Day 1- March 27,2023	
Time	
8:00 - 9:30	**Registration** **Posters and Showcase**
8:45- 9:15	**Executive Committee Meeting (CAA Room, 2nd Floor)**
9:30- 9:55	**Opening Ceremony (Auditorium)** National Anthem Quran Recitation Video: ICASE History and achievements Al Asayal School Performance
9:55- 10:30	**Welcoming Remarks (Auditorium)** Introduction- Prof Sufian Forawi Prof. Abdullah Alshamsi, Vice Chancellor, BUiD Dr. Saif Al Seiari, AMUD Vice Chancellor ICASE President- Prof. BaoHui Zhang Alef Education- Dr. Aishah Al Yammahi MSTA President–Prof. Sufian Forawi
10:30- 10:40	**Break**
10:40- 11:00	**Plenary Keynote Presentation (Online) (Auditorium)** Dr. Amal Kasry, Chief of Section, Basic Science, Research Innovation and Engineering (RIE), UNESCO, Paris, France.
11:00- 11:30	**Keynote Speaker Panel (1) with Discussion (Auditorium)** - Professor Fazal Malik, the Pro Vice Chancellor at Amity University Dubai, UAE - Professor Christiana Omoifo, University of Benin, Nigeria - Dr. Khalid Al Marri, Dean of Research, The British University in Dubai, Dubai, UAE
11:30- 12:00	**Keynote Speaker Panel Discussion: STEM Education Approaches, Cutting Edge Technology and Pressing Issues (Auditorium)** Prof. Sufian Forawi (Chair)

12:00-1:00	**Poster Presentations**			
12:30-1:00	**Break**			
	Sessions			
Strand	**A**	**Chair: Dr. Heba Chaya**	**B**	**Chair: Dr. Marwa Eltanahy**
Time	**Title/Author**	**G06, Ground floor**	**Title/Author**	**G07, Ground floor**
1:00-2:15	**24** - Educational Leaders' Views Regarding the Implementation of Depth of Knowledge Model in Preparing Students for the MAP Exams in American Curriculum Schools in the United Arab Emirates *Mina Radhwan* **20** - Case study based on differentiated assessment on teaching English language to the learners with disabilities in a school in Al Sharjah *Omaima Sawalha* **26** - Validating a Cross-Cultural Measure of Epistemic Cognition in Science – an EFA Approach *Dean Cairns* **17** -Triple Helix Supporting STEM Education to Increase Future STEM Careers in the UAE *Fatima Yousif Husain & Sufian Forawi*		**5** - Challenges of E-learning on Chemistry Students during the First Wave of 2019/2020 COVID-19 Lockdown: Implications on Sustainable STEM Education *Bennedeth. A Ezellora , Chukwunazo. Maxwell Obikezie , & Rebecca Ebonam Chikendu* **6** - Sustainable Development Goals and Science and Technology Education *Aletha R. Cherry & Teresa J. Kennedy* **40** - Wicked Healthcare Problems Coupled with Versatile Educational Challenges in Healthcare and Health Informatics *Marjo Rissanen* **46** - Investigation of the Impact of Outdoor Ecology Course on Preschool Preservice Teachers' Connectedness to Nature *Yasemin Ozdem Yilmaz*	
Strand	**C**	**Chair: Prof. Ben Akpan**	**C**	**Chair: Prof. Anand Kumar**
Time	**Title/Author**	**G06, Ground floor**	**Title/Author**	**G07, Ground floor**
2:15-3:30	**1** - Student Teachers' Self-Study into Culturally Responsive Teaching Practice *Steven Sexton* **10** - Social Media Time, Students' Basic Science Achievement and Behaviour in Delta State, Nigeria, *Rachel Ovuezirie Atomatofa, Crescentia Ojenikoh Sekegor, & ThankGod Akporotu*		**16** - Teachers' Integration of Digital Technologies in STEM Teaching Practices in Tertiary Institutions in Akwa Ibom State, Nigeria *Anyanime Akpan, Rebecca Ufonabasi Etiubon, & Agnes Udoh* **13** - Students´ Misconceptions about Respiratory Processes Using Students´ Animations of Respiratory Processes *Ana Valdmann & Hedy Suurmets*	

	14 - The Impact of Teacher Coaching in the Professional Learning Communities in Nigeria: Coaches' and Teachers' Experiences *Alawiyyatu Aliyu Musa &Amina Ibrahim Abubakar* **25 -** The Pre-service Teachers' Perceptions of Integrated Teaching, Using ICT and Inquiry Learning in Science Classes *Anne Laius & Minna Presmann*	**23 -** Emerging Digital Technologies: Building Skills, Competencies and Knowledge of STEM Pre-service Teachers *Peter Abayomi Onanuga &Owodunni Adewale Saka* **32 -** A Study Comparing Grade 6 and 9 Students' Intrinsic Motivational Changes towards Science Learning Across Time *Moonika Teppo, Regina Soobard, and Miia Rannikmäe*
End of Day 1		

Day 2- March 28,2023

Time		
8:00 - 9:30	**Registration** **Posters Presentations**	
8:30 - 9:30	**Workshops by Mathematics and Science Teacher Association (MSTA)- UAE**	
	Workshop # 1 (Training room 1, 3rd floor)	**Workshop # 2 (Training room 2, 3rd floor)**
	STEM education modeling and instruction MSTA (Teachers and Students) - Prof. Sufian Forawi + Eduscience AlMazrooie	STEM Education and Entrepreneurship Teaching Strategies - Dr. Hind Kassir
9:30-10:00	**Plenary Dennis Chisman Oration** by Professor Jack Holbrook	**Auditorium**
10:00-10:20	**Keynote Speaker Panel (2) with Discussion** - Professor Hassan Hamid Tairab, The United Arab Emirates University, UAE - Professor BaoHui Zhang, Shaanxi Normal University, China - Professor Jack Holbrook, Dennis Chisman Oration	**Auditorium**
10:20-11:00	**Keynote Panel (2) Discussion: STEM Reform, Interdisciplinary Movement and the Future Challenges** Dr Olatunde Adekola (Chair)	**Auditorium**
11:00-11:15	**Break**	
Sessions		

Strand	**A**	**Chair: Prof. Miia Rannikmae**	**B**	**Chair: Prof. Bulent Cavas**
Time	**ID/Title/Author**	**G06, Ground floor**	**Title/Author**	**G07, Ground floor**
11:15-12:30	**57** - A Pathway to Pedagogical Convergence: Co-Teaching of a Physics Course for Pre-Service Science Teachers *Kadir Demir& Brett Criswell* **43** – Factors Affecting the Integration of Curriculum 4.0 in Engineering programs: A Qualitative Study of Public Sector University of Sindh *Muhammad Mujtaba Asad, Roha Ather, Alkarim Datoo, Fahad Sherwani, & Norah Almusharraf* **18** – Psychology of Children's Play, Imagination, Creativity Development in Early Childhood: The Role of STEAM-education *Evgeniya Olegovna Shishova &Valerian Gabdulchakov* **21** –The Level of Statistical literacy and Statistical Reasoning Among Ninth-grade Students *Asma Alhakmani & Mohammed Alghafri*		**9 –** Results of the STEM – Oman curriculum on the interest of 10th grade students towards STEM's careers and subjects *Maryam Al Mahrouqi* **11** – Nurturing Conducive Environment to Foster Secondary School Girls Participation in STEM Subjects: Organization for Women in Science for the Developing World (OWSD) Scaling Involvement *Nkadi Onyegegbu & Ngozi Nwodo* **22** –The Effect of University based Science Workshops on Emirati School Students' Perceptions of Science study, Work and Careers *Martina Dickson, Melissa McMinn, & Curtis C. Bradley* **34** - COVID-19 Engineering Design Challenge: Phenomenon-Based Learning and Student Innovation *Teresa Kennedy & Bulent Cavas*	
12:30-1:00	**Break**			
Strand	**C**	**Chair: Dr. Vasu Prakash**	**C**	**Chair: Dr. Tendai Charles**
Time	**Title/Author**	**G06, Ground floor**	**Title/Author**	**G07, Ground floor**
1:00-2:15	**30 –** Greek teachers' and students' views towards STEM education *Constantina Stefanidou,Achilleas Mandrikas, Kyriakos Kyriakou, Ioanna Stavrou, Ilias Boikos, & Constantine Skordoulis* **37** –A Systematic Literature Review of the Influencing Factors of Teachers' Informatization Teaching Leadership *Yue Zhang, Liguo Zhang, Yaoqing Li, & Xiaorong Yue* **38** – Science Teachers' Beliefs on Science Teaching and Learning for implementing in STEM Education *Miku Yoshida*		**36** – Intelligent Chatbots for Gender Inclusive Science *Gianna Avellis* **44** – Exploring Elementary Stream Instruction in the UAE *Ihsan Ahmad Bani Melhem & Sufian Forawi* **50** – Effects of Inquiry-Based Model on Nigerian Junior Secondary School Students' Misconceptions and Achievement in Basic Science and Technology *Bernadette Ozoji, Beatrice Nuhu, Peter Lemarck, Chike Izundu, & Mohammed Dung*	

	49 – The Flipped Classroom: Enhancing Self-Confidence Among Adolescents Studying Chemistry *Ryan Gallagher*		**58** – A Study on Missions, Operations, and Performance of Non-governmental International Science Education Related Organizations *Ziwei Yan, BaoHui Zhang, and Xin Wang*	
Strand	**C**	**Chair: Prof. Teresa Kennedy**	**D/E**	**Chair: Prof. Asit Kumar**
Time	**Title/Author**	**G06, Ground floor**	**Title/Author**	**G07, Ground floor**
2:15-3:30	**3 –** Learner Centered Teaching Strategies: Imperative to Improvement of Secondary School Students 'Attitude towards Physics *Patience Agommuoh & Ngozi Joseph-Kalu* **31** – Influence of Scenario-Based Learning on Problem-Solving Using Critical Thinking Analysis Approach in Medical and Health Science Education *Huda Mohamad Ali Rasheed & Sufian Forawi* **45** – The Influence of Ambient Weather Parameters on the Prediction of an Electrical Power Production of a Combined Cycle Power Plant in the UAE *Hajer Ali Ahmed Saeed Alabdouli* **56** – Empirical Analysis of Fast-food Restaurants Green Practices and Its Effect on Customer Satisfaction *Mary Fatima Lompot & Allan Louie*		**59** – A Comparative Study on the Role of Science Teachers published in English and Chinese *Xin Wang, BaoHui Zhang & Ziwei Yan* **55** – Developing Student Agencies and Stem Identities Through Stem Program for B40 (Low-Income Group) Students *Mohamad Sattar Bin Rasul, Roseamnah Abdul Rauf, &Ruhizan Mohammad Yasin* **42** – Development of Industrial Revolution 4.0 Framework for Educational Institutes of Rural Sindh: A Conceptual Framework *Muhammad Mujtaba Asad, Fahad Sherwani, Roha Ather, Ali Nawab, Alkarim Datoo, & Irfan Ahmed Rind* **29** –The Perceptions of Students with Learning Difficulties towards Developing Science Learning in Private School in Dubai *Muna AlSadoon & Sufian Forawi*	

	A	**Chair: Dr. Aslam Sarfraz**	**B/C**	**Chair: Dr. Declan Kennedy**	**C/D**	**Chair: Dr Munir Sirajo**
	Title/Author	**G06, Ground floor**		**G07, Ground floor**	**Title/Author**	**Training Room #1, 3rd floor**
3:30-4:45	**48** – Paradigm Shift in STEM Research Strategies toward Collaborations: From Un-disciplinary to Multidisciplinary, Interdisciplinary and Transdisciplinary Approaches *Asit Kumar Das, Satabdi Das, & Nivedita Sarkar Talukder*		**63-** Addressing Attractiveness of Science Career Awareness *Miia Rannikmäe, Jari Lavonen, Rachel Mamlock-Naaman, & Regina Soobard* **65-** The United Nations Decade of Ocean Science for Sustainable Development: Actions for science educators		**69-** A study on the influence of FPEE strategy on students' scientific explanatory ability *Ma Liping, Hu Shengli* **53-** Identification of Science Teacher Profiles Based on Lesson Observation Data *Dace Namsone, Kārlis Greitāns, Ģirts Burgmanis*	

	28 – Teaching Chemistry in Context with Nano: A Gateway to STEM Field *Riam Abu Much & Salam Ali* **15** –Development of Stem Education in Nigeria, the Way Forward *Catherine Omole* **27** –An Analysis of STEM Topics on the IELTS Examination: Is the IELTS Exam Suitable for the Assessment of the Academic English of STEM University Students? *Hilda Freimuth*	*Teresa J Kennedy, Janchai Yingprayoon, Sermin Acik, Bulent Cavas* **66**- Mobile applications applied in STEM education in primary school *Ana B. Prieto & Teresa J. Kennedy* **64**- Effect of Training Biology Teachers in Scientific Thinking Skills on Senior Secondary School Students' Achievement in Biology in Kano. *Bernadette Ozoji & Ngozi Ihejirika*	**67**- Linking Science Teacher Professional Development Needs with Appropriate Interventions to Promote Student Conceptual Understanding *Dace Namsone, Kārlis Greitāns,* **68**- Online diagnostic assessment system in support of numeracy teaching and learning *Ģirts Burgmanis*
4:45-5:45	**ICASE Roundtable (CAA Room, 2nd floor)**		
5:45-6:00	**Break**		
6:00-8:00	**Iftar Dinner**		
	End of Day 2		

Day 3- March 29,2023

Time	**MSTA Workshop # 3 (Training room #1, 3rd floor)**	**MSTA Workshop # 4 (Training room #2, 3rd floor)**
9:00-10:00	Teaching Towards Independent Learning (Teachers and Leaders) - Dana Dannawi	S.T.E.M Scientific Teaching Empowers Minds (Teachers and Leaders) - Dr. Lara Abdullah
	Sessions	
Strand	**A** **Chair: Prof. Abdulai Abukari**	**B** **Chair: Dr. Emad Abu Ayyash**
Time	**Title/Author** **G06, Ground floor**	**Title/Author** **G07, Ground floor**
10:00-11:15	**33** - A Rigorous Curriculum Reform Approach for Developing PBL Science Units in the United Arab Emirates *Noura Assaf*	**8** - Ethno-Chemistry Practices: A Panacea for Teaching Selected Difficult Concepts and Enhancing Rural Secondary Schools Students' Interest and Understanding in Chemistry *Hope Amba Neji, Cecilia Obi Neji, and James Odum Ibe*

	62 - The Impact of English Reading on the Measures of Academic Progress (MAP) Results *Dana Dannawi & Amin Alhaj Hamad* **35** - ADIC: A New Model for Designing Interactive Digital Content *Dr. Abdurrahman Ghaleb Almekhlafi* **39** - Group Based Multidisciplinary Learning in Solving Work-Related Research Problems *Antti Rissanen & Kalle Saastamoinen*	**12** - Effect of Mathematics Communication Skills in the Teaching and Learning of Word Problems on Students' Academic Performance *Anne Meremikwu & Hope Neji* **19**- Organising Children's International Science and Mathematics Festival: Experiences and Implications *Sudhakar Agarkar& Vasu Prakash* **7 –** Effect of Metacognitive Instructional Strategy on Secondary School, Students Achievement in Biology: Implication to Science, Technology and Mathematics (STEM) Education *Nneka Rita Nnorom, Obiebere Rita Okechukwu, & Bibiana Chijioke Okoli*
Strand	**C** **Chair: Dr. Abdurrahman Almekhlafi**	**D** **Chair: Dr. Hind Kassir**
Time	**Title/Author** **G06, Ground floor**	**Title/Author** **G07, Ground floor**
11:15-12:30	**41** - From Project into Lesson Plan: Pre-service Science Teacher's STEM project and Implication for Pedagogical Competence of Science Education *Ely Djulia &Halim Simatupang* **52** - Effectiveness of STEM Approach on Elementary Students' Outcome *Sanaa Al-Timani and Sufian Forawi* **51** - Investigating the Effects of Virtual Laboratories on Students' Motivation and Attitudes toward Science *Dareen Shukri alnaser* **2 –** Status of STEM Education Reforms and Teacher Views in UAE *Sufian Forawi*	**47**- Biology Teachers' Perception of Their Technological Pedagogical Content Knowledge for Teaching Genetics: Implications for Professional Development *Clara Dumebi Moemeke* **60**- High Fliers Program for Future STEM Educationalists *Miia Rannikmae, Kari Sormunen, Cecilia GALVÃO, Josip Burušić & Regina Soobard* **54** - Evaluation of Technology-driven active learning framework for enhancing student engagement and inclusivity in Higher education *Abidha D*
12:30-1:00	**Break**	

1:00-1:45	**Roundtable (Room G06)** Science and Mathematics Education in Multicultural Contexts *Hind Kassir, Mona Mohamed, Sufian Forawi, Elaine Alquran, Sura Sabri, Nimmy Thomas & Marwa Eltanahy* **Dr. Evgeniya Shishova (Chair)**
1:45-2:15	**Keynote Presentation:** Professor Sibel Erduran, University of Oxford **(Room G06)**
2:15-3:30	**ICASE General Assembly (Room G06)**
	End of Day 3
	Day 4- March 30,2023
9:30-10:30	**Award Ceremony (Auditorium)**
10:30-11:30	**Closing remarks (Auditorium)**
11:30-12:30	**International Organizing Committee (IOC) Meeting** **Local Organizing Committee (LOC) Meeting**
	End of Day 4 and Conference

International Council of Associations for Science Education

The Dubai Declaration on STEM Education Solutions to Complex Global Challenges

The 7th ICASE World Conference on Science and Technology Education, which also marked the 50th anniversary of the founding of ICASE, was held in Dubai, UAE from 27 – 30 March, 2023. We, the conference participants from across Africa, Asia, Australasia, Europe, Latin America, and North America believe that education through science and technology should provide solutions to complex global challenges. This will require teachers to be equipped with quality teacher education and teaching materials for both learning in and out of the classroom. However, parents, industry, government officials, and the wider community need to recognize that education has changed from when they were students. Science and technology are a part of everyone's life and therefore necessitates functional literacy. While there are some teachers who may not realize they are already incorporating relevant practices, not enough teachers have been trained nor are there enough student teachers being prepared for relevant education through science and technology.

The conference participants call upon all involved in research, policy development and practice in Science and Technology Education to carry out their actions in implementing this Declaration in their region of the world, acknowledging the key role of teachers for all students.

We resolve to:

- increase ICASE member organizations' appreciation of the need to provide STEM education solutions to complex global challenges by raising teacher diversity of teaching approaches and assessment techniques and for ICASE to provide support and encouragement in this;
- highlight the importance of education through science and technology to promote problem-solving, decision-making, and personal development of not only teachers but also their students;
- build on students' intrinsic motivation and initial enthusiasm for learning through STEM education;
- pursue educational policies related to promoting education through science and technology both within society and the world of work/industry;
- promote a common language for the goals of education through science and technology that recognizes its place in STEM education for students;
- rethink current certification and summative examination policies to enable greater attention to assessment of personal and social development of the individual through STEM education; and
- work in collaboration with UNESCO, national and regional governments, science teacher associations, and other NGOs to further the cause of science and technology education in a changing world.

Dated in Dubai, UAE this 29th day of March 2023

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7TH ICASE WORLD SCIENCE AND TECHNOLOGY EDUCATION CONFERENCE

27 – 30 MARCH 2023, Dubai, UAE

The International Council of Associations for Science Education (ICASE) would like to invite scholars and practitioners around the world to attend this global gala event. The conference participants include policy makers, curriculum developers, scientists, science and university educators and researchers, science teacher association officers and members, and primary / secondary STEM teachers to share research results and engage in discussions about the latest developments in STEM education. Established in 1973 with support from UNESCO, the objectives of ICASE are to extend and enhance the work of its member organizations; provide and support activities and opportunities to enhance formal, non-formal, and informal STEM education at all levels worldwide; establish and maintain an international communication network; and encourage and support the establishment and development of professional STEM organizations, especially where none currently exists in a country / region.

The ICASE 2023 world conference is also a celebration of the 50th anniversary of her establishment. It is a global event and is considered as a unique opportunity for all STEM researchers and educators to reach out, connect, and share their best practices. This is a conference that will reflect views and perspectives of STEM education globally, and aims to enable all attendees to use the ideas locally upon their return. For this reason, we urge all ICASE friends who have contributed to ICASE in the past, who still support ICASE today, and who will contribute in the future, to take part in this important conference. The conference will be held in the Gulf region at the British University in Dubai in collaboration with Amity University, Dubai, United Arab Emirates from 27 – 30 March 2023.

We look forward to receiving you in Dubai, UAE.

Conference Theme
STEM Education Solutions to Complex Global Challenges

Conference Strands
A. STEM Education Policy
A1. Public – Private partnerships in STEM education
A2. Curriculum development, evaluation, and assessment
A3. STEM education policy trends and reforms
A4. International comparative programs (PISA, TIMSS, ROSES, etc.)
B. STEM Education Impact
B1. Innovation and entrepreneurship in STEM education
B2. Sustainability and environmental education
B3. Career awareness in STEM-related fields
C. STEM Teaching Practices
C1. Teacher education and professional development
C2. STEM teachers and the role of professional associations in promoting 21st century skills
C3. Textbook's standards in STEM education
C4. Cultural, social and gender issues
C5. Digital technologies in STEM education
C6. Best STEM education practices
D. STEM Education Pedagogy and Projects
D1. Collaboration between formal and non-formal STEM learning contexts

D2. STEM education funded projects (NSF, European Union, National Agencies, Erasmus Plus, etc.)
D3. Engineering Education Research & Practice

E. Others

E1. We welcome creative topics that are relevant to the conference theme.

Programme Outline Publications:

The Journals
– Journal of Baltic Science Education – SSCI Journal, http://www.scientiasocialis.lt/jbse/
– Science Education International – ERIC Journal, http://www.icaseonline.net/journal/index.php/sei

Conference Committees

Local Organizing Committee

Prof. Sufian Forawi, Chair
Prof. Anand Kumar
Dr. Hind Kassir
Dr. Malini Bishnoi
Dr. Elaine Quran
Dr. Fatima Husain
Ms. Dana Dannawi
Mr. Husam Jarrar
Mr. Tamir Forawi

International Scientific Committee

Dr. Declan Kennedy
Dr. Steven Sexton
Professor Uchenna Nzewi
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Professor Cesar Mora
Professor Virgilio Umangay Manzano
Dr. Bob Worley
Dr. Yasemin Ozdem Yılmaz
Dr. Sarfraz Aslam

International Organizing Committee

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Professor Bulent Cavas
Professor Teresa Kennedy
Dr. Sarfaz Aslam
Professor Miia Rannikmae
Professor Sufian Forawi
Professor Anand Kumar
Dr. Hind Kassir
Ms. Dana Dannawi
Dr. Husam Jarrar
Dr. Malini Bishnoi
Mr. Tamir Forawi

Keynote Speakers

Professor BaoHui Zhang, Shaanxi Normal University, China

Prof. ZHANG BaoHui is Qujiang Scholar professor, former dean at the School of Education (SOE), Shaanxi Normal University (SNNU), Xi'an, China. He is president of the International Council of Associations for Science Education (ICASE) (2020-2023). He is East-Asia Association for Science Education (EASE) 2021 Distinguished Contribution Award winner. He also has work experiences in Beijing Normal University, Nanjing University, China, University of Pittsburgh, Michigan State University (USA), and Nanyang Technological University, Singapore. Prof. Zhang has supervised post-doc fellows, doctoral, master, and undergraduate students from a number of countries, such as Russia, USA, Canada, China, Singapore, the Philippines, Indonesia, Tanzania, the Netherland, Pakistan, among others. His teaching and research is at the intersection of science education, educational technology, learning sciences, and teacher education. A study released in Jan. 2019 by the Research Center of China Science Evaluation (RCCSE) based on the biggest Chinese electronic academic journal database CNKI revealed that he ranked the 3rd on the top 50 Chinese Education Researchers (2006-2019). He has presented education research work of his and his collaborators' in 19 countries and regions. More information about him can be found here: http://zhangbaohui.snnu.edu.cn.

Professor Hassan Hamid Tairab, The United Arab Emirates University, UAE

Prof Hassan Tairab has been in the field of education since 1985 as a science teacher, an educator, a curriculum and a program developer and an administrator in various academic settings. He currently works as a professor of science education with a responsibility of developing and implementing science education academic programs both graduate and undergraduate levels in addition to his supervisory role of PhD MEd students. Prof Tairab has published and presented science education research in various international journals and meetings. His research interest focuses on issues related to teaching and learning of science at all grade levels in addition to STEM education and science teachers' professional development and learning. He has successfully obtained and executed research grants on various perspectives of science education. Prof Tairab is currently a chair/member of several national educational committees and works as a consultant and as a reviewer for several national and regional research foundations. Prof Tairab received his BSc & Education (Distinction) from the University of Khartoum, Sudan, and MEd (Distinction) and PhD in Science Education from the University of Hull in the United Kingdom.

Dr. Khalid Al Marri, The British University in Dubai, Dubai, UAE

Dr Khalid is an associate professor of project management at the Business and Law department of the British university in Dubai. Dr Khalid is proclaimed for setting high standard of accomplishment by holding the first PhD award in Project Management in the region. Dr Khalid has an undergraduate degree in Civil Engineering from the University of Arizona and master's degree in Engineering Management from the Catholic University of America. Following which he commenced his engineering career in 1996 in the Dubai Municipality and has been in the government services in the Sewerage & Irrigation Department and the Roads Department as Head in the Roads Construction Section. Dr Khalid holds the credential of having produced, through a doctoral program, the first framework for developing projects through public private partnerships (PPP) in the UAE. This framework is the first to lay the foundations for a standardized PPP practice in the UAE for practitioners. It highlights the most important factors for the success of PPP projects, such as value for money, risk sharing and allocation, renegotiations, and the roles of the public and private parties. Dr Khalid is also credited for developing a framework for establishing a nuclear research reactor project in the UAE through the utilization of public private partnerships, which was one of the first frameworks for PPPs in research reactor projects in the world and followed strict safeguards and required full awareness of nuclear safety, security & control of nuclear materials handling.

Professor Fazal Malik, Vice Chancellor, Amity University Dubai, UAE

Prof. Fazal Malik is the Pro Vice Chancellor at Amity University Dubai. He earned a PhD from Nottingham Trent University in the UK and Master's Degree in International Journalism from City University, London. He also has a post-graduate diploma in Business Administration and Certificate in Public Relations Practice from George Washington University. Before joining Amity University Dubai, he worked as Associate Dean at Higher Colleges for Technology, United Arab Emirates. With nearly three decades of international experience, Dr. Fazal has developed and delivered a range of programs at a number of universities in the UK, UAE and India. He successfully launched flipped learning project at Amity University to enable students to access learning anytime, anywhere which proved very useful in remote learning during the Covid-19 pandemic. A prolific researcher, he has authored scores of publications, presentation and commentaries on the relationship between media, place and identity. Dr. Fazal is the Editor of the Global Media Journal (Arabian editions), and a Board member of the Journal for Content, Community and Communication. A known commentator on Higher Education, Creative Industries and innovative disruption, he writes Oped-Columns in Gulf News and Khaleej Times and The National Newspapers in the Dubai. Before making transition to academia, Dr. Fazal worked as Broadcast Journalist for the BBC in the UK, researching, reporting news and producing current affair programs from across the world. He also set up a range of community-based projects in the UK, including community radio stations to create lifelong learning opportunities for disadvantaged communities in the UK.

Professor Sibel Erduran, University of Oxford, UK

Sibel Erduran is a Professor of Science Education and Fellow of St Cross College at University of Oxford, United Kingdom. She is also Professor II at University of Oslo, Norway. She is the President of the European Science Education Research Association; Editor-in-Chief of Science & Education and an Editor for International Journal of Science. Her work experience includes positions in the USA, Ireland as well as the UK. Her research interests focus on the infusion of epistemic practices of science in science education and she has a keen interest in the professional development of science teachers. Her work on argumentation has received international recognition through awards from NARST and EASE. She is currently working on two funded projects: FEDORA (EU Horizon 2020) and SciKids (UAEU). Her books published in 2019 are entitled Argumentation in Chemistry Education: Research, Policy and Practice (Royal Society of Chemistry) and Transforming Teacher Education through the Epistemic Core of Chemistry: Empirical Evidence and Practical Strategies (Springer).

Professor Christiana Omoifo, University of Benin, Nigeria

Dr. Christiana Omoifo is a Professor of Science Education/Curriculum since 2005. She has 32 years of teaching, supervision, and research experience in higher education, She, also had ten-year experience at the junior and senior secondary school. Dr. Omoifo served as a Fulbright scholar, George Washington university, USA (1999-2001), postdoctoral fellow, Japan Society for the Promotion of Science, Hiroshima university (2001–2002), and visiting DAAD research fellow, University of Kassel, Germany (August, 2001), focusing on science curriculum development, higher education research, teaching of science and research and data analysis respectively. She served as Director, Centre for Record Processing Unit, Assistant Dean, School of Postgraduate Studies, Chair, Faculty of Education teaching practice committee and Head of Department, Educational Psychology and Curriculum Studies, University of Benin. She is a fellow of Science Teachers Association and Gender Studies Association of Nigeria. She is also, member of Nigerian Academy for Education, Organisation for Women in Science in Developing countries and immediate past chair, ECRA, NARST, USA. Dr. Omoifo won several academic awards and is Association of African Universities and Nigerian Universities Commission grantee. She served as research consultant for UNICEF, UNESCO, World Bank, Federal Ministry of Education, Nigeria, and many others. She has 90 publications.

Professor Jack Holbrook, University of Tartu, Estonia

1. Student Teachers' Self-Study into Culturally Responsive Teaching Practice

Steven S. Sexton
College of Education, University of Otago

Abstract: This study sought to understand the rationale behind decisions New Zealand primary student teachers in the second year of their three-year Bachelor of Teaching (Primary) programme made regarding how they planned, what they planned, and why they had planned these teaching experiences from their student teacher perspectives. This study investigated the academic decisions these sixteen participating student teachers made about planning for science, technology, and the arts as they worked to be a more culturally responsive teacher. These participating student teachers, as part of their normal programme, engaged in reflection-on action to inform reflection-for action as part of critical peer groups. These in-class discussions explored the decision-making process that these student teachers used to inform their curriculum decision making approaches. The findings of this study contributed directly to these student teachers' own programme academic development in how it supports student teachers to learn how to become resilient and successful by being informed about what other student teachers have experienced in their learning to teach journeys.

Keywords: Primary education, critical peer, initial teacher education, STEAM

2. Status of STEM Education Reforms and Teacher Views in UAE

Prof. Sufian Forawi
British University in Dubai

Abstract: As in reform agendas of many countries in the region, EMEA, MENA, GCC, the United Arab Emirates status of SETM education is no different. The UAE presented steady strategic development towards STEM education and career development. The purpose of this study was to explore the status of reforms and teacher views of STEM education in the UAE. Methodology of the qualitative study followed the constructivist philosophical underpinning and used document and analysis and teacher interviews to collect and thematically analyze the data. Main results included STEM education reform themes including policy development, teacher preparation and training, curriculum enhancement, and school support. Yet, several challenges were noted: need of clear strategic STEM, development of curricula and programs, both at government and private schools as well as universities, based on real industry applications and sustainable resources that are in Arabic language and culturally embedded.

Keywords: STEM education reforms, policy development, UAE STEM education challenges

3. Learner Centered Teaching Strategies: Imperative to Improvement of Secondary School Students'Attitude towards Physics

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Abstract: This study employed a descriptive survey research design to investigate how learner centered teaching strategies can improve secondary school students' attitudes towards physics. The population of the study is all senior secondary school two (SSS2) physics students in Umuahia Education Zone of Umuahia North Local Government Area of Abia State. Purposive sampling technique was used to select one hundred (100) senior secondary school two (SSS2) physics students from four coeducational senior secondary schools in Umuahia North Local Government Area of Umuahia Education Zone of Abia State. The instrument for data collection was the researchers developed structured questionnaire of the Likert type on senior secondary school students' assessment of learner centered teaching strategies as a way to improve secondary school students' attitudes towards physics. Two (2) research questions and one (1) null hypothesis tested at 0.05 level of significance guided the study. The instrument was validated and the reliability index of 0.89 was obtained. The research questions were answered using mean while the null hypothesis was tested with chi-square statistics. Results showed that brain storming, role playing, and demonstration, classroom debate, learning through research, group working and concept mapping are learner centered teaching strategies that could improve secondary school students' attitudes towards physics. Recommendations were made based on the findings.

Keywords: Science, Physics, Teaching Strategy, Learner centered strategy and attitude

4. Pre-service Teachers' Awareness and Attitude toward STEM Education as a Panacea for National Development

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Abstract: The attitude and behaviour of individuals toward the national development today would determine how prepared we are for the future and how the environment will respond to us in the future. Hence this study sought to examine pre-service science education teachers' awareness of STEM education and attitude towards it. The research adopted the descriptive survey of the correlation type, and 400 pre-service teachers were randomly selected for the study. The questionnaire was distributed to 400 pre-service teachers in three Colleges of Education in Oyo State, Nigeria with 310 duly filled and returned. Mean, Multiple Regression, and t-Test were used for data analysis. Findings revealed that pre-service teachers in the colleges of education are having a high level of awareness level of STEM education, they also found that the pre-service teachers had favourable attitudes toward STEM education for national development. The study, therefore, recommended among others that the schools where teachers are trained for the future should restructure their curriculum to incorporate STEM education that informs the trainee teachers of the significant roles, they can play in achieving national development through STEM and most importantly promote its knowledge in their classroom.

Keywords: Pre-service Science Teachers, STEM Education, Attitude, National Development

5. Challenges of E-learning on Chemistry Students during the First Wave of 2019/2020 COVID-19 Lockdown: Implications on Sustainable STEM Education

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Abstract: This study discussed the challenges of e-learning by Chemistry students during the first wave of 2019/2020 COVID-19 lockdown in Nigeria: implications on sustainable STEM education. The study concentrated in Awka South Local Government Area of Anambra State, Nigeria. A descriptive survey research design was used to carry out the study. The population sample of the study comprised of 114 Chemistry students (44 males and 70 female) that participated in e-learning during the first wave of 2019/2020 COVID-19 lockdown in Nigeria. Two research questions and one hypothesis were formulated for the study. The instrument used was developed by the researchers known as E-Learning Challenges by Chemistry Students (ECCS) with reliability of .75. The ECCS was distributed by the researchers to the students. Mean and standard deviation were used to answer the research questions while t-test was used to test the null hypotheses. The findings showed a statistical significance difference between the mean responses of male and female Chemistry students to ECCS in favour of female students. Based on these findings, conclusions and recommendations towards implication on sustainable STEM education were made.

Keywords: STEM, Chemistry, e-learning, and COVID-19

6. Sustainable Development Goals and Science and Technology Education

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Abstract: The Sustainable Development Goals (SDGs) are a collection of independent yet interconnected goals in support of the United Nations 2030 Agenda for Sustainable Development. The goals, created with the 21st century skills in mind, weave STEM (science, technology, engineering, and mathematics) disciplines throughout and aim to end poverty, protect the health of our planet, and provide equitable educational opportunities to ensure that by 2030 all members of civil society can enjoy prosperous and fulfilling lives. This poster provides a historical perspective of the concept sustainability, its relationship with global development, and the importance of developing a global STEM literate workforce capable of responding to the worldwide challenges presented today and into the future. Implementation models of international non-governmental organizations (NGOs) as well as regional and national examples highlighting STEM programming related to formal, non-formal, and informal STEM educational settings promoting Education for Sustainable Development (ESD) are discussed.

Keywords: Sustainability, sustainable development, sustainable development goals (SDGs), education for sustainable development (ESD), 21st-century skills, STEM, STEM education, formal, non-formal and informal learning, lifelong learning

7. Effect of Metacognitive Instructional Strategy on Secondary School, Students Achievement in Biology: Implication to Science, Technology and Mathematics (STEM) Education

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Abstract: The study investigated the effect of metacognitive instructional strategy on secondary school students achievement in biology: Implication to STEM Education. Two research questions guided the study. The design of the study was quasi experimental, pretest, posttest and non-randomized control group type. The sample of the study was 318 biology students, drawn from Government owned Public Secondary School, in Aguata L.G.A of Anambra State Nigeria. Data was collected using Biology Achievement Test (BAT). The instruments for data collection was validated, and the reliability of the instrument was established using Pearson Product Moment Correlation Coefficient which gave reliability coefficient of 0.87. Data were analyzed using mean and standard deviation to answer the research questions. The result of the study showed among others, that students performed better when exposed to metacognitive instructional strategy in biology class than when exposed to lecture method. Also that female students performed better than male counterparts using metacognitive instructional strategy. Based on the findings educational implications and conclusions were made and recommendations proffered.

Keywords: Metacognitive Instructional Strategy, Achievement, Biology, STEM Education

8. Ethno-Chemistry Practices: A Panacea for Teaching Selected Difficult Concepts and Enhancing Rural Secondary Schools Students' Interest and Understanding in Chemistry

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Abstract: The study investigated the effects of ethno-chemistry practices as panacea for teaching and enhancing rural school students' interest and understanding of difficult chemistry concepts in Ikom Education Zone, Cross River State, Nigeria. The study adopted pre-test post-test non-equivalent control quasi-experimental design where the experimental groups were taught chemistry content using ethno chemistry practices while the control group were also taught same content with conventional method. The population of the study involved all rural senior secondary school (SS2) students comprising of (2,764) from the 113 schools in six (6) local Government Areas. Stratified and purposive sampling technique were employed in selecting one hundred and forty-for (144) the subjects after students were taught in intact classes. The instrument used for data collection was chemistry interest questionnaire and chemistry understanding test (CUT). The research questions were answered using simple percentages, mean and standard deviation scores. The hypotheses were tested using analysis of covariance (ANCOVA). The study revealed that rural secondary school students taught selected difficult chemistry concepts with the use of ethno-chemistry practices had significantly higher interest in learning chemistry ($p=0.000$; $>.05$) than those taught with conventional method. Furthermore, finding revealed that the use of ethno-materials accounted for 76.6% of the variance in understanding than their counterparts taught without ethno-chemistry materials. Based on the findings, it was recommended that chemistry teachers should adopt the use of ethno-chemistry practices in teaching chemistry as innovative approach to enhancing students' interest and understanding.

Keywords: Ethno-chemistry, interest, understanding and chemistry

9. Results of the STEM - Oman Curriculum on the Interest of 10th Grade Students towards STEM's Careers and Subjects

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Abstract: The purpose of this study is to investigate the effect of STEM- Oman integrated with science class on the interest of 10th grade students towards STEM's careers and subjects. Quasi- experimental research was conducted in the second semester of the academic year of 2018-2019. Sixty-four female students of tenth grade from two secondary schools at the same town had participated in this study. The researcher used STEM-O that was established by the Ministry of Education in Oman to be integrated in the common topics in science subject in the experimental group (31), while the control group (33) studied these topics in a normal seating without STEM-O. Data were collected by survey of student' interest toward both STEM' subject and career (STEM-CIS). According to the research results, overall, there is no significant difference in mean scores for interest towards STEM career and subjects between groups. Moreover, there is no significant difference in ISTEMC neither ISTEMS for interactivity between groups or science achievement levels. However, there is a significant difference in interests in STEM careers' Technology between groups favor the control group. In addition, there is significant difference in interests in STEM subject' Math between groups favor the experiment group and interests in STEM subject' Technology between groups favor the control group. In the light of the research results, some suggestions have been made for future studies.

Keywords: STEM Education Impact, STEM Teaching Practices, Interest Towards STEM Careers, Interest Towards STEM Subjects.

10. Social Media Time, Students' Basic Science Achievement and Behaviour in Delta State, Nigeria

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Abstract: Academic achievement has been affected by many factors including time spent on social media sites. This study investigated the Basic science achievements and behavior of students' who are heavy, moderate and low users of social media sites after school hours in Nigeria. Three research questions and two hypotheses guided this study. A sample of 180 students who consent to having full or partial access to an active phone at home after school hours were used. Two instruments, the online social networking questionnaire (OSNQ) and the students' 1st term 2020/2021 basic science examination results were validated and used to obtain the data that were analyzed using descriptive and ANOVA statistics. The result showed that Tiktok was the most visited social media site. Data contained no significant outlier (p=0.054 kolmogorov-smirnov test); Results showed that irrespective of the sites visited, longer time (more than two hours), spent on social media sites after school hours negatively affects students basic science achievement and behaviour. Recommendations were made to teachers and guardians on value re-orientation of the students on proper use of social media sites as well as the maximum time to spend.

Keywords: Social media time, Basic science achievement, Behaviour, Social media sites

11. Nurturing Conducive Environment to Foster Secondary School Girls Participation in STEM Subjects: Organization for Women in Science for the Developing World (OWSD) Scaling Involvement

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Abstract: The Science Teachers Association of Nigeria (STAN) in collaboration with the Organization for Women in Science for the Developing World (OWSD) over the years has funded researchers and educators in Nigeria. The idea is to promote best practices in the teaching and delivery of the relevant subjects with the ultimate aim of increasing the desire of Secondary School girls (SSG) to pursue career in Science, Technology, Engineering, and Mathematics (STEM). These efforts to a greater extent yielded very positive results. Despite the progress made through this intervention some gaps still exist as the participation of the SSG in STEM remains unimpressive. Achieving SSG full participation in STEM in Nigeria is difficult and complex. So what can OWSD do to solve this problem? This paper attempts to describe the various methods adopted by OWSD of South East Nigeria in solving this problem. The methods include "door to door adopt a girl-child" in secondary schools, creation of mentorship environment, establishment of Biotech laboratories, hands-on field activities, Workshops and Seminars for science teachers and researchers. This coordinated approach no doubt yielded very significant results and has increased the response of SSG to STEM.

Keywords: Organization for Women in Science for the Developing World (OWSD); Science, Technology, Engineering, and Mathematics (STEM), Secondary School Girls; Nurturing Environment

12. Effect of Mathematics Communication Skills in the Teaching and Learning of Word Problems on Students' Academic Performance in Mathematics

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Abstract: The study investigated the effect of mathematics communication skills in the teaching and learning of word problems on students' academic performance in Calabar Education Zone, Cross River State, Nigeria. The study adopted pre-test post-test non-randomized quasi-experimental design The population of the study involved all senior secondary school (SS1) students comprising of (3,962) from the six (6) local Government Areas. Stratified and purposive sampling techniques were employed in selecting one hundred and fifty (150) respondents. The instrument used for data collection was Mathematics Application Test (MAT) and Mathematics Comprehension Test (MCT). . The reliability of the instrument was ascertained using kudar-Richardson's formular (KR-20) which yielded a reliability of 0.89 and 0.86 respectively. The students in the experimental class were taught word problems using low mathematical language skills (LMLS). While those in the control group were taught with high communication skills (HMLS). The research questions were answered using mean and standard deviation scores while the hypotheses were tested using analysis of covariance (ANCOVA) at 0.05 level of significance.. The study revealed that students taught mathematics with simple language skills outperformed their counterparts taught with high language skills. It is recommended that mathematics teachers should adopt simple mathematics communication skills that would enhance students' academic performance in mathematics.

Keywords: Mathematics, communication skills, academic performance

13. Students´ Misconceptions about Respiratory Processes Using Students´ Animations of Respiratory Processes

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Abstract: Enhancing different competences is essential in today's schools; teachers and students are expected to use different information and communication technologies. In this study, students created animations about the breathing process using the slowmation method. The main objective of the study was to identify the misconceptions 9th grade students have about the breathing process and how these change during the creation of animations. The use of the Slowmation method helps to identify misconceptions in students, but at the same time is exciting and motivates students to learn.

Keywords: respiratory processes, students´ misconceptions, animation

14. The Impact of Teacher Coaching in the Professional Learning Communities in Nigeria: Coaches' and Teachers' Experiences

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Abstract: Poor teaching methodology has been identified as one of the principal factors responsible for students' poor literacy performance in Nigeria. Eventually, poor literacy affects students' performance in science-related subjects. Researchers have observed that teacher-coaching helps in improving teaching delivery and students' literacy. However, teacher coaching is minimally practiced in Nigeria. Thus, this study investigates the experiences and perceptions of coaches and teachers on teacher-coaching practices in order to make recommendations that would ensure best practices. Ten (10) coaches and 30 teachers were selected from three schools in North-eastern Nigeria to participate in the study. Data were collected by using a questionnaire. The data were analyzed using descriptive statistics. Findings reveal that both the coaches and teachers have positive experiences and perceptions of the teacher-coaching practices. The study makes recommendations that would improve teaching methodologies and teacher-coaching practices which would in turn enhance students' performance in literacy and science-related subjects. Finally, the study makes other recommendations for further studies.

Keywords: Experience, Nigeria, perception, teacher-coaching

15. Development of Stem Education in Nigeria, the Way Forward

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Abstract: Stem Education is a key facet for entrepreneurship and economic growth. In order to achieve this, efforts have to be intensified to advance the development and implementation of STEM education. This paper is a descriptive study to find out the level of awareness and development of Stem Education in Nigeria. Interviews conducted with stake holders in the Education sector showed that efforts are being made by various stake holders (e.g the project developers) in different parts of the country, at the primary and the secondary levels to get students involved. It was also found out that the current state of Stem education in Nigeria needs to be properly developed, monitored and integrated into the school system in order to attain success. It was recommended that goals and time frame be attached to the plan in order to monitor the progress.

Keywords: Innovation, Project developers, Stem Development

16. Teachers' Integration of Digital Technologies in STEM Teaching Practices in Tertiary Institutions in Akwa Ibom State, Nigeria

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Abstract: Globalization, rapid development in information communication technologies and the recent Covid-19 pandemic has further institutionalized the application of digital technologies in education. These digital technologies are emerging day by day making a paradigm shift in teaching and learning, as well as making the 21st century classroom more engaging, compelling, attractive and interesting, thereby giving the teacher new roles, now methods and new engagements in and out of the classroom. A descriptive survey research design was adopted for the study, three research questions and a hypothesis guided the study. The population of the study comprised 2254 male and female STEM lecturers and 270 randomly sampled for the study. A 32-item questionnaire on a four point Likert scale developed by the researchers and validated by experts was used for the study. Reliability coefficient of 0.78 was obtained for the instrument using Cronbach alpha coefficient. Hardcopies of the questionnaire and electronic copies were given through whatapp, email and goggle form (with the link) to the respondents for data collection. Mean standard deviation and independent t-test was used to analyze the data obtained. Findings showed that there was high level of teachers' competence in integrating digital technologies in STEM teaching practices. The level of integration and use of digital technologies was moderate and male teachers made us of digital technologies more than the females in STEM teaching practices. Based on the findings, it was recommended among others that the tertiary education and teachers education curricular at all levels should be restructured to focus on contextualized, multiple intelligence and digital abilities, as well as global relevance and exposure. Pedagogical practices should be made to embrace the use of digital technologies, in order to provide opportunities for teachers to have appropriate knowledge and skills to meet with increasing globalization and the needs of the society.

Keywords: teachers, digital technologies, integration, STEM, teaching practices, tertiary institution.

17. Triple Helix Supporting STEM Education to Increase Future STEM Careers in the UAE

Fatima Yousif Husain and Sufian Forawi
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Abstract: Increasing communication between government schools, universities, policymakers and industry can benefit STEM education and STEM careers. These collaborations are pertinent in the UAE because the nation is aiming to meet the growing demand for a future STEM workforce by increasing the number of students pursuing STEM careers. The main purpose of the study is to investigate stakeholders perceptions and responses on formal and informal STEM education programs, STEM careers and the Triple Helix components in the UAE. The researcher employed a quantitative methods approach for this study that included questionnaires. This study will contribute to the literature of developing a knowledge-based economy by highlighting how the Triple Helix components can be a vital component to fulfilling the UAE's Vision 2030. The results from this study showed that the stakeholder's responses were positive regarding the Triple Helix collaboration in the educational field.

Keywords: Triple Helix model, formal and informal STEM education, career development

18. Psychology of Children's Play, Imagination, Creativity Development in Early Childhood: The Role of STEAM-Education

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Abstract: The study explores the issues related to the role of children's play in the development of cognition, emotion, imagination, and creativity in childhood. To increase the effectiveness of preschooler's educational activities we should improve their educational environments in order to ensure each child's creativity and initiative by allowing them to be independent and active. The study is based on theoretical foundations of sociocultural studies devoted to the role of children's play in the development of cognition, emotion, imagination, and creativity in playworlds and educational environments (Vygotsky, 1966; Elkonin, 1978; Leontiev, 1981; Bronfenbrenner, 1999; Nilsson, Ferholt & Lecusay, 2018; Smirnova, 2013, 2019). Thus, in the course of our study, it was proved that the educational environment will contribute to the effective formation of preschool children's play activity. The effectiveness of the pedagogical process, as an environment in which the child exists, can be of various types: supportive, developing, rich, comfortable, or, in some cases, neutral. Children's game arises from the child's living conditions in the environment. In this case, play does not disconnect people, but, on the contrary, unites the "adult world" and the "world of children", ensuring the creation of conditions for the mental development and "growing up", preparing the child for a future life. The data obtained can serve as reference points for transformation of the preschool education system.

Keywords: Psychology of children's play, development of imagination, creativity in childhood, educational environment, STEM education

19. Organising Children's International Science and Mathematics Festival: Experiences and Implications

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Abstract: Problems of 21st century are complex and need to be tackled collaboratively. Such a collaboration must begin at the school level. With this aim in mind Sri Prakash Vidyaniketan at Visakhapatnam in Andhra Pradesh State of India has come out with an idea of arranging International Children's Science and Mathematics Festival for school going students. It is a biennial event that started from November 2012. So far, four such festivals could be arranged (2012, 2014, 2016 and 2018). The experience gained in the organization of these festivals are quite enriching. Moreover, the lessons learnt are very relevant to make use of knowledge from the disciplines of Science, Technology and Mathematics to deal with global problems cooperatively. The festival has many components like Lecture Demonstrations by experts, Project Presentation by Students, Visit to Places of Interest in the City and Cultural Get-together. Students and teachers from different countries are seen to take active part in all these activities. This participation is found to enhance universal brotherhood among students and their mentors. Experiences gained and the lessons learnt in the organizations of international children's science and mathematics will be presented during the conference.

Keywords: science and math festival, collaborative problem solving, universal brotherhood

20. Case Study Based on Differentiated Assessment on Teaching English Language to the Learners with Disabilities in a School in Al Sharjah

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Abstract: The study is an attempt to provide neurodivergent students with ADHD, ASD or Dyslexia with an educational structure that helps them overcome developmental issues as well as learn the English language. The study followed primary as well as secondary research methodology, wherein the data was collected based on Qualitative research, with the primary data being gained via case studies on selected students with specific learning disability, while the secondary data was gathered by assessment of existing available research, online, and offline. The study revealed that differentiated learning techniques, based upon behavioral, and other therapies, can be used to evaluate students with learning disabilities. The study concludes that such differentiated learning techniques, alongside special care in teaching, can achieve proper balance in learning in the case of such students.

Keywords: assessment, differentiation

21. The Level of Statistical Literacy and Statistical Reasoning Among Ninth-Grade Students

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Abstract: The study aimed to investigate the level of statistical literacy and statistical reasoning among ninth-grade students. The study sample consisted of (121) students of the ninth grade. The researcher designed the statistical literacy and statistical reasoning tests, and both tests were verified for validity and reliability. The statistical literacy test was covered three skills and it was applied to (52) students of the ninth grade, while the statistical reasoning test was measured four skills and it was applied to (69) students of the ninth grade. The finding showed that there is a statistically significant difference at the level of significance (0.5) between the mean scores of students of the statistical literacy test and the pre- specified value. The mean scores of statistical literacy test was 13.5 out of 27, whereas the mean scores of students of understanding basic statistical terms skill was 4.2 out of 9, and mean scores of students of interpreting statistical terms in social contexts skill was 5 out of 9. As well the mean scores of students of questioning claims skill was 4.3 out of 9. The study also confirmed the existence of significant difference at the level of significance (0.5) between the mean scores of students of the statistical reasoning test and the pre- specified value. The mean scores of students of the statistical reasoning test was 18.8 out of 34, where the mean scores of students of data classification skill was 5.9 out of 10, and the mean scores of students of organizing data skill was 4.8 out of 9, as well the mean scores of students of representing data skill was 2, 8 out of 6, while the mean scores of students of data analysis skill was 5.2 out of 9. The study recommended highlighting and strengthening the statistical literacy among students at all levels of study, developing statistical reasoning skills through activities provided in daily classes, and supporting the integration of modern educational software into mathematics curricula in general, and statistics topics in particular.

Keywords: statistical literacy, statistical reasoning

22. The Effect of University-Based Science Workshops on Emirati School Students' Perceptions of Science Study, Work, and Careers

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Abstract: As the UAE's economy moves from one based on fossil fuels to one based on knowledge, it is becoming increasingly critical to have national representation in key employment sectors, one of which is STEM. In order for this to become a reality, representation of Emirati STEM students in higher education is also critical. In the first phase of this research project, Emirati high school students took part in university-based workshops led by university science degree students, also Emirati. In order to explore their views on the experience, and investigate whether this impacted on their views of science study, careers, and themselves as future scientists, we collected both qualitative and quantitative data from fifty-six students using a survey questionnaire. Key findings were that participating in the workshops within the university setting (and away from the school setting) were instrumental to their impact, and that being taught by trainers of their own culture and nationality was powerful enough to make them consider studying science at university in some cases. The findings of the study directly address ADEK's priorities in terms of UAE citizens' uptake of STEM degrees, which in turn addresses the wider UAE Economic Vision 2030 aims related to STEM.

Keywords: UAE; Science; Careers; Aspirations; University

23. Emerging Digital Technologies: Building Skills, Competencies and Knowledge of STEM Pre-service Teachers

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Abstract: Introduction In higher education, instruction that incorporates effective performance skills training is vital to equipping pre-service teachers with the tools needed to educate learners. In a typical learning environment, especially in the University, pre-service teachers are expected to acquire a range of skills and competencies to link the theory with the classroom practice. In 2020s, to ensure that the pre-service teachers in education courses, more importantly the STEM courses, teacher education programmes should work on policy direction as to how science and technology would be taught and assessed to lay a solid foundation for the nation on which the basis is to accelerate industrial and technological development. This is because there are practically no teacher education policies that link pre-service teacher education and in-service teacher education (PSTE and ISTE) in any coherent way, or that fully recognize the role of ISTE in teacher motivation and in ensuring continuous improvement in the quality of teaching and learning. However, national policy on Science and Technology Education (S &T E) stated that the essence of the policy direction is to make students and teachers self- adaptable to the knowledge and skills in S & T E.

Keywords: Emerging technologies, digital, STEM, content knowledge, pedagogical knowledge

24. Educational Leaders' Views Regarding the Implementation of Depth of Knowledge Model in Preparing Students for the MAP Exams in American Curriculum Schools in the United Arab Emirates

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Ministry of Education, UAE

Abstract: Students' assessments are considered significant factors in the process of improving education all over the world. The Depth of Knowledge Model supports teachers in enhancing students' learning skills and improving their academic progress. Nowadays, for educational accountability, countries, schools, and teachers are evaluated based on the results of students' progress in various types of assessments. Benchmark tests are types of external assessments where students are not performing well according to the required targets of the UAE National Agenda 2031 in some of the UAE schools. Therefore, the purpose of the current study is to investigate educational leaders' views regarding the implementation of the Depth of Knowledge Model (DOK) for enhancing students' academic skills in the MAP exams. A qualitative approach was followed to collect the needed data by interviewing 15 educational leaders who implemented DOK in their daily teaching processes. The findings revealed that most leaders have knowledge and understanding of the importance of implementing the Depth of Knowledge Model and its impact on students' outcomes in the benchmark exams.

Keywords: Depth of Knowledge Model - MAP exam - Students' Academic Skills

25. The Pre-service Teachers' Perceptions of Integrated Teaching, Using ICT and Inquiry Learning in Science Classes

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Abstract: The current study explored the pre-service science teachers' perceptions of integrated teaching, using ICT and inquiry learning in science classes. The aim of the study was to identify the pre-service teachers' perceptions of integrated teaching based on their subjects taught in teacher training teaching experience and possible differences in their opinions. A qualitative research method was used and a questionnaire was designed to elicit respondents' perceptions, including questions on science teaching objectives, ICT, inquiry learning and integration of science subjects. The data were analysed both quantitatively and the qualitatively. The program QCAmap was used for qualitative analysis, followed by MS Excel program for further analysis and comparison. The results showed that the results differed between studying one or more science subjects' during pre-service courses as two and more proposed science subjects placed more importance on the integration and transfer of subject knowledge and the introduction of relationships in nature. In addition, respondents' perceptions of the integrated teaching of science were found to be dependent on the disciplines being studied. It also emerged that half of the respondents did not consider the carrying out of inquiry learning in science classes to be important and only a quarter of the respondents attached the importance to the necessity of using ICT. At the same time, more than half of the respondents pointed out that it is important to make links with everyday life when teaching. Future research could explore in detail the impact of integrating science teaching on students' achievements and their interest in learning all science subjects in an integrated way and also whether the teaching of science as a holistic benefits students in their future lives.

Keywords: integrated science teaching; pre-service teachers; QCAmap, ICT, inquiry learning

26. Validating a Cross-Cultural Measure of Epistemic Cognition in Science – an EFA Approach

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Abstract: There is growing evidence for the importance of well-developed epistemic cognition in science for improved student outcomes. Sophisticated epistemic cognition is particularly important for effective problem solving and thus the implementation of effective inquiry learning approaches. This study aimed to validate an existing instrument for measuring epistemic cognition in science (ECS) in secondary age students in a culturally diverse population using an exploratory factor analysis approach (EFA). The participants were 11–16-year-old students in English medium private schools in the UAE (n = 439). The students were provided with a 26-item questionnaire, consisting of a four-point Likert response scale, designed to measure the four theorized domains of epistemic cognition in science: source of knowledge, certainty of knowledge, development of knowledge, and justification of knowledge. The responses were screened and then analysed using the EFA functions included in the Psych R package. The analysis provided evidence for four, internally consistent domains of ECS, but some of the items were not associated with the initially theorized domains. Suggestions for the rewording of items to increase domain alignment and scale reliability in culturally diverse samples are provided.

Keywords: Epistemic cognition about science , science, secondary school, inquiry learning, exploratory factor analysis, scale reliability, United Arab Emirates

27. An Analysis of STEM Topics on the IELTS Examination: Is the IELTS Exam Suitable for the Assessment of the Academic English of STEM University Students?

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Abstract: The International English Language Testing System (IELTS) exam is used worldwide to assess academic ability to function in English medium instruction STEM programs at universities worldwide. This study examined twenty-four official academic IELTS examinations through a content analysis to determine how much the university entrance exam for English as an additional language (EAL) students focuses on STEM topics. Six categories of the exam were analyzed. This included the academic lecture part of the listening test, the three academic reading passages of the reading test, and the two academic writing tasks of the writing test. The speaking test was not examined. Findings revealed that 49 out of 144 topics were STEM related, translating to 34% of the content. Of these 49 topics, 42 were general science topics, 3 were technology, 3 were engineering, and 1 was maths. This indicates that although the test may be marginally suitable for EAL students wishing to enter science as a major in general, it is not ideal for the testing of academic English readiness of technology, engineering, or math students.

Keywords: IELTS, assessment, entrance examinations, STEM

28. Teaching Chemistry in Context with Nano: A Gateway to STEM Field

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Abstract: Nanoscience and nanotechnology (NST) are at the forefront of the modern science in the 21st century. It is a multidisciplinary science field that combines chemistry, biology, physics, technology, mathematics and even engneering science. In the past few years, the demand for teaching NST in schools and academic institutions have been increased. This study aims to investigate the effect of teaching chemistry topics in context with NST applications on student`s motivation and learning achievments. The uniqueness of nanoscience and nanotechnology stems from the fact that it is a multidisciplinary scientific field that could combines the main disciplines identified in STEM education. The study was carried out on high-school students from the Arab sector in Israel, who studied chemistry topics in the context of nanotechnology applications. The main hypothesis driving this proposal is that teaching basic science topics in context with NST applications will enhance student`s motivation to learn science and contribute to a better understanding of basic science topics. The proposed research is an opportunity to enrich the science teaching curriculum in high schools with nanoscience and nanotechnology topics, and to enable the students to expand their skills to integrate between different scientific fields and its impact on our modern life.

Keywords: nanoscience, nanotechnology, multidisciplinary, science education, Teaching module, STEM education

29. The Perceptions of Students with Learning Difficulties towards Developing Science Learning in Private School in Dubai

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Abstract: The intent of this research study is to investigate students with LD' perceptions toward science learning in private schools in Dubai, these perceptions include intrinsic motivation, self-efficacy and self-determination. The quantitative research question has been addressed: What are students with LD' perceptions regarding developing science learning in middle schools in Dubai? Quantitative research approach has been used through students with LD questionnaire which distributed online, the data has been collected and analyzed, the results show there were positive attitudes of this group of students towards developing science learning with some considerations indicating to these students' motivation, self-efficacy and self- determination which need cooperation among stakeholders in the educational field.

Keywords: Science learning, Students with Learning Difficulties

30. Greek Teachers' and Students' Views towards STEM Education

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National and Kapodistrian University of Athens

Abstract: The paper presents primary and secondary Greek students' and teachers' views towards STEM education. The research showed that most students consider themselves good at Mathematics and Science. At the same time, they do not find very likely to follow a career that is related either to these subjects or Engineering and Technology. Regarding their personal skills, most of them stated that they have communication and cooperation skills. Regarding the teachers, although they find STEM education important in cultivating both scientific practices and students' everyday skills, they do not use STEM approach in class, mainly due to lack of the appropriate equipment and lack of the necessary teachers training. The above-mentioned views are discussed in the context of designing appropriate educational material for teacher training in STEM education.

Keywords: Students' view, teachers' views, STEM education

31. Influence of Scenario-Based Learning on Problem-Solving Using Critical Thinking Analysis Approach in Medical and Health Science Education

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Abstract: With the abrupt changes in educational systems, the educational sectors and teachers tried to develop new skills and practice toward students' understanding of new skills and knowledge. So, there were some ways to encourage students to use their critical thinking to identify the problem when providing scenarios based on clinical experience. This research study was a descriptive systematic review with meta-analyses for randomized control trials and quasi-experimental research studies conducted from the period of 2008 to 2022. The main themes of the research study were scenario-based learning on problem-solving by using a critical thinking approach abilities, the tutor's role in solving the struggles that students faced during application of scenario-based learning, and the strategical plan of the medical and health professional education toward scenario-based learning. The subthemes from the theme of scenario-based learning on problem-solving by using a critical thinking approach abilities was problem-solving technique and the plan of action during patient care with the implementation of the plan of care provided during clinical practice. The meta-analyses were done for 15 research studies in the medical and health science education specialist. This research examined the analyses from these studies by using Revman Review Manager 5.4 software. The result of the study showed that all the research participants were 5265 at 100% weightage and risk ratio, M-H, random, and 95% CI were 0.78(0.69, 0.89), with heterogeneity Tau^2= 0.05, chi ^{2} = 164.88, and df= 14 (p=0.00001) that is highly significant($p < 0.05$). And the total effect was Z= 3.59 (p= 0.0003). In conclusion, the study is supporting the study with homogeneity results highly significant. Also, most of the studies supported that scenario-based learning is highly important in teaching medical and health science specialties and this can help them before going to the training in the hospitals.

Keywords: scenario-based learning, critical thinking, problem-solving, medical & health science students.

32. A Study Comparing Grade 6 and 9 Students' Intrinsic Motivational Changes towards Science Learning Across Time

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University of Tartu

Abstract: Research findings has indicated that going from primary to secondary school involves changes in science teaching and learning. However, there is a lack of long-term studies investigating students' intrinsic motivation towards science transition from one school level to another. In order to explore the issue, the main aim of the current study is to identify students' perceived changes in intrinsic motivation (in terms of interest, competence, choice, effort and value) towards science learning going from grade 6 to 9 based on self-determination theory perspective. Data were collected twice – first when students were in grade 6 and secondly after three years when the same students were in grade 9. A sample of 171 lower secondary school students completed the self-reported questionnaire. Group analysis of the data confirms that students' science-related intrinsic motivation drops with age - specifically regarding students' perceived competence, effort and value. Further suggestions and implications for practice are discussed.

Keywords: intrinsic motivation, science education, self-determination theory

33. A Rigorous Curriculum Reform Approach for Developing PBL Science Units in the United Arab Emirates

Noura Assaf
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Abstract: The purpose of this study was to investigate the impact of the rigorous Curriculum design approach for developing PBL science units in a private American school in Abu Dhabi, UAE. The study followed an explanatory sequential mixed-method approach whereby Measure of Academic Progress (MAP) science growth score results and teachers' interview questions were used as data collection tools. Among the participants (N=304) middle school students from grades 6 to 8 participated in this study whereby the majority of whom were Emiratis, N=295 students with valid MAP scores results were considered as well as six middle school science teachers who were purposefully chosen and interviewed as they implemented the RCD-PBL science curriculum units. Descriptive and inferential statistics were used to analyze the results of the quantitative tools while thematic analysis was used for the qualitative data. The results have shown that the RCD-PBL curriculum science units have a positive impact on teaching and learning and largely impact the students and affected their MAP scores, however, teachers' involvement, qualifications, receptivity, readiness, and willingness are fundamental factors for developing and ensuring proper implementation and success of this curriculum design and educational approach regardless of the challenges faced.

Keywords: Rigorous Curriculum Design, Project-based learning, Measure of Academic Progress.

34. COVID-19 Engineering Design Challenge: Phenomenon-based Learning and Student Innovation

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Abstract: This paper describes student involvement in the COVID-19 Engineering Design Challenge, an international Phenomenon-based Learning (PhBL) project developed through a collaboration between the International Council of Associations for Science Education (ICASE) and the Texas STEM Coalition to provide students in primary, secondary, and higher education learning environments with an opportunity to identify issues related to the Pandemic and design innovative solutions to address societal problems. Over 800 students from 12 countries participated in the Challenge from March 2020-December 2022. Teacher instructions, sample student classroom instructional plans, and student innovations will be shared.

Keywords: Phenomenon-based Learning, PhBL, student innovation, STEM education, engineering design; 21st century skills

35. ADIC: A New Model for Designing Interactive Digital Content

Dr. Abdurrahman Ghaleb Almekhlafi
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Abstract: Developing digital interactive content for learning is not an easy task. It needs extensive subject-matter expertise, technological know-how, teaching strategy knowledge, and an understanding of learning theories. Additionally, when creating content, developers require a framework in the form of an instructional model. One of the more recently created instructional models is the Almekhlafi Model for Digital Interactive Content (ADIC) model. The focus is on digital interactive content as opposed to the conventional instructional design of teaching materials, which makes it distinctive. Abdurrahman Almekhlafi, a university professor of educational technology, developed the model in 2018. The model was validated and has been implemented in different contexts ever since. It has been used as a framework for designing and developing teaching, learning, and training digital interactive content. ADIC model consists of four phases: Planning, Designing, Production, and Evaluation. Each phase consists of steps that could lead to coherent, easy-to-follow interactive content.

Keywords: ADIC, Digital Interactive Content, Instructional Design

36. Intelligent Chatbots for Gender Inclusive Science

Gianna Avellis
InnovaPuglia SPA and Italian Research Staff Association

Abstract: One of the aims of this project is to tackle diversity and inclusion of girls in science through the digital living mentoring and learning hub. Our objective is to make STEM education more gender inclusive for the younger women, especially NEET (Not in Education, Employment and Training) women, to achieve their career aspirations through the application of mobile technologies. This is the result from our investigation on Software Engineering (SE) and Artificial Intelligence (AI), where we were studying the application of intelligent chatbots to design software and have applied it to address a more gender inclusive science, namely the iCHAT-GENDER - An Intelligent Chatbot for Gender Inclusive Science. The project builds on bringing informal learning into the classroom, driving engagement through co-design thinking principles building on the practical informal maker-style activities to develop resilience in learners and mentoring guide to provide important guidance and the process of "instrumententalising". Hence, to take ownership of materials and adopting and adapting and repurposing the artefacts into 'instruments'. These 'instruments' of bring an act of learning to an owned artefact, enable capacity building.

Keywords: STEM Education of NEETS, Chatbot, Mobile Technologies

37. A Systematic Literature Review of the Influencing Factors of Teachers' Informatization Teaching Leadership

Yue Zhang, Liguo Zhang, Yaoqing Li, and Xiaorong Yue
School of Education, Shaanxi Normal University

Abstract: Teachers' informatization teaching leadership is an important force to promote students' informatization learning, teachers' informatization teaching professional development and informatization culture construction of schooling. The influencing factors of teachers' informatization teaching leadership determine the effect of teachers' informatization teaching leadership. Therefore, this study uses the system literature review method to analyze the influencing factors and influencing mechanism of teachers' informatization teaching leadership. Based on the literature analysis, this paper puts forward some ideas on the research direction of the future teacher informatization teaching leadership, including paying attention to the influence of localized leadership situation and education digital transformation background on the teacher informatization teaching leadership, as well as in-depth discussion on the influencing factors and influencing mechanism of the teacher informatization teaching leadership.

Keywords: teacher informatization teaching leadership; Information technology teaching; Teaching leadership; Information leadership

38. Science Teachers' Beliefs on Science Teaching and Learning for Implementing in STEM Education

Miku Yoshida
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Abstract: Although STEM, STEAM education is important for the better world in the future, teachers find it difficult to attract students to STEM. When teachers need to develop their teaching profession to new, such as disciplinary-based education to STEM education, they find it difficult to change due to their beliefs. This study tried to reveal in-service science teachers' current subject-specific beliefs. The study found out that teachers' beliefs showed that curiosity and/or interest towards science is the most important factor for students learning. It showed that teachers' core beliefs are not disciplinary-oriented, but more open to STEM education.

Keywords: Beliefs, professional development, STEM, STEAM

39. Group Based Multidisciplinary Learning in Solving Work-Related Research Problems

Antti Rissanen and Kalle Saastamoinen
National Defence University

Abstract: This is a case study of STEM-related master level education. Here we go through an example on the way how to teach risk of damage connected to helicopter winching. We were teaching this case study through the method called group-based multidisciplinary learning. Moreover, we observed skill and reasoning ability development due to the early research methodological education during the two last years of master level education. From the point of science and engineering, we present in this study shortly basic cable physics and the risk of damage through practical examples for the whole winching system.

Keywords: real-life problems, group base learning, technology education

40. Wicked Healthcare Problems Coupled with Versatile Educational Challenges in Healthcare and Health Informatics

Marjo Rissanen
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Abstract: Wicked problems in healthcare practice as well in healthcare management require extended ethical awareness and interventions. This means a specific development challenge for health education and health informatics area. Here ethics is an area which requires educational activities and involvements. Ethical issues in healthcare are in interest area of researchers. Translational healthcare tries to decrease the gap between theory and praxis. Wicked problems in healthcare mean challenge also for health professionals as well as healthcare clients. Therefore educational procedures should be targeted not only for health professionals and administrators but also for healthcare clients. Systems and tools in healthcare do not make ethical decisions. These are supportive solutions for ethical ponderings in educational, evaluative, and other kinds of decision making processes in healthcare. Increased ethical awareness also increases intellectual action in any working environment.

Keywords: healthcare ethics, translational design, educational interventions, support systems

41. From Project into Lesson Plan: Pre-service Science Teacher's STEM Project and Implication for Pedagogical Competence of Science Education

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Universitas Negeri Medan

Abstract: Science Technology Engineering Mathematics (STEM) framework has enhanced science teaching learning around the world. Integrating STEM into scientific approaches in science learning is a challenge for pre service science teacher, so this study aims to investigate: 1) what kind of STEM project created by students relevant to secondary science; 2) how these projects can be integrated into lesson plan as pre service teacher pedagogical requirement for teaching science. About 186 pre service science students were involved in this study. STEM-based science learning implemented in each two classes at the last three years have been focused to analyze STEM projects created from each group and essay test administered into students individually. Project-based learning was implemented into students for eight meetings then continue with constructing lesson plan for the next eight meetings each semester. Qualitative analysis showed that some STEM projects have been created by group such as money detector, wind power, generator, eco-box, solar system model, smartphone projector, mini stove, water purifier, portable air conditioner, thermometer model. All STEM projects were created based on science concepts includes electricity, energy change, static fluid, light, photosynthesis, temperature and heat, and human respiratory system. Students convergent and divergent thinking skills have been promoted when they created STEM projects. All projects then become sources for constructing STEM-based lesson plan. To investigate individual understanding about STEM-based learning, 8 item essays were administered into students to know students' pedagogical competences concerning STEM framework and its lesson plan consist of students ability in, learning analysis, constructing learning scenario, works sheet, learning media, and its evaluation instrument regarding STEM. Result showed respectively from higher into lower competence are analyzing science learning (70), learning scenario (60.5), worksheet (52.3), learning media (55.8), and evaluation instrument (47.9). The study imply although STEM framework has been increased students thinking ability in creating STEM projects, its pedagogical aspects to construct STEM-based lesson plan become new challenge for further teaching practice and research.

Keywords: Pre-service science teacher, STEM project, lesson plan, pedagogical competence

42. Development of Industrial Revolution 4.0 Framework for Educational Institutes of Rural Sindh: A Conceptual Framework

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Abstract: The term "digital transformation" in the context of education refers to rethinking the teaching and learning processes for a student body made up of digital natives, taking into account the practical aspects of the digital transformation through knowledge and technical skills, and being digital through the incorporation of skill, mindset, and digital attitudes. Technology, people, organizations, and pedagogical motivations enable, support, and direct the digital revolution toward Education 4.0. In order to identify the learning gaps in the public universities of Sindh, focused group interviews from the engineering students will be identified and suggestions from the engineering teachers to overcome the identified gaps will be taken through semi-structured interviews. Two teachers will be selected from four public universities of rural, Sindh Pakistan. Furthermore, on the basis of the qualitative results, a framework for the engineering undergraduate programmes for the universities of Rural Sindh will be developed. However, its efficiency will be measured through the survey questionnaire from 120 teachers of four target public universities of rural Sindh, Pakistan.

Keywords: Industrial Revolution 4.0, Education 4.0, Engineering Education, Rural Sindh

43. Factors Affecting the Integration of Curriculum 4.0 in Engineering programmes: A Qualitative Study of Public Sector University of Sindh

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[3]Prince Sultan University

Abstract: IR 4.0 demands a change in curriculum lined up with current region revelations with new headway, new plans, new strategy, new association and new thoughts, to assemble the presentations of the modern world. This study investigated factors affecting the integration of Curriculum 4.0 in engineering programmes at public sector university of Sindh, Pakistan. Semi-structured interviews were conducted from the Engineering faculty at public sector university of Sindh, Pakistan. This calls for tectonic changes in curriculum, teaching strategies, teaching resources and skills, attitude and aptitude required for teaching and learning as per IR 4.0. Curriculum 4.0 needs to designed under the supervision of all stakeholders including industries. The content must be aligned with market and industrial upcoming demands. Teachers insist that Curriculum 4.0 is important to gauge trends of students' performance and ultimately that can help them identify students' future pathways and possible careers by assessing their strengths and weaknesses.

Keywords: Industrial revolution, Education 4.0, Curriculum 4.0, Engineering Education 4.0, Engineering Curriculum

44. Exploring Elementary Stream Instruction in the UAE

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[2]The British University in Dubai

Abstract: The main purpose of this research paper was to explore the elementary students integrated STREAM projects in Abu Dhabi, the United Arab Emirates. The major research question was what are the main aspects of elementary students' integrated STREAM projects in a school in Abu Dhabi, the UAE? STREAM as it stands for Science, Technology, Reading, Engineering, Art and Mathematics, is an integrated curricular approach that focuses on the 21st century skills that aims to develop students' skills and knowledge.

Keywords: STREAM Projects based on reading stories

45. The Influence of Ambient Weather Parameters on the Prediction of an Electrical Power Production of a Combined Cycle Power Plant in the UAE

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Abstract: To improve the utilization of power plants and enhance production, this study is devoted to predicting the baseload electrical power production of a combined cycle power plant in the UAE. The data for this study was taken from plant sensors over a period of one month (September 2021) from specific sensors installed in the power plant. Accordingly, this paper studies four input variables: ambient temperature (AT), relative humidity (RH), atmospheric pressure (AP), and exhaust steam vacuum (V). All influence the target variable, which is power production (P). The analysis includes applying machine learning methods such as linear regression and artificial neural networks (ANNs) to develop a predictive power production model. The linear regression model R-sq value was found to be 53.49%. Moreover, the power linear regression model is ascertained to be more accurate than the ANN power predictive model.

Keywords: Power Prediction, Gas Turbines, Steam Turbines, Artificial Neural Networks, Linear Regression, Combined Cycle Power Plant

46. Investigation of the Impact of Outdoor Ecology Course on Preschool Preservice Teachers' Connectedness to Nature

Yasemin Ozdem Yilmaz
Mugla Sitki Kocman University

Abstract:

Keywords: connectedness, ecology, teacher, preschool

47. Biology Teachers' Perception of Their Technological Pedagogical Content Knowledge for Teaching Genetics: Implications for Professional Development

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Abstract: The study was aimed at understanding the teachers' views about their competence in integrating technology into the teaching of the domain-specific area of genetics. A random sampling technique was adopted to select two states out of the six in the South-South geopolitical zone of Nigeria while a stratified random sampling technique was employed to select six local government areas from the two sampled states. Three senior secondary schools were randomly selected from each local government area. 42 biology teachers in the 18 senior secondary schools formed the sample. A 35-item likert scale 'Biology Teachers' perception of their Technology Pedagogic Content Knowledge for Genetics' (BTP-TPACK) was administered for data collection. Results showed that 88% of the biology teachers have high perception of their competence in the components of TPACK but differed along gender lines with males having a more significant perception (N=8, Mean = 85.35) of their TPACK than females (N=34, Mean= 78.97). However, teachers' age, qualifications, and teaching experience did not differ significantly. Confidence-building pieces of training were suggested for female biology teachers to improve their understanding of technology integration and confidence while the recruitment policy consider recruitment of some more male teachers to teach biology in schools.

Keywords: TPACK, Technology integration, Science Teacher development, Gender in TPACK, Biology teacher education

48. Paradigm Shift in STEM Research Strategies toward Collaborations: From Un-disciplinary to Multidisciplinary, Interdisciplinary and Transdisciplinary Approaches

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Abstract: The 21st Century is the ear of Collaborative Strategies in academia; and obviously, paradigm-shift has been made in STEM (Science, Technology, Engineering and Mathematics) Education and Research is increasingly relying on Collaborative Approaches to address the complexity of the real-world problems. It is revealed from several studies, policy-decisions and administrative reforms taken by several Governmental Organizations that Collaborative Strategies, i.e., multidisciplinary, interdisciplinary, and even transdisciplinary approaches have been considered towards solving complexity of the real-world problems. As a result, trends in publication of 'Multi-Author' Research-Papers are accelerating rapidly. Such environment of the globe has fostering paradigm shift in Education and Research strategies from Unidisciplinary to collaborative approaches. Now the questions arise, whether Multidisciplinary, Interdisciplinary and Transdisciplinary collaborations in the field of Education and Researches would be made within the different Disciplines (Subjects) of the same Institutions, or different Institutions of the same state or the Country, or global collaboration? It depends upon the nature and complexity of the real-world Problems, feasibility of collaboration and the strategic planning of the collaborative Institutions, Funding Agencies and ultimately, the Governments concerned.

Keywords: STEM Education, Research-Collaboration, Unidisciplinary, Multidisciplinary, Interdisciplinary, Transdisciplinary, Crossed-Fertilized / Cross-Breeding Ideas

49. The Flipped Classroom: Enhancing Self-Confidence Among Adolescents Studying Chemistry

Ryan Gallagher
University College Cork

Abstract: One of the key aims of post-primary education in Ireland is to develop all aspects of the individual, such as the creative, critical, intellectual to prepare them for working life, for living in the community and for leisure. Student self-confidence and student agency are critical to the students' development at this stage. The Flipped classroom is a model within the blended learning pedagogy and is one that has gained considerable attention in educational circles since school closures due to the Covid-19 pandemic. The benefits of the flipped classroom towards developing student self-confidence are noteworthy. However, at national and international level, the vast majority of research on the flipped classroom is third-level focused. This paper discusses a number of issues that arise from data collected from research carried out by the author and how the flipped classroom can benefit adolescents preparing for a high stakes summative exam in Ireland. It was found that she successful implementation of the flipped classroom is achievable but scaffolding is required for adolescents. Video lessons are often seen as the core resource in the implementation of the flipped classroom. However video lessons alone are insufficient for developing student self-confidence. Students require multiple resources, particularly resources focused on assessment, to bolster their self-esteem.

Keywords: The flipped classroom, self-confidence, student agency, student-centred learning, assessment.

50. Effects of Inquiry-Based Model on Nigerian Junior Secondary School Students' Misconceptions and Achievement in Basic Science and Technology

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Abstract: The study investigated the effects of Inquiry-Based Model on junior secondary school students' misconceptions and achievement in Basic Science and Technology in Jos, Plateau State, Nigeria. The study adopted the pre-test, post-test quasi-experimental design. Population of the study comprised 2,407 students. Purposive sampling technique was used to select two schools from 16 schools in the area of the study. The sample comprised 120 students. Basic Science and Technology Misconceptions Questionnaire (BSTMQ) and Basic Science and Technology Achievement Test (BSTAT) were used to collect data from the sample. The instruments were validated with reliabilities established as 0.88 and 0.85, respectively, using Cronbach alpha method and Kuder Richardson Formula 21. Data collected were analyzed using SPSS. Research questions raised were answered using mean and standard deviation while hypotheses formulated were tested using Analysis of Covariance at 0.05 level of significance. Results showed that students taught using inquiry-based model had less misconceptions and achieved better in BSAT than those taught using lecture method. It was concluded that inquiry-based model was effective in reducing students' misconceptions and improving their achievement in Basic Science and Technology. The study recommended that science and technology teachers should incorporate inquiry-based model into their instructional delivery.

Keywords: Basic Science and Technology, Achievement, Inquiry-Based Model, Misconceptions

51. Investigating the Effects of Virtual Laboratories on Students' Motivation and Attitudes toward Science

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Abstract: Allowing students to practice science inquiry in the classroom is fundamental for science education. Students should master investigation skills, promoting their understanding of science concepts. Virtual labs have emerged as a powerful interactive tool that can be a suitable alternative to real labs, especially when lacking enough equipment and safety measures. This mixed approach study investigates the effects of virtual science labs on students' motivation and attitude toward science. Students (n=237) from grades (7,8,9,10, and 11) were surveyed to evaluate their virtual lab experience in an American curriculum private school in Dubai with the theoretical basis of motivation theories. The study reported that virtual labs positively impact students' overall motivation in terms of intrinsic motivation, perceived usefulness, effort, perceived self-efficacy, and attitude toward science. Students perceived self-efficacy and usefulness significantly impact student attitudes toward science ($p<0.001$). Students' perceived self-efficacy is a predictor of their effort in the lab by 6.1%. Students with high self-efficacy put more effort into completing a virtual lab task than students with low self-efficacy.

Keywords: Students’ motivation, virtual labs, self-efficacy, attitudes toward science

52. Effectiveness of STEM Approach on Elementary Students' Outcome

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Abstract: The world is at the edge of a revolution in technology that has its origins in the field of science, math, technology and engineering(STEM), that developed into a crucial approach globally in the 21st century. The present study is conducted to investigate the effectiveness and the impact of STEM education application on elementary students' academic achievement in UAE since UAE is a model country that puts its effort towards innovation as well as a fast developing country in economy. This empirical study is used to investigate the issue of concern in two Private American schools in UAE. Applying a mixed –method approach, 37 teachers were participated to explore their perceptions regarding STEM implementation on elementary students' outcome and 6 educational leaders from subject coordinators and academic coordinators were interviewed to examine their views and opinions about STEM integration in UAE. The quantitative findings, based on the survey results, show that educators' perceptions regarding STEM implementation on elementary students' outcome promotes their critical thinking, problem solving and collaboration skills that are required for their future careers. The qualitative study, based on the interview questions, show that UAE has made better improvement in STEM integration but is still limited and restricted by challenges.

Keywords: Integrated STEM, problem solving, critical thinking, collaboration, mixed method

53. Identification of science teacher profiles based on lesson observation data

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University of Latvia

Abstract: It is characteristic that besides other duties teacher competence management and development is becoming a part of school responsibilities. Still school leaders lack experience and instruments how to accomplish these duties. From teacher perspective competence management and development can be seen as the process of identification and implementation of professional development. An effective competence management approach that is widely used in business environment is the identification of required and actual competence profiles to judge which development is needed. Such competence management approach isn't characteristic for school environments, still is a promising perspective how to solve challenges regarded to teacher professional development.

Teacher professional development interventions are often criticized as being too general ("one size fits all" dominates), therefore the search for practices how to "tailor" professional development initiatives to individual teacher needs topical for teacher professional development research. An effective way how to personalize teacher professional development could be the determination of teacher professional development profiles and the design of the professional development around these profiles.

Person-centred approaches dominate in the identification of science teacher profiles, as surveys and tests are commonly used. Examples, how the identification of science teacher profiles can be done using lesson observation data are missing.

Science teaching is a complex process; to limit the complexity of this study, authors focus on teaching that promotes student conceptual understanding. A mixed method study was designed and conducted in a sample of 26 science teachers, who represented urban municipalities science teacher population. The study included science teacher lesson observation and analysis, and determination of science teacher performance regarded teaching that promotes student conceptual understanding. Science teacher performance data was used to identify teachers with similar performance across the selected criteria and to create science teacher profiles.

A methodology how lesson observation data can be used to identify teacher profiles in small teacher samples is described. Six various science teacher profiles in teaching that promotes student understanding were identified, characterizing the variety of science teacher professional development needs.

Keywords: Teacher professional development; Conceptual understanding; Teacher profiles

54. Evaluation of Technology-Driven Active Learning Framework for Enhancing Student Engagement and Inclusivity in Higher Education

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Abstract: The objective of this action research was to investigate the effect of a technology-driven active learning framework with interactive simulations and collaborative learning on student engagement and inclusivity. The framework was implemented in the Engineering electromagnetism module with 14 students majoring in Electrical and Electronics Engineering at HE Level 6. The project's sub-goals included facilitating problem-solving, fostering the inclusivity of mature learners, and enabling visualization of abstract concepts in order to enhance academic achievement. The framework made it possible to convert the conventional egg-crate classroom setup into a contemporary active learning setting. Both quantitative and qualitative data-gathering techniques were used to examine the cognitive, affective, and behavioral elements of involvement. The study revealed that the students had a favorable attitude toward the active learning framework supported by technology. The findings demonstrated that the framework enhanced student engagement, inclusivity, deep learning, and learner interaction. Academic performance significantly improved as the proposed framework increased student contentment, conceptual understanding, and self-efficacy.

Keywords: technology-driven active learning, collaborative learning, problem-solving, concept visualization

55. Developing Student Agencies and Stem Identities through Stem Program for B40 (Low-Income Group) Students

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Abstract: This research focuses on enhancing student STEM agencies and identities among low-socioeconomic families known as the B40 Group. This Online STEM program is a Longitudinal Research Grant Scheme (LRGS) program entitled Multidimensional Approach to Uplifting Social Wellbeing of Malaysian B40 with a focus on B40 Households' well-being Thru STEM Education. Impact studies were conducted on 148 secondary school students from the B40 family. The program adopts the Science of Smart Communities (SOSC) module that combines four submodules namely energy, urban infrastructure, wireless communications, and transport. Interventions also involve the application Virtual Reality (VR) applications to develop the Smart City Model to meet the requirements of teaching and learning implementation during the post-Covid-19 era. Throughout the process of implementing the activity, the Needham 5 Phases approach was carried out, including the orientation phase, triggering ideas, reconstructing ideas, implementation, and reflection. The research is important as it supports the ability to characterize the historical STEM identities of those who access informal STEM programs and B40 Households and the impact of the program on their STEM identities. The program aims to support the development of student agencies and STEM identities. The study examined five identity constructs: competence, performance, external recognition, self-recognition, and ways of seeing and being. The results show that student agency has increased throughout the intervention. Personalized learning, collaborative problem-solving, identity visibility, and identified engagement have helped students improve student agencies. Students who have the lowest confidence in their ability to make positive changes throughout the intervention. The findings also show the role of facilitators as a good example that can enhance student agencies and identity. To conclude, practical implementation strategies and application strategies to meet the various students' needs in B40 student groups are very important.

Keywords: B40, STEM education, STEM agencies, STEM identities

56. Empirical Analysis of Fast-food Restaurants Green Practices and Its Effect on Customer Satisfaction

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Abstract: The level of implementation of green business practices of fast-food restaurants in terms of water use and wastewater generation, waste recovery management, energy conservation, resource utilization, and environmental compliance in the National Capital Region (NCR), Philippines, were presented and examined. The difference between the level of customer satisfaction before and during the implementation of green practices was tested and analyzed thoroughly. Moreover, the proponents also identified the opportunities and challenges that fast-food restaurants encountered in implementing green practices. The proponents utilized a quantitative research approach. Surveys were conducted among seventy fast-food managers/supervisors and one hundred fifty customers of five of the top fast-food companies in the Philippines. The research indicates that fast-food companies in NCR, Philippines, moderately implement the five areas of green business practices. A difference in the level of customer satisfaction after fast-food companies implemented green practices was also reflected, suggesting the vital role green business practices play in customer satisfaction levels.

Keywords: Green Business Practices, Fast-food Restaurants, Customer Satisfaction, Sustainability

57. A Pathway to Pedagogical Convergence: Co-Teaching of a Physics Course for Pre-Service Science Teachers

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Abstract: A physics course for pre-service teachers was the testbench for a collaboration between a physics and a [science] education faculty member. This article describes a framework (pedagogical convergence) that outlines key insights from what allowed the collaboration to be successful. That success included supporting the pre-service teachers in advancing both their content and pedagogical content knowledge. Elements of the framework will be useful across various co-teaching contexts.

Keywords: pedagogical content knowledge, conceptual change, co-teaching in higher education, STEM, physics education

58. A Study on Missions, Operations, and Performance of Non-governmental International Science Education Related Organizations

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Abstract: International science education NGOs make a significant contribution to the development and training of scientific talent, and it is worthwhile for international science education NGOs to learn how these organisations do this. However, little research has been done on the mission, operation and performance of international science education organisations. This study used information from international organisation databases, the Internet and other sources in English and Chinese to try to find answers. The results of the study show that an analysis of the organisation's vision and goals indicates that international science education NGOs support or encourage their members or science education organisations around the world to develop science and technology education around research topics. However, the development and impact of these organisations is uneven. This study is based on specific examples of international science education NGOs, and all data are based on content analysis of their current websites and relevant databases. The data is highly up-to-date, detailed and comprehensive, and is informative and useful for the operation and development of international science education NGOs.

Keywords: Non-governmental Organizations; Science Education Organizations; Performance

59. A Comparative Study on the Role of Science Teachers published in English and Chinese

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Science teachers are essential part of science education system; they affect the development of students. However, existing research shows that science teachers have problems such as a large age span and uneven quality, which makes science education ineffective, the positioning of science teachers in an education can be vague; science teachers might have confusion about their roles. In order to better understand the current situation and future development trend of research on the role of science teachers in China and overseas, this study compares and analyzes a total of 30 documents on the role of science teachers in Chinese or English. The documents were rom Web of science or CNKI databases. Content analysis was applied on time of publication, volume of papers, research topic, similarities and differences of the role development of science teachers in China or overseas. Results show that: 1. At present, the development trend of research on the role of science teachers Published in English and Chinese is relatively slow, and has not received due attention. Most mainstream research paradigms are still in the stage of theoretical exploration; 2. The research theme of the role of science teachers mainly includes five aspects: role expectation, role orientation, role identification, role transformation and role. 3. The "should be" research published in Chinese and the "real" research published in English should be combined and form a positive interaction. This study is helpful to systematically analyze the current situation of research on the role of science teachers, with a view to providing a basis for subsequent research on the role of science teachers.

Keywords: The Role of Science Teachers; Content Analysis; Comparative Research

60. High Fliers Program for Future STEM Educationalists

Miia Rannikmae, Kari Sormunen, Cecilia GALVÃO, Josip Burušić & Regina Soobard

High Fliers project seeks to contribute meaningfully to the preparation of STEM -related professional careers, and especially for educationalists within schools, higher education institutions and science promotion organizations, seen as a concern in all partner countries: Estonia, Finland, Portugal, Croatia). The paper is introducing 4 models program and support action geared towards promoting social attributes of particular importance for future STEM educationalists. We discuss the piloting results among different stakeholders in all participating countries

Keywords: STEM
careers, transdisciplinary skills, future educationalists.

61. Science and Mathematics Education in Multicultural Contexts

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The roundtable paper provides critical review and analysis of related research topics of science and mathematics education of their paramount importance to diverse readers and researchers in fields of science education, policy making, and academia. The main scope of the paper highlights the theory and practice of these fields, contributes descriptively and empirically to the research, and provides recommendations and implications to similar contexts.

Keywords: STEM, cooperative learning, inquiry-based learning, TIMSS, Project-based learning, multicultural context and UAE

62. The Impact of English Reading on the Measures of Academic Progress Results

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Abstract: As the Dubai government is trying its best to improve the educational system in the private schools and achieve the goals of the national agenda 2021 in the education sector, benchmarking is one of the important keys to assess private schools in Dubai. The study focuses on the results of MAP in a private school for grade 6 that follows the U.S curriculum. Multivariate analysis of variance (MANOVA), Hoteling T2 and the simultaneous confidence intervals were used to find out whether English has an impact on the results of the MAP in the following subjects: math, science, English reading, and language. The low performance of the school sample was due to English reading scores, while no improvement was shown in the attainment of the students in mathematics and sciences.

Keywords: MANOVA, Reading, MAP, Benchmarking, Language, UAE, Mathematics, Science, English

63. Addressing Attractiveness of Science Career Awareness

Miia Rannikmäe, Jari Lavonen, Rachel Mamlock-Naaman, & Regina Soobard

Abstract: Education systems worldwide strive to enable a capable workforce, yet universities recognise the declining interest among students in undertaking STEM-related teacher courses and the lackof popularisity of STEM teacher profession among graduates. Seeking to minimise the gap between the beliefs of scientists and those of science education staff plus an appreciation of the need for greater understanding of differences between science and science education research, a staff development model is developed from undertaking a SWOT, based on self-determination theory and internationally evaluated. The model is geared to both science and science education researchers, having a focus on promoting STEM related career awareness among STEM students.

Keywords: Career awareness, twinning, professional development.

64. Effect of Training Biology Teachers in Scientific Thinking Skills on Senior Secondary School Students' Achievement in Biology in Kano, Nigeria.

Ngozi Ihejirika and Bernadette Ozoji

Abstract: The study investigated the effect of training biology teachers in scientific thinking skills on senior secondary school students' achievement in biology in Kano, Nigeria. Pre-test, post-test quasi experimental design was employed. The sample used comprised 975 senior secondary two students. Biology Achievement Test was used to collect data from students. The BAT was content validated with the internal consistency established as .85 using Cronbach alpha method. The experimental group was taught biology concepts for eight weeks by teachers trained in scientific thinking skills while the control group was taught the same biology concepts for the same length of time by biology teachers not trained in scientific thinking skills. Data analysis was done using SPSS version 26.0. Research questions were answered using mean and standard deviation while hypotheses were tested using ANCOVA at .05 level of significance. Results showed that the experimental group achieved higher than the control group. Gender was found not to have any significant effect on biology achievement of students in the experimental group. It was concluded that training teachers in scientific skills improved students' achievement in biology. It was recommended that teachers should engage students in scientific thinking skills for improved achievement outcome in biology.

Keywords: Achievement, Biology, Scientific thinking skills.

65. The United Nations Decade of Ocean Science for Sustainable Development: Actions for science educators

Teresa Kennedy, Janchai Yingprayoon, Sermin Acik & Bulent Cavas

Abstract: The United Nations designates specific days, weeks, years, and decades as occasions to mark particular events or topics in order to promote, through awareness and action, the objectives of the UNESCO and its international partners. The United Nations Decade of Ocean Science for Sustainable Develop is currently in progress and will continue through the end of 2030. This paper provides information about the Decade, the UN Sustainable Development Goals (SDGs), and share ways that educators and their students can become involved in ocean science activities in conjunction with the Ocean Decade.

Keywords: Ocean, Ocean Decade, sustainability, sustainable development, sustainable development goals (SDGs), education for sustainable development (ESD).

66. Mobile Applications Applied in STEM Education in Primary School

Prieto Ana and Teresa Kennedy

Abstract: In most of the world, STEM education is being promoted in order to bring children and young people closer to these topics, improve their performance and provide them with information so that they can consider following related careers in the future. To evaluate the interest of the students and their learning, a STEM education project was implemented in two courses of the first cycle of primary education in Junín de los Andes, (Patagonia region), Argentina. The objective was to gain an understanding of how eight and nine year old students learn STEM concepts related to atmosphere, the knowledge, skills acquired and the perceptions of the students about their research. The GLOBE Observer app, satellite imagery, apps supporting virtual reality (VR) and augmented reality (AR), lab experiences, and video conferences were used to investigate the influence of clouds on air temperature and the influence of aerosols on sky color. Students produced research reports and videos to participate in the GLOBE Program's International Virtual Science Symposium.
Taking measurements, analyzing data, writing a report and making videos allowed students to improve their perception of science and research, acquire knowledge and skills, develop self-confidence in their knowledge to teach others.

Keywords: Mobile applications, GLOBE Program, Problem-based learning (PrBL), STEM education, Balanced play

67. Linking Science Teacher Professional Development Needs with Appropriate Interventions to Promote Student Conceptual Understanding

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University of Latvia

Abstract: The search for more and more effective science teacher professional development interventions continues. There have been a lot of reports about science teacher professional development interventions, who reach the intended goals – changes in teacher practice and student results, still there isn't a common methodology how such interventions should be designed and implemented.
Conceptualization of effective professional development, its design and interventions can solve variety of problems – the resources invested in teacher professional development could be reduced and student achievements in science could be enhanced.
In recent years a variety of ideas around effective science teacher professional development have emerged: science teacher professional development should be tailored to teacher needs; the professional development should embody balanced set of behaviour change mechanisms and should be adequately implemented.
The authors of this study tackle the problem of conceptualization of the design of effective science teacher professional development interventions by a proposal how science teacher professional development needs regarded to promotion of student conceptual understanding should be linked. In particular, authors analyse six previously identified science teacher professional development need profiles to conceptualize the aims teachers of each profile should achieve. The aims are then analysed through the lens of behaviour change mechanisms and a hypothesis, which corresponding professional development form could benefit to each science teacher profile is stated.

Keywords: Professional development needs; teacher professional development; conceptual understanding

68. Online diagnostic assessment system in support of numeracy teaching and learning

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Abstract: Numeracy is core of STEM education and its teaching and learning can increase students' academic success in STEM subjects. Diagnostic assessment have the potential to support students' learning of numeracy knowledge. It provides students with proper feedback and teachers with information for intervention planning. Recent advances in technology-based assessment have made available to support student learning with immediate feedback.

In this paper, we describe development and piloting of online diagnostic assessment system with function to provide feedback to students and educators in real-time on numeracy knowledge learning. The paper outlines three-dimensional framework which forms theoretical basis of our online diagnostic assessment system, it describes the main functions of system and shows how diagnostic assessment can be used to measure numeracy knowledge learning.

The data for empirical study was drawn from 7th grade students. 209 students from 4 schools completed three diagnostic tests with different contexts (mathematics, science).

Results revealed that online diagnostic system can be used to provide feedback to students and teachers on numeracy knowledge learning in three dimensions – disciplinary context, application of knowledge and skills and cognitive aspects of learning (proficiency of knowledge).

Keywords: online assessment, numeracy, diagnostic assessment

69. A Study on the Influence of FPEE Strategy on Students' Scientific Explanatory Ability

Liping Ma, Shengli Hu

Abstract: Students' ability of scientific explanation is one of the abilities that international science education focuses on (NRC, 1996; NGSS, 2013; OECD, 2015). Constructing scientific explanation is helpful for students to understand scientific knowledge and improve their ability of scientific inquiry (Sandoval, W. A., & Reiser, B. J.,2004; Shanshan Lu, Hualin Bi, 2018). Science educators at home and abroad have conducted a large number of studies to help students construct reasonable scientific explanations (Melissa, B., Mark, W, 2011; McNeill, K. L., & Krajcik, J., 2007; Tang K S, 2016; Yao J X, Guo Y Y., 2017). However, the research mainly focuses on the explanation of scientific phenomena, and the teaching research on predictive explanation in relatively lacking. Therefore, this study puts forward the sequence of activities of forecast, pre-explanation, experiment and explanation, forms the FPEE teaching strategy, and discusses the influence of pre-explanation-driven experimental inquiry on students' scientific explanatory ability, in order to provide a reference for scientific explanation teaching based on experimental inquiry.

Keywords: Scientific explanation, Scientific explanatory ability, Explanatory scaffolding, FPEE strategy, Pre-explanation