Digital Environment" (INCLUDE), aimed at enhancing key competences through the Content and Language Integrated Learning methodology. More specifically, the scenario enhances students' self-esteem, since they become aware of their potential of overcoming limits, prejudices and conventions, as well as skills and attitudes related to key competences promoted by EU, such as the ability to deal with uncomfortable and complex situations, to assume a problem-solving attitude, to engage in creative processes, to be open to image new possibilities.

Keywords. Lateral thinking, drawing exercise, creativity in science classes

POSTERS

Playing Europe: KA229 Erasmus+ project

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The education landscape is evolving rapidly towards more modern methods, also known as blended learning. Several studies show the importance of games in the learning process and the pupils' motivation. In this way, we hope to use them to deal with diversity in the classroom. Games also have a cultural and traditional value in every EU country, which we can integrate in our teaching methods.

Gamification in the classroom is not yet widespread, since games tap into 21st century skills, like problem-solving, collaboration, negotiation, which do not necessarily constitute the bedrock of our current educational system. Additionally, gamification is a good way to motivate our students and has good effects on the pedagogical process. At the same time, traditional/folk games are part of our culture. In many ways, traditional games are culturally influenced and vary from place to place. They may involve singing traditional songs, or certain practices that have very deep cultural roots. Youth should grow up and be able to associate their childhood with where and who they grew up with. It is important for them to be some kind of cultural totem in their childhood so that they have a sense of pride for their homeland. Besides, these games require among others physical activity, social skills, creativity, imagination, competition, and sense of brotherhood. Therefore, our project 'Playing Europe' is in agreement with the Europe 2020 strategy, advancing the synergies, experience and knowhow between four partner schools (coordinator: IES El Carmen from Murcia, Spain, Istituto Istruzione Superiore Orso Mario Corbino from Partinico, Italy, Evangeliki Model School of Smyrna from Athens, Greece, Sint-Gummaruscollege from Lier, Belgium). It started on 1st September 2020 with two-year duration.

This project is innovative in many respects as it will bring: a) innovation in participants' intercultural awareness due to the focus on multiculturalism in the educational process, b) innovation in technology education as new and interesting ways to organize information will be used to fulfil the project activities, c) pedagogical innovation, realized through competency-based education, which allows students to advance based on their ability to master a skill or competency at their own pace, d) social innovation as the project will foster

a sense of risk-taking in accepting and embracing otherness and taking responsibility for preserving the European cultural heritage and values for the future generations.
The objectives of the project are:
• Acquiring new tools and strategies for dealing with diversity in the classroom.
• Learning about the European culture and history through our traditional games.
• Integrating traditional games and toys in the pedagogical process, especially as a measure to respond to diversity in secondary schools.
• Improving oral and written English skills.
• Enhancing soft and hard skills (communication, teamwork, collaboration, critical thinking, etc.) through traditional games.
Each host country will handle the organization for the short-term exchange with the topics i) "Presentation of traditional games", ii) "Our history, iii) "Teaching Unit", iv) "Educational Visit", v) "Integration in the host school'', vi) "Playing Europe - The quiz''.
We hope that the schools will not only establish long-term partnerships to work on transnational educational projects, but they will develop and share additional knowledge, skills, experience and educational games, which will be integrated in their classes.

Keywords. Gamification, traditional games, Playing Europe: KA229 Erasmus+ project.

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