



**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

**STEM Education International Conference 2021 (STEMEIC2021)  
“STEM Education and Innovation in Africa and beyond during and post COVID-19:  
Ensuring Quality, Equity and Inclusivity”**

**17<sup>th</sup> – 19<sup>th</sup> November 2021**

**VIRTUAL CONFERENCE  
BOOK OF PROGRAMME AND ABSTRACTS**

**Venue:  
Masinde Muliro University of Science and Technology (MMUST)**



**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

**Table of Contents**

**CONFERENCE BACKGROUND .....6**

**MESSAGE FROM THE CHANCELLOR .....7**

**MESSAGE FROM THE CHAIRPERSON OF COUNCIL.....8**

**MESSAGE FROM THE VICE CHANCELLOR.....9**

**MESSAGE FROM THE CHAIRPERSON CONFERENCE ORGANISING STEERING COMMITTEE AND  
DIRECTOR INTERNATIONAL RELATIONS AND ACADEMIC LINKAGES ..... 11**

**STEMEIC2021 PROGRAMME ..... 13**

**Older people health vulnerability to climate change and climate variability and adaptation strategies  
in Korogocho and Kiwandani informal settlements in Nairobi city, Kenya ..... 26**  
*Fredrick Okaka<sup>1</sup>; Paul Omondi<sup>2</sup>.....26*

**The Disjunction between Availability of Opportunities in STEM Careers and Lack of Enthusiasm to go  
into the Careers: Disentangling the Paradox ..... 27**  
*Atieno Rose Opiyo .....27*

**Syntactic Errors in Compositions Written by Standard Seven and Eight in Kakamega Municipality  
Schools..... 28**  
*Beatrice Charity Kemunto Obwoye .....28*

**Trend analysis of the changes in Kenya’s lakes’ water levels over the last 20 years ..... 29**  
*Ann Gichuhi, Kevin Achieng .....29*

**The Efficacy of Early Childhood Development Education Curriculum Implementation in Hamisi Sub-  
County, Vihiga County-Kenya..... 29**  
*Herbert Amunavi.....29*

**Cognitive Agility of Cyber Operators on Situational-Aware Cyberspace Protection..... 31**  
*David Njoga, Samuel Liyala.....31*

**Preservice Teachers’ Implementation of Laboratory Experiments in Stem Education ..... 32**



**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

Rose Mutende ..... 32

**Secondary school students' motivation beliefs and cognitive learning strategy use: trajectories Pre- and Post- Covid- school lockdowns..... 33**

*Diana Kwarikunda<sup>1</sup>, Ulrich Schiefele<sup>2</sup>, Charles Magoba Muwonge<sup>3</sup>, Joseph Ssenyonga<sup>3</sup>..... 33*

**Enabling Interventions for Increasing Female Students Access and Participation in Stem Related Subjects in Secondary School in Kenya ..... 34**

*Mark Waya<sup>1</sup>, Dr. Aliva Luvaso<sup>2</sup>..... 34*

**Assessment of Teachers Pedagogical Practices Influencing Information and Communication Technology Integration in Sciences and Mathematics in Public Secondary Schools, Kenya..... 35**

*Elsie Muenj Musau<sup>1</sup>, Rose Mutende<sup>2</sup>..... 35*

**An interlace of African Traditional Religion practices among the Abatirichi people of Western Kenya in mitigating climate change ..... 36**

*Sundukwa, P<sup>1</sup>, Ekwenye, J<sup>1</sup>, Mulinya, C<sup>2</sup>..... 36*

**Factors Affecting Small Scale Farmers Coping Strategies to Climate Change In Vihiga Sub-County In Kenya ..... 37**

*Mulinya C..... 37*

**Strengthening STEM education through E-Learning in Masinde Muliro University of Science and Technology..... 38**

*Angela Mungai<sup>1\*</sup> Benard Wesonga<sup>2</sup>, Umulkher Ali <sup>1</sup>, Anne A. Musotsi <sup>3</sup> Gordon Nguka <sup>3</sup>Donald Kokonya<sup>2</sup> Grace Litali<sup>4</sup>..... 38*

**Climate Change Education: The Road to Sustainable Development..... 39**

*Prof. Josephine K.W Ngaira..... 39*

**ICT Integration in Learning of Physics in Secondary Schools in Kenya: Systematic Literature Review 40**

*Elijah Okono..... 40*

**Enhancing the Learning of Secondary School Mathematics through online Pedagogy ..... 42**

*Robert Wakhata ..... 42*

**Effect of Resource-Based Instructions on Pre-service Biology Teachers' Academic Achievement ..... 43**



**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

*Josiane Mukagihana<sup>1</sup>, Florian Nsanganwimana<sup>2</sup>..... 43*

**Biology Instructional Resources Availability and Extent of their Utilization in Teaching Pre-Service  
Biology Teachers ..... 44**

*Josiane Mukagihana<sup>1</sup>, Catherine Aurah<sup>2</sup> ..... 44*

**Effect of Collaborative Concept Mapping Teaching Strategy on Students’ Performance in Mathematics  
in Selected Secondary Schools in Bomet County, Kenya..... 45**

*Joseph Kipkemoi Bii<sup>1</sup>, Martin Wanjala Sibweche<sup>2</sup> ..... 45*

**Effectiveness of Scaffolding Instructional Technique On Students` Learning Outcomes In “The Mole”  
Topic In Chemistry In Secondary Schools In Bungoma County Kenya ..... 46**

*Kennedy Kangale Wekesa<sup>1</sup>, Martin Wanjala<sup>1</sup>, Ronald Michieka<sup>1</sup> ..... 46*

**Implementation of the Financing Locally Led Climate Action Programmes (FLLoCA) will Enhance Local  
Resilience to Impacts of Climate Change ..... 47**

*Agevi, H & Mwendwa, KA..... 47*

**Students’ Academic Performance in Stem Subjects and Related Factors: A Case of a STEM Model Boys’  
School In Nandi County, Kenya ..... 48**

*Peter Ng’eny..... 48*

**Mental Health and Special Educational Needs: Exploring their Relationship in the Management of  
Challenging Behaviours among Learners with Autistic Spectrum Disorders in Western Kenya ..... 50**

*Edward Khasakhala<sup>1</sup>, Moses Sichari<sup>1</sup>, Kennedy Bota<sup>1</sup>, George Ayaga<sup>1</sup>, Donald Kokonya<sup>1</sup>, Benard Wesonga<sup>1</sup> ... 50*

**What is in a name: from DSM IV to DSM V in relation to ASDs..... 52**

*Khasakhala, E. Kanaiza, S. Odunga, N. Keya, I. .... 52*

**Neuroscience and Education: Unlocking the potential of students with Learning difficulties ..... 52**

**Creating Wealth and Wholesome Environment Through the Utilization Of Agricultural Waste In  
Livestock Production ..... 53**

*Gbolagunte Sunday Ojewola..... 53*

**Exploring the Possibilities of Preservice Mathematics Teachers 3-D Designing and Printing  
Manipulatives to Support Teaching and Learning of Mathematics ..... 54**



**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

*Denish Akuom*..... 54

**The Glocalized Form of Makerspaces: A Focus on Socio-Critical Literacies and Third Space Creation in Culturally Responsive Making** ..... 55

*Emmanuel Nti-Asante*..... 55

**Eight steps to conducting a comprehensive literature review: Example of privacy literacy 2.0**..... 56

*Slimane Aboulkacem* ..... 56

**Exploring Teaching Using Technology in University Education: Challenges and Opportunities** ..... 57

*Salmon Owidi, Teresa Okoth* ..... 57

**Improving the Quality of Language Teachers to Support Stem Education** ..... 58

*Irene Simiyu<sup>1</sup>, Dr. Adelhide Bwire<sup>2</sup>, Prof. Samson Ondigi<sup>2</sup>*..... 58



## CONFERENCE BACKGROUND

STEM Education International Conference is growing and will soon gain tremendous importance in the sustainable development of STEM education and related fields. Masinde Muliro University of Science and Technology (MMUST) and Diversity Education Institute (DEI) are proud to extend their promotion of research and education in the field of STEM by this international conference. The 2021 International Virtual Conference on STEM Education International Conference (STEMEIC2021) with a theme "STEM Education in Africa and beyond during and post Covid-19: Ensuring quality, equity and inclusivity" will be the second in the series of conferences organized by MMUST following the STEM Education International Conference (STEMEIC2020). STEMEIC2021 aims to address advances in research on STEM Education and related fields by bringing together researchers in the fields of science, technology, engineering and mathematics and related fields internationally. To document research findings and ideas, we are very pleased to inform that the accepted papers of STEMEIC2021 will be published to one of the following categories.

1. Journal of STEM (JSTEM): Conference series (JSCS) to be published in Masinde Muliro University of Science and Technology Conference Series (Online ISSN: 22223-490X)
2. Conference Book of Proceedings by STEMEIC2021

The proceedings will be edited by Dr. David Barasa, Dr. Annette Okoth, Dr. Benard Mudogo, Dr. Beatrice Shikuku, Dr. Lucy Mandillah, Dr. Rose Mutende, Dr. Catherine Aurah, Mr. Ronald Michieka, Mr. Kaleb Mwendwa, Dr. Victor Ndinda and Dr. Teresa Okoth



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### MESSAGE FROM THE CHANCELLOR



#### **Chancellor, Dr. Peter Wanyaga Muthoka**

D.ML (Honoris Causa), (MUA); MA(Ed); UCLA/ USA); BA (Hons) UEA), EBS, MBS, FKIB, FKIM, MID.

It is with great honour that I join you today as we host the Science, Technology, Engineering and Mathematics Education International Conference (STEMEIC2021). As the Chancellor, I am proud to have this Conference organized and hosted by this institution together with our national and international partners.

I wish to emphasize the fact that Science, Technology, Engineering and Mathematics are important for building and maintaining the development of any successful country. From the medical scientists, who develop treatments for diseases, to the civil engineers, who design and build a nation's infrastructure, every aspect of human life is based on the discoveries and developments of scientists and engineers. Let us, therefore, build on STEM education in order to foster a skill set that stresses critical thinking and problem-solving abilities.



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### MESSAGE FROM THE CHAIRPERSON OF COUNCIL



**Dr. Jane Musangi Mutua**  
Chairperson of Council

I wish to take this opportunity, on behalf of the entire Council of Masinde Muliro University of Science and Technology, to welcome you to this Science, Technology, Engineering and Mathematics Education International Conference (STEMEIC2021).

The Council has been and still remains committed to steering the making of meaningful changes in order to strategically place MMUST on the global map. This includes the ongoing recruitment and promotions among teaching and non-teaching staff. The University is also implementing the Strategic Plan for the period 2019-2023 which aims at addressing the long-term development of the University as it responds to the political, legal and economic changes nationally and globally. The direction taken through the implementation will ascertain that the University contributes to niche areas of the Vision 2030 and beyond by laying great emphasis on fostering research, innovation and technology development.

We thank you for joining us in this Conference.





## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### MESSAGE FROM THE VICE CHANCELLOR



#### **Prof. Solomon Shibairo**

Vice Chancellor

I take this opportunity to welcome you to Masinde Muliro University of Science and Technology (MMUST) and to this Science, Technology, Engineering and Mathematics Education International Conference (STEMEIC2021). We are grateful to the sponsors and partner institutions as well as participants from across the globe for the support so far given to make this Conference a success. We hope to have a productive three days of sharing innovative ideas which will positively impact our society.

MMUST continues to play its role in promoting Knowledge Economy in areas which form our niche areas as a University of Science and Technology. We are cognizant of the fact that MMUST, together with other tertiary and research-based institutions, have the responsibility of driving Kenya's knowledge and economic ambitions. To achieve this, we need strong collaborations and linkages both locally and internationally. This also calls for a collective effort to align our researches and innovations with the national needs and priorities of Vision 2030, the Big Four Agenda and the Africa Agenda 2063. I wish you fruitful deliberations.



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### MESSAGE FROM THE CHAIRPERSON CONFERENCE ORGANISING COMMITTEE



#### **Prof. Charles Mutai**

Deputy Vice Chancellor (Planning, Research and Innovation)

I am, indeed, excited that the STEMEIC is here for the second year running. This Conference whose theme is 'STEM Education and Innovation in Africa and beyond during and post COVID -19: Ensuring Quality, Equity and Inclusivity relates well with the current thinking and directions by global leaders in education. This Conference comes on the heels of the 14th International Multidisciplinary Conference and the Research Dissemination Conference held early this year, and which focused on post COVID-19 pandemic.

As the world grapples with the COVID-19 pandemic, it is clear that more effort should be directed towards developing strategies to ensure that we can live in the new normal. Science, education and innovation are, therefore, key to achieving new ways of working around the virus. Masinde Muliro University of Science and Technology continues to organize conferences that address current issues and providing a platform for researchers to share their findings. To this end, this Conference will see researchers engaging and sharing their outputs with members of the community as well as other research network groups.

I welcome all you to this second STEMEIC Conference.



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### MESSAGE FROM THE CHAIRPERSON CONFERENCE ORGANISING STEERING COMMITTEE AND DIRECTOR INTERNATIONAL RELATIONS AND ACADEMIC LINKAGES

**Dr. Catherine M. Aurah**  
General Chair  
STEMEIC2021 Virtual Conference



Greetings,

Dear Distinguished Guests and Conference Participants, on behalf of Masinde Muliro University of Science and Technology, Diversity Education Institute and conference committee members, we cordially welcome you to the 2021 International Conference on STEM Education (STEMEIC2021). We are very pleased with the positive response to our invitation from various local and international research institutions as well as institutions of higher learning. The enthusiasm showed by participants locally and abroad, gives us the confirmation, that what we started last year with STEMEIC2020

is a big move in the right direction.

STEMEIC2020 was highly successful in bringing researchers together, disseminating ideas and fostering communication and collaborations. Still with the spirit of STEMEIC2020, STEMEIC2021 with a theme "STEM Education in Africa and beyond during and post Covid-19: Ensuring quality, equity and inclusivity" continues with the intention of bringing together STEM Educators and researchers from related fields from all over the world to present and discuss their research findings. In line with MMUST motto, "To provide excellent university education, training and research through integrating science, technology and innovation into quality programmes to suit the needs of a dynamic world." we hope this will create opportunities for more research collaborations.



## **SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

The papers for this conference were selected after a rigorous review process. We wish to offer our gratitude for professionalism of the organizing committee, authors, reviewers, and volunteers for the successful coordination. Without their relentless efforts, the conference would not be possible. We also express our deepest gratitude and appreciation to Diversity Education Institute for creating and hosting the open platform; and to our co-sponsor, Brandenburg University of Applied Sciences for their support towards this conference.

Finally, on behalf of the organizing committee, we hope all of you will have a fruitful discussions and deliberation during the 3-day conference, and we wish you a pleasant virtual and interactive experience.



**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

**STEMEIC2021 PROGRAMME**

<b>DAY 01 - WEDNESDAY, 17TH NOVEMBER, 2021</b>			
<b>DAY01</b>	<b>WEDNESDAY 17<sup>TH</sup> NOVEMBER 2021:</b>		
	<b>MODERATOR: PROF. BUKHALA PETER</b>		
	0600 -0630	Conference Registration	
	0630 - 0700	Welcome Address by Conference Chair	
		<b>Prof. Charles Mutai</b>	
	0700 - 0730	Elucidating on the <b>Science, Technology, Engineering and Mathematics (STEM) Education International Conference 2021 (STEMEIC 2021)</b> , and Introduction of the DEI CEO <b>Mr. Alphonse Furuma /Ernest Mbalanya</b> Dr. Aurah, Catherine	
<b>PRESENTATIONS</b>			
<b>TRACK 01</b>	<b>NEW INSIGHTS INTO STEM EDUCATION RESEARCH. SESSION CHAIR: DR. PROF BUKHALA PETER</b>		
	TIME	Paper ID	Paper Title
	0730 - 0800	ID 1	The Disjunction between Availability of Opportunities in STEM Careers and Lack of Enthusiasm to go into the Careers: Disentangling the Paradox <b>Atieno Rose Opiyo, PhD</b>



**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

	0800-0830	ID 2	Cognitive Agility of Cyber Operators on Situational-Aware Cyberspace Protection <b>David Njoga, Samuel Liyala</b>
<b>INAUGURATION SESSION</b>	<b>MODERATOR: DR. DAVID BARASA</b>		
	Speeches		
	0830-0900		DVC PRI, Prof. C. Mutai: Introduces dignitaries present and welcomes Vice Chancellor: <b>the Host</b>
	0900 - 0940		Welcoming Remarks by Host Vice Chancellor and Invitation of Council Chair and Chancellor
	0940-1020		Speech by Chair of Council, MMUST
	1020-1100		Speech by Chancellor, MMUST
	<b>1100-1120</b>		<b>Q &amp; A SESSION</b>
	<b>1120-1130</b>		<b>GROUP VIRTUAL PHOTO</b>
	<b>GUEST Speaker</b>		<b>MODERATORS: DR. Aurah, Catherine</b>
	1130-1210		Principal Secretary State Department of Early Learning and Basic Education Dr. Julius Jwan Quality Education Post COVID 19
	1210-1230		<b>Q &amp; A SESSION</b>
	1230-1300		Factors Affecting Small Scale Farmers Coping Strategies to Climate Change in Vihiga Sub-County in Kenya. <b>C. Mulinya</b>
	1300-1340		Prof. Dr. Mustafa Hilmi ÇOLAKOĞLUPNevşehir Hacı Bektaş Veli University.



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EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

		mustafacolakoglu@nevsehir.edu.tr
		STEM Education as part of hybrid model in the post Covid-19 pandemic"
	1340-1400	Q & A SESSION
	WORKSHOP	Dr. Slimane Aboukacem Sam HJouston State University sxa066@shsu.edu
	1400-1440	The Eight Steps to Conducting Comprehensive Literature Review: Example of Privacy Literacy 2.0
	1440-1500	Q & A SESSION
<b>TRACK04</b>	<b>TRACK 04: INNOVATIVE PEDAGOGIES IN STEM EDUCATION DURING AND POST-COVID-19 PANDEMIC</b> <b>SESSION CHAIR:</b>	
	1500-1520 ID 8	Biology Instructional Resources Availability and Extent of their Utilization in Teaching Pre-Service Biology Teachers <b>Josiane Mukagihana, Catherine Aurah</b>
	1520-1540 ID 9	ICT Integration in Learning of Physics in Secondary Schools in Kenya: Systematic Literature Review <b>Elijah Okono</b>
	1600-1620	Exploring The Possibilities of Preservice Mathematics Teachers 3D Designing and Printing Manipulatives to Support the Teaching and Learning of Mathematics <b>Denish Akuom</b> <b>Montclair State University, USA</b>



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EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

<b>GUEST Speaker MODERATOR: Dr. Rose Mutende/ Dr. Humphrey Agevi</b>			
	1620-1700	Prof. Dr. Dietmar Wikarski Brandenburg University of Applied Science, Germany wikarski@th-brandenburg.de  Topic: STEM education as basis for understanding and managing changes in a globalized world	
	1700-1740	Dr. Lisa Brown Sam Houston State University, Texas lob002@SHSU.EDU  Struggles and triumphs of women of colour in STEM and their STEM education	
	1740-1800	Q & A SESSION	
	1800-1810	<b>END OF DAY ANNOUNCEMENTS</b>	
<b>DAY 02: THURSDAY 18<sup>TH</sup> NOVEMBER, 2021</b>			
	0600 -0630	Log-in and Registration	
<b>TRACK 03</b>	<b>INTEGRATED STEM EDUCATION: SESSION CHAIR: DR. RAPHAEL ONG'UNYA /Ms. ESTHER MULUSA</b>		
	0630- 0700	ID 4	Students' Academic Performance In STEM Subjects And Related Factors: A Case Of A Stem Model Boys School In Nandi County, Kenya <b>Peter Ng'eny</b>
	0700-0730	ID 5	Secondary school students' motivation beliefs and cognitive learning strategy use: trajectories Pre- and





**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

			Post- Covid- school lockdowns <b>Diana Kwarikunda, Ulrich Schiefele, Charles Magoba Muwonge , Joseph Ssenyonga</b>
	0730-0800	ID 6	Assessment Of Teachers Pedagogical Practices Influencing Information And Communication Technology Integration In Sciences And Mathematics In Public Secondary Schools, Kenya. <b>Mueni Musau, Rose Mutende</b>
	0800-0830	ID 7	Effectiveness Of Scaffolding Instructional Technique On Students Learning Outcomes In The Mole Topic In Chemistry In Secondary Schools In Bungoma County Kenya <b>Kennedy Kangale, Wekesa Martin Wanjala, Ronald Michieka</b>
	0830-0900		Exploring Teaching Using Technology in University Education: Challenges and Opportunities. <b>Salmon Owidi, Teresa Okoth</b>
<b>KEYNOTE SPEAKER</b>	<b>THURSDAY 18<sup>TH</sup> NOVEMBER, 2021</b>		
	<b>MODERATOR: DR. NDIKU JUDAH</b>		
	0900-0940		<b>Natalya Novikova, Andrey Konov</b> Pitirim Sorokin Syktyvkar State University, Syktyvkar, Komi Republic, Russia.



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EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

		The Role of Mobile Technopark "Quantorium" To Create Conditions for The Availability of Education for Rural School Children in The Conditions of Digitalization	
	0940-1000	Q&A	
	<b>TRACK 6: ENHANCING STEM EDUCATION THROUGH ONLINE PEDAGOGY.</b>  <b>SESSION CHAIR:</b>		
	1000-1020	ID 11	Strengthening STEM education through E-Learning in Masinde Muliro University of Science and Technology <b>Angela Mungai, Benard Wesonga, Umulkher Ali , Anne A. Musotsi , Gordon Nguka, Donald Kokonya, Grace Litali</b>
	1020-1040	ID 12	Enhancing the Learning of Secondary School Mathematics through online Pedagogy <b>Robert Wakhata, Dr. Védaste Mutarutinya, Dr. Sudi Balimuttajjo</b>
	1040-1100	ID 13	Enabling Interventions For Increasing Female Students Access And Participation In Stem Related Subjects In Secondary School In Kenya <b>Dr. Aliva Luvaso , Mark Waya</b>
<b>Guest Speaker</b>	<b>Moderator Prof. P. Bukhala/ Dr. Triza Okoth</b>		
<b>1100-1140</b>	<b>Prof. Asenath Jerotich Sigot</b> Masinde Muliro University of Science ant Technology.		



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EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

	Department of Nutritional Sciences. P.O. Box 190 – 501000 Kakamega, Kenya. <b>Telephone:</b> 0722612160  <b>Email:</b> <a href="mailto:asigot@mmust.ac.ke">asigot@mmust.ac.ke</a>  <b>TOPIC:</b> The Importance of Personalized, Student-Centered Learning and Academic Innovations in the COVID-19 Era and Beyond		
<b>1140-1200</b>	<b>Q/A</b>		
<b>TRACK 07</b>	<b>GENDER RESPONSIVE STEM EDUCATION SESSION CHAIR: Ronald Michieka</b>		
<b>TRACK 8</b>	<b>LANGUAGE, CULTURE AND STEM. SESSION CHAIR:</b>		
Guest speaker	1200-1240	<b>Prof. Odeo Ipara</b> The Role of African Languages in Enhancing the Potential of Science and Technology	
	1240-1300	Q/A	
	1300-1330	ID 14	Syntactic Errors In Compositions Written By Standard Seven And Eight In Kakamega Municipality Schools <b>Beatrice Charity Kemunto Obwoye</b>
	1330-1400	ID 15	Improving the quality of language teachers to support STEM education <b>Irene Simiyu, Adelhide Bwire, Samson Ondigi</b>



**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

<b>KEYNOTE SPEAKER FORUM</b>	<b>MODERATOR: Dr. Shikuku B/ Dr. Benard Wesonga</b>		
	1400-1440		Dr Jane Rarieya, Associate Professor & Director, Teaching & Learning Aga Khan University jane.rarieya@aku.edu  Women In Stem Careers – Looking Within The Box: Opportunities And Challenges
	1440-1500		Q/A
<b>TRACK 04</b>	<b>INNOVATIVE PEDAGOGIES IN STEM EDUCATION DURING AND POST-COVID-19 PANDEMIC: SESSION CHAIR: Dr. Lucy Mandila/ David Baraza</b>		
	1500--1530	ID 17	Effect of Collaborative Concept Mapping Teaching Strategy On Students' Performance In Mathematics In Selected Secondary Schools In Bomet County, Kenya <b>Joseph Kipkemoi Bii, Martin Wanjala Sibweche</b>
	1530-1600	ID 18	Effect of Resource-Based Instructions on Pre-service Biology Teachers' Academic Achievement <b>Josiane Mukagihana, Florian Nsanganwimana, Catherine Aurah</b>
<b>Guest Speakers</b>	<b>Moderator: Dr. Catherine Aura/ Dr. Robert Kati</b>		
	1600-1640		<b>Prof. Vickie J. Mitchell</b> <a href="mailto:vmitchell@shsu.edu">vmitchell@shsu.edu</a> Sam Houston State University College of Education



**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

		Developing Inclusive Classrooms and Self-Determination Skills for Students with disabilities and Special Needs	
KEY NOTE	1640-1720	<p><b>Prof. Tom J. McConnell</b></p> <p>Professor of Science Education Department of Biology, Ball State University; USA tjmcconnell@bsu.edu</p> <p>Building Inclusive and Gender Responsive STEM Education Programs: Models, Strategies and Challenges</p>	
	1720-1740	Q/A SESSION	
	1740-1800	END OF DAY ANNOUNCEMENTS	
<b>DAY 03: FRIDAY 19TH NOVEMBER, 2021</b>			
0600-0630		CONFERENCE REGISTRATION	
<b>TRACK 11</b>	<b>INCLUSIVE EDUCATION AND STEM SESSION CHAIR: PROF. NGUKA/ Ronald Michieka</b>		
	0630-0700	ID 20	Neuroscience and Education: Unlocking the potential of students with Learning difficulties <b>Khasakhala, E. , Okaya, Sichari M, Ayaga, G, Bota, K</b>
	0700-0730	ID 21	Mental Health and Special Educational Needs: Exploring their Relationship in the



**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

			Management of Challenging Behaviours among Learners with Autistic Spectrum Disorders in Western Kenya <b>Edward Khasakhala, Moses Sichari, Kennedy Bota, George Ayaga, Donald Kokonya, Bernard Wesonga</b>
	0730-0800	ID 22	What is in a name: from DSM IV to DSM V in relation to ASDs <b>Edward Khasakhala, Okaya, Moses Sichari, Kennedy Bota, George Ayaga</b>
<b>SPEAKERS</b>	<b>DAY 03: FRIDAY 19th November</b> MODERATOR: Dr. Triza Okoth		
	0800-0840		Rev. Prof. Judith S. K. Achoka. School of Education Masinde Muliro University of Science and Technology. achokajudith@yahoo.com , jachoka@mmust.ac.ke  STEM EDUCATION IN INFORMAL CONTEXTS
	0840-0900	<b>Q/A</b>	
<b>Guest Speaker</b>	<b>SESSION MODERATORS</b> Dr. Triza Okoth		
<b>Keynote Speaker</b>	0900-0940		Prof Phalandwa Abraham Mulaudzi University of South Africa (UNISA) Thabo Mbeki School of Public and International Affairs 287 Cnr Nana Sita & Lilian Ngoyi Streets Pretoria <a href="mailto:mulaupa@unisa.ac.za">mulaupa@unisa.ac.za</a> <b>Tel: 012 320 3180</b>



**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

		Language and Culture in the Context of STEM Teaching: A focus on the Modern African Child.	
	0940-1000	Q/A	
<b>TRACK 12</b>	<b>THE COMPLEXITIES OF CLIMATE, ENERGY AND ENVIRONMENT</b> Session Chair: <b>Annete Okoth/ Dr. Mandillah Lucy</b>		
	1000-1030	ID 23	Implementation of the Financing Locally Led Climate Action Programmes (FLLoCA) will Enhance Local Resilience to Impacts of Climate Change <b>Humphrey Agevi</b>
	1030-1100	ID 24	Creating Wealth and Wholesome Environment Through The Utilization Of Agricultural Waste In Livestock Production <b>Gbolagunte Sunday Ojewola</b>
	1100-1130	ID 25	Older people health vulnerability to climate change and climate variability and adaptation strategies in Korogocho and Kiwandani informal settlements in Nairobi city, Kenya. <b>Fredrick Okaka, Paul Omondi</b>
	1130-1200	ID 26	Climate Change Education: The Road To Sustainable Development <b>Prof, Josephine Ngaira</b>
<b>GUEST SPEAKER</b>	Moderator: Dr. Rose Opiyo/ Dr. Joyce Kagendo		
	1200-1240	Prof. Dr. Peter Flassig Brandenburg University of Applied Sciences flassig@th-brandenburg.de	



**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

		Topic: "Circularity and holistic life cycle analysis"
	1240-1300	QUESTION ANSWER SESSION
	1300-1320 ID 3	Preservice Teachers Implementation of Laboratory Experiments in Stem Education <b>Rose Mutende, Catherine Aurah</b>
	1320-1340 ID 19	The Efficacy of Early Childhood Development Education Curriculum Implementation in Hamisi Sub- County, Vihiga County- Kenya. <b>Amunavi et al, 2021</b>
	1340-1400	Trend analysis of the changes in Kenya's lakes water levels over the last 20 years <b>Anne Gichuhi, Kevin Achieng</b>
<b>Guest Speaker</b>	<b>Moderator: Rose Mutende</b>	
	1400-1440	<b>Andrey Koptelov, PhD</b> Associate Professor Dr. Koptelov is the director of the Center for International Education School of Teaching and Learning, College of Education at Sam Houston State University. <a href="mailto:axk022@shsu.edu">axk022@shsu.edu</a> +1 (936) 294-1140 < <a href="http://www.tsus.edu/">http://www.tsus.edu/</a> >  Technology Based Projects Development for Pre-Service Teachers Research Experience





**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

	1530-1610	Ms. Bekere Amassoma Oracle Academy Program Manager, Sub Saharan Africa bekere.a.amassoma@oracle.com  “Digitalisation of STEM education “
	1610-1620	Q & A SESSION
<b>KEYNOTE SPEAKERS</b>	<b>DAY03: FRIDAY 19<sup>TH</sup> NOVEMBER, 2021: MODERATORS: Prof BERNADETTE SABUNI/DR. RAPHAEL ONGÚNYA</b>	
	1620-1720	PROF. FATUMA CHEGE; PRINCIPAL SECRETARY, STATE DEPARTMENT FOR IMPLEMENTATION OF CURRICULUM REFORMS  Topic: The Role Of Universities In Implementation Of Cbc: Challenges And Opportunities
	1720-1730	Q & A SESSION
<b>CLOSING SESSION</b>		<b>CLOSING REMARKS:</b>
		❖ SECRETARIAT CHAIR
<b>SESSION CHAIR: PROF. Peter Bukhala</b>	1730-1830	❖ STEERING COMMITTEE CHAIR
		❖ DEI: Finance Director: Announcement of STEMEIC2022
		❖ CONFERENCE CHAIR



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EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

		❖ HOST VICE CHANCELLOR
		<b>VOTE OF THANKS: DR. ANNETTE OKOTH</b>

**Older people health vulnerability to climate change and climate variability and adaptation strategies in Korogocho and Kiwandani informal settlements in Nairobi city, Kenya**

*Fredrick Okaka<sup>1</sup>, Paul Omondi<sup>2</sup>*

Moi University

**Abstract**

Climate change has serious implication on the health of everyone, but older people potentially face more serious harm. Recent reports highlight the vulnerability of older people to climate change, yet limited research has focused on this, specifically on those living in informal settlements under poor and sub-standard conditions that are highly susceptible to the impact of climate change. To address this, the purpose of this study was to investigate older people health vulnerability to climate change and variability in informal settlements in Nairobi city and their coping mechanism. The study participants were randomly drawn from two informal settlements of Korogocho and Viwandani. Primary data were collected using questionnaires, Key Informant Interviews and Focus Group Discussions. Participants rated a variety of factors that often contributed to their health vulnerability to climatic stressors arising from climate change. Among the most influential, they highlighted chronic health conditions that increase sensitivity to climate change, poor conditions of housing, lack of adequate sanitation facilities, limited health services, and poor access to clean water. Those at greater risk were those living by oneself, older people with limited ability to use communication technology and men as compared to women. As coping mechanisms to health effects of climate change, the older people had taken some adaption measures like staying indoors, dressing heavily, buying clean water from vendors and making drains around their homes. But they reported that these adaption measures were seriously hampered by financial limitations and chronic medical conditions. This study recommends



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

that there is need for adaptation planning that can help keep older people living in informal settlements safe in the face of climate change."

**Keywords:** Climate change, older people, health, informal settlements

### **The Disjunction between Availability of Opportunities in STEM Careers and Lack of Enthusiasm to go into the Careers: Disentangling the Paradox**

*Atieno Rose Opiyo*

Masinde Muliro University of Science and Technology

#### **Abstract**

**Background/ Statement of Problem:** Science, Technology, Engineering and Mathematics (STEM) studies are highly placed not only as critical drivers towards attainment of the Global SDGs and African 2030 Agenda for Sustainable Development, but more importantly, as foundations upon which rests every country's innovation and economic prominence. STEM careers are rated as the most "marketable", "exciting", "convenient" and "cool". While lots of initiatives and huge investments have gone into popularizing STEM across the entire education continuum. Ironically, in Kenya, just as most of countries in the Global South, these fields that make life, are still the fields that are least attractive to student career pursuits.

**Objectives and Methodology:** Based on an interpretive qualitative account involving Six (6) Deans and 166 fourth year students from six (6) schools of MMUST, the study sought to establish why STEM majors that form the basis of cool STEM careers are least attractive to students.

**Results/ Conclusions:** Graduate students' interest and enthusiasm in the six selected STEM majors was reported to be diminishing as students moved towards their specializations with a few STEM entrants switching to non-STEM and non- technical fields, through interfaculty transfers. Annually, students terminate studies or drop out of college without earning academic qualification. Physics Sciences and engineering are recorded to be the least popular fields, attracting less than 3 percent of students that enroll in STEM fields. Seemingly, the inhibiting factors against STEM careers seem to be powerful enough to even counter the monetary rewards and social prestige that comes with being a "scientist". This



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

paper amplifies the voices of selected STEM student's, on STEM career both as a "risk worth avoiding" or "a risk worth taking" in Kenyan Universities.

Novelty/ Implication: It advocates for HE transformative pedagogical reforms, student-driven instructional programming and innovative institutional strategies to improve enrolment and persistence in STEM in Kenyan Universities.

**Keywords:** Career Enthusiasm, Pedagogy, Science, Technology, Engineering and Mathematics, MMUST, Kenya

### **Syntactic Errors in Compositions Written by Standard Seven and Eight in Kakamega Municipality Schools**

*Beatrice Charity Kemunto Obwoye*

Turkana University College

#### **Abstract**

Errors are mistakes that can affect the results of any writing. As learners learn and use language, they commit errors. English language is the medium of instruction in school. Competencies acquired in English have a direct correlation with performance in STEM Subjects. Learning English language comes with challenges of L2 and these are the challenges pupils in standard seven and eight are tasked to overcome in the continuum of achieving competence and proficiency in English language which in turn enable the learners to comprehend concepts in Science, Technology and Mathematics. Composition writing is examined and marked out of 40 while English grammar is examined and marked out of 50. A conversion table is used to have a total score of 100%. English is learnt as a second language and therefore errors made during the acquisition and learning process can be a hindrance to good performance not only in English language but in other subjects in the curriculum taught using English. An error is realized if language is used in a way that a fluent speaker of English language regards as faulty. The paper presents errors found to be consistent in compositions written by standard seven and eight pupils in Kakamega Municipality. The objectives of the paper include finding errors made by standard seven and eight learners and how these errors impact on acquiring scientific vocabulary that enhance good performance in the STEM subjects in Kakamega Municipality Schools. Findings showed that the errors found in compositions written by standard seven and eight are those related to spelling, punctuation (including inappropriate use of the capital letter), word choice,



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

sentence structure, omission errors, errors of addition, mis-formation errors, mis-ordering errors, fossilized errors and errors related to tense. The paper makes use of Eckman's markedness differential hypothesis, error analysis and inter-language theories. The findings will be helpful to teachers of English in learning environments whose learners have little exposure to English outside the classroom. Simple random sampling of compositions written by standard seven and eight pupils in 20 schools within Kakamega Municipality was carried out during marking of cluster exams to collect data.

**Keywords:** Composition, Errors, Language, Medium, Stem, Syntactic

### **Trend analysis of the changes in Kenya's lakes' water levels over the last 20 years**

*Ann Gichuhi, Kevin Achieng*

Taita Taveta University

#### **Abstract**

Water levels in Kenyan lakes have been fluctuating in the past years. This has been attributed to climate change and change in economic activities in the lakes' catchment areas. In the last 20 years however, most Kenyan lakes have witnessed an increase in water levels. The increase in water levels have resulted in flooding around the lakes' shores which have displaced communities that lived adjacent to the lakes, led to loss of human and animal life as well as loss of biodiversity in these areas. For this study, we focus on ten lakes: Turkana, Victoria, Baringo, Bogoria, Elementaita, Nakuru, Naivasha, Olbolosat, Magadi and Jipe. We use hydrological data and satellite imagery to plot the trend analysis of the change in the lakes' water levels. Preliminary results show that most Kenyan lakes' storage and water levels have increased over the last 20 years. This increase is correlated to the increase in rainfall, and degradation of watersheds around the lakes.

### **The Efficacy of Early Childhood Development Education Curriculum Implementation in Hamisi Sub- County, Vihiga County-Kenya**

*Herbert Amunavi*

Masinde Muliro University of Science and Technology



Sam Houston  
State University



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German Academic Exchange Service



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### Abstract

The early years of a child are extremely important because it is the fastest and most critical period of growth which harbors a lot of developmental opportunities. From birth to six years, the child's brain should have fully developed. This means careful design, planning and implementation for developmentally appropriate programmes in these early years is crucial for early childhood outcomes. However scientific research affirms that there is a general unpreparedness of ECDE learners as they transit over to grade one due to myriad of factors among them; context of the programme, input in the programme, process within the programme and product of the programme. The purpose of this study was to assess the efficacy of processes in ECDE curriculum implementation in Hamisi sub-county within Vihiga county- Kenya. Study objectives were to; establish the relationship between quality preparation and utilization of professional documents, assess the suitability of pedagogical strategies, determine the extent of use of learning resources and finally evaluate the suitability of assessment strategies deployed in promoting learners' readiness to transit over to grade one in Hamisi Sub-County. The study was guided by curriculum implementation theory by Gross (1971), Ecological Systems Theory by Bronfenbrenner (1986) and Stufflebeam's CIPP evaluation model (1983). The study adopted a mixed (Embedded) research paradigm. The study population comprises the CSO's, Section Head, ECDE centre in charges and teachers and pre-primary two pupils' parents. The study had a sample size of 377 respondents drawn proportionally from the local. The study utilized simple random sampling and stratified sampling in choosing its study sample. The tools for data collection comprised of interview schedule, questionnaire, and Focus Group Discussions (FGD). Quantitative data was analyzed using Statistical Package of Social Sciences (SPSS) while qualitative data was done by qualitative content analysis. The findings will inform various stakeholders. The county government will use these findings in its policy formulation on effective supervision and management of ECDE centers to realize learners' readiness for school. The National government through the Ministry of Education since it has the general responsibility of managing the education in the country will find the findings handy in filling the various gaps identified. ECDE Sub-County directors, Curriculum Support Officers manning respective educational zones, the head teachers responsible with supervision of ECDE canters and finally ECDE teachers will find these findings quite informative since it will have provided various strategies on effective implementation of ECDE curriculum to enhance learners preparedness for school.

**Keywords:** Professional documents, pedagogical strategies, learning resources and assessment strategies



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### Cognitive Agility of Cyber Operators on Situational-Aware Cyberspace Protection

*David Njoga, Samuel Liyala*

Jaramogi Oginga Odinga University of Science and Technology

#### Abstract

The effectiveness of the cyberspace protection for the national critical information infrastructure (CII) depends on a dynamically and reliably established cyberspace situational awareness framework. The current attribution-based cyberspace protection models and frameworks are characterised by over dominance of government agencies and laws, over-reliance on technology and lack of trust, transparency and goodwill leading to weak protection of critical information infrastructure. The study adopted a survey descriptive research design, which conveniently sampled participants answered questions administered through Self-Regulation Questionnaires through three stage Delphi-Technique evaluation. Data was then analyzed using mean, standard deviation, frequency distributions, Pearson's correlations and Linear Regression Analysis. The study revealed that there was a statistically significant moderate and positive association /relationship between cognitive agility and situational-awareness. This implies that the cyberspace protection is as strong or as weak as the cyberspace protection operators. The study concluded that a human-factored security endeavour is required that can improve the capabilities of the operational technology human constituents, so that they can appropriately recognise and respond to cyber intrusion events within the CII environment. Amidst evolving security trends that places human industrial actors as prime vectors of CII cyber-attacks, human-factored security efforts are required to manage and control the menace of prevailing attacks. Its invaluable considering that cyber security knowledge and skills capabilities of the CII workforce (people) is crucial and strategic towards building a more effective and cybersecurity-compliant workforce. Cognitive agility is a major contribution to cyberspace's protection since cyberspace is a fluid, technically changing environment, continuously increasing in scale and sophistication that must be constantly supervised and redefined by actors' stable presence. These findings provide a human-centred security capability and resilience building model which can be used to strengthen the security aptitude of human agents within CII. Noting the 'standardization' and 'accountability' common to traditional education models, this study recommends new and likened pedagogical interventions which provide the context for new literacies that include metacognitive strategies such as critical thinking, complex problem solving, expert communication and applied knowledge in real world settings. Inspired by constructivism, and the slow education approach to learning,



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

specific pedagogical interventions designed to improve higher-order thinking and understanding, such as self-directed workshops, flipped classroom, reflection logs, and cognitive task analysis are introduced. An outcome of this method is students gaining situational self-efficacy and empowerment as they engage in critical thinking. This is valuable for cyber education as it leads learners to exhibit and contextualize richer relationships and meanings beyond the prescribed lesson content.

**Keywords:** Cyberspace, Cognitive, Critical, Human

### Preservice Teachers' Implementation of Laboratory Experiments in Stem Education

*Rose Mutende*

Kibabii University

#### Abstract

In today's increasingly technological and scientific society, the active engagement with hands-on learning is critical for STEM Education. The effective implementation of constructivist instructional practices during Laboratory Experiments will foster critical thinking, collaboration, communication and creativity. This study sought to establish preservice teachers' application of the Laboratory Experiment teaching method in STEM Education during Teaching Practice (TP) which lasted 14 weeks. The sample comprising 107 Bachelor of Education (B.Ed.) Science students, their respective Head of Subjects (HOS), and the three faculty provided the data through questionnaires, interview schedules and the teaching practice assessment form. The data were analyzed descriptively and inferentially. The study concluded that (i) the Laboratory Experiment Teaching Method as taught in the university-based Subject Methods Courses and implemented by the B.Ed Science students on TP is limiting. (ii) The HoS can be an important school-based resource for provision of technical support for STEM Education (iii) the classroom is a potential context for learning to implement as well as hone the Laboratory Experiment Teaching Method. The study made recommendations based on the findings that aim at enhancing preservice teachers' implementation of the constructivist instructional practices that constitute the Laboratory Experiment Teaching Method in STEM Education. The study contributes to teacher preparation for STEM Education by focusing on the instructional practices that preservice science teachers should be helped to adopt and implement so as to provide effective STEM Education.

**Keywords:** Laboratory experiment, instructional practices, constructivism





## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### Secondary school students' motivation beliefs and cognitive learning strategy use: trajectories Pre- and Post- Covid- school lockdowns

*Diana Kwarikunda<sup>1</sup>, Ulrich Schiefele<sup>2</sup>, Charles Magoba Muwonge<sup>3</sup>, Joseph Ssenyonga<sup>3</sup>*

2. Universität Potsdam, Germany

3. Mbarara University of Science and Technology

#### Abstract

For the past years, several researchers have highlighted the role of motivation and self-regulation for achievement in STEM subjects and lifelong learning. Although most of these researches have used variable-centered approaches; approaches that are theory-driven; assume that the relation between the constructs of motivation can be applied to all the learners and lack the ability to deal with heterogeneity within and between individuals, their research findings' interpretability and recommendations are limited to specific contexts. On the other hand, data-driven approaches like person-centered (PCA) analyses primarily aim to categorize individuals into groups, revealing different existing but unobserved homogeneous subgroups of individuals (latent profiles) underlying a heterogeneous group, providing a moderate amount of parsimony and specificity upon which targeted interventions can be made. After the declaration of the Covid -19 Pandemic, the closure of schools for a long time disrupted the learning process. Whilst other countries quickly adopted the online and Hybrid teaching and learning, other countries especially in Africa lacked the capacity and capability to quick-restart school. The long wait for school reopening (which varied across different countries worldwide) could have enhanced further variations not only in learners' motivation and self-regulation but also in other socio- factors that affect STEM learning. Thus it is highly recommended that person-centered approaches be done. To this regard, using our study as an example, whilst grounded in the socio-cognitive and self-determination theories, we examined trajectories of 934 students' (initially in grade 9) motivation and cognitive learning strategy use pre-and post-Covid school lockdown in Uganda. Latent profile transition analyses indicate that the six motivational profiles were moderately unstable, and the five cognitive learning strategy profiles were moderately stable yet still showing significant variability. Notably was the decrease in profile



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

composition of the high-quantity- (50.1% change,  $\chi^2 = 25.9$ ,  $p < 0.001$ ,  $V = 0.38$ ) and primarily intrinsically (42.4% changed,  $\chi^2 = 27.4$ ,  $p < 0.001$ ,  $V = 0.42$ ) motivated students. From the findings, recommendations to enhance education support and development of the cognitive learning strategies were highlighted."

**Keywords:** Person-centered approach, data driven research, motivation, cognitive learning strategies

### Enabling Interventions for Increasing Female Students Access and Participation in Stem Related Subjects in Secondary School in Kenya

*Mark Waya<sup>1</sup>, Dr. Aliva Luvaso<sup>2</sup>*

1. Moi University
2. Rongo University

#### Abstract

Advocacy for the participation of women in STEM is not only premised on human rights ground but also grounded in the benefits of STEM subjects in labour market. The reality on the ground, however, confirms that there's low access and participation of female students in STEM related subjects. This should worry all stakeholders. The latest statistics are unlikely to be any better. This calls for urgent interventions. Responsibly, this study explored enabling interventions that will enhance access and participation of female students in STEM related subjects in secondary schools in Kenya. Social connectionist model guided the study. The study adopted descriptive survey design while data was collected using questionnaires and interview schedules. Research instruments were validated using face and content validity while reliability involved the use of test-retest method at  $r = 0.7$ . Data was analyzed both qualitatively and quantitatively. The findings revealed that gender typing at secondary school has created a perception that soft science subjects are for female gender compared to hard sciences. The study established that interventions such as mentoring and career guidance at secondary schools, change of school policy on subjects choice and engendering curriculum can increase female students participation in STEM subjects.

**Keywords:** Access, participation, STEM, interventions



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### Assessment of Teachers Pedagogical Practices Influencing Information and Communication Technology Integration in Sciences and Mathematics in Public Secondary Schools, Kenya

*Elsie Muenj Musau<sup>1</sup>, Rose Mutende<sup>2</sup>*

- 1. St. Paul's University*
- 2. Kibabii University*

#### Abstract

Though a lot of research has been carried out in the field of ICT in education, little has been done in the area of pedagogical practices that influence ICT integration in Sciences and mathematics in Kenya. The purpose of this study will be to investigate Teachers' pedagogical practices that influence ICT integration in Sciences and Mathematics. Economies the world over in recent years have placed emphasis on ICT integration in Sciences and Mathematics in order to offer learning that is relevant for the 21st Century. This research will investigate 265 Science and Mathematics teachers trained in ICT integration from five counties in Kenya. The descriptive survey research methodology will be used to find out the teachers' pedagogical practices. These practices that influence ICT integration include peer collaboration, didactic teaching and learning, project based learning and problem based teaching and learning methods. Previous studies in the field of ICT integration have focused on teacher, learner and administrative factors that influence ICT integration. This research will be done through the use of questionnaires, observation schedules and interview sessions. The findings of this research will add to the body of knowledge in the field of ICT integration in Sciences and mathematics. Educationists, teacher trainers and the Ministry of Education will also get information on how to prepare teachers who can produce learners with the necessary 21st Century skills to enable them fit in the current job market.

**Keywords:** Teacher's Pedagogical practices, Assessment, ICT integration



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### **An interlace of African Traditional Religion practices among the Abatirichi people of Western Kenya in mitigating climate change**

*Sundukwa, P<sup>1</sup>, Ekwenye, J<sup>1</sup>, Mulinya, C<sup>2</sup>*

1. Masinde Muliro University of Science and Technology, Kenya
2. Kaimosi Friends University College

#### **Abstract**

Existing empirical studies indicate a considerable level of epistemological uncertainty concerning the rate and extent of climate change in the African region. In this regard, little research has demonstrated that traditional religious beliefs and practices can have an impact on environmental attitudes, especially; the relationship between African traditional religious persuasion and climate change attitudes given climate change is an emerging phenomenon. This is because African traditional religious belief systems and cultural practices directly shape public opinion, affects climate change policy in certain areas of traditional jurisdiction. The study therefore examined the role of Traditional African Religion practices among the Tiriki people of Vihiga County, Kenya in climate change mitigation. The methodology of this study was located within the framework for conducting empirical studies in Religious studies. The qualitative methods of collecting data was utilized, and since the scope of the study falls within the field of religion and environment, a brief history of climate change religion's entrance into attempt to address mounting climate change problems was provided. A Descriptive survey design was adopted where 10 key informants who are the custodians of the Tiriki culture were randomly selected from each of the seven wards (political units) of Hamisi constituency, the study area. Primary data was collected through oral interviews and focused group discussions. The study results revealed that since Abatirichi traditional religious and cultural practices are pegged on traditional forests as a place for their traditional shrines, home for their ancestors-'misambwa' and sacred trees, they are consciously aware of the harsh consequences of climate change like droughts, thus, unconsciously protect their traditional forests for fear of punishment from God or their ancestors-'misambwa'. The study concluded that, conservation of forests and bushes by Abatirichi is key to the preservation of their culture because the forests harbour their spirits-'misambwa' and their strong protective herbs and sacred trees that are part and parcel of their daily life. That is, the Abatirichis' love for their traditional culture makes them preserve



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## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

traditional and sacred trees and bushes which make them conserve forests, thus unconsciously playing a role in mitigating climate change

**Keywords:** African traditional religion, Abatirichi, climate change

### Factors Affecting Small Scale Farmers Coping Strategies to Climate Change In Vihiga Sub-County In Kenya

*Mulinya C.*

Kaimosi Friends University College (A Constituent of Masinde Muliro University of Science and Technology)

#### Abstract

This study examines factors affecting adaptation strategies to climate change of small-scale farmers in Vihiga sub County in Kenya. Vihiga sub County which is found in Vihiga County is a rich agricultural area where various food and cash crops are grown. However, changes in climate coupled with declining soil fertility over the area have impacted on crop production, and hence affect food security especially among small scale farmers. The study sought to examine farmer's perceptions to climate change and factors that influenced small scale farmers in adapting to climate change. The study adopted a descriptive survey design. Data from both primary and secondary sources were used. Primary data included Focal Group Discussions (FGDs), questionnaires and interview schedules administered to farmers to gain information on farmer's perceptions to climate change, adaptation strategies to climate change if any and factors likely to influence their adaptation strategies. Despite these changes in climate, crop farmers had put in practice some adaptation strategies to cope with the changing trends, though they were faced with many challenges/ constraints in trying to implement these strategies and this was related to certain factors. Out of 9 adaptation strategies that the farmers were aware of, planting of drought tolerant crops was ranked first among farm adaptive measures, while rain water harvesting was ranked as least utilized. Out of seven factors surveyed, age, education, family size, farm size, family income, gender and farming experiences were significantly related to adaptation strategies. Despite different



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

support and technological interventions being available, lack of finances, lack of information, shortage of labour expertise was noted by the respondent as major constraints to coping with climate change effects. These results provide policy makers and development service providers with important insight, which can be used to better target interventions which build promote or facilitate the adoption of coping mechanisms with potential to build resiliency to changing climate and resulting environmental impacts. Key Words: Climatic Change, Adaptation Strategies, constraints, Small scale farmers.

**Keywords:** Climatic Change, Adaptation Strategies, constraints, Small scale farmers.

### Strengthening STEM education through E-Learning in Masinde Muliro University of Science and Technology

*Angela Mungai<sup>1\*</sup> Benard Wesonga<sup>2</sup>, Umulkher Ali<sup>1</sup>, Anne A. Musotsi<sup>3</sup> Gordon Nguka<sup>3</sup> Donald Kokonya<sup>2</sup> Grace Litali<sup>4</sup>*

Masinde Muliro University of Science and Technology

<sup>1</sup>Department of Economics

<sup>2</sup>Department of Medicine,

<sup>3</sup>Department of Nutritional Sciences

<sup>4</sup>Department of Nursing

#### Abstract

In response to the COVID-19 outbreak in March 2020, higher learning institutions made a shift to an online or blended form of instruction. The primary objective of this research, therefore, is to determine ways of strengthening STEM education through inclusive e-learning in MMUST. This is operationalized through the following the following sub-objectives, to assess the capacity of ODEL platform to provide online education technologies to sciences and medical sciences, assess the socioeconomic status of students in MMUST, evaluate the perceived e-learning challenges and determine the perception of regulatory bodies on on-line education technologies and identify best methods and resources for inclusive e-learning in MMUST for STEM. A mixed research design was adopted with the use of qualitative and quantitative data. Stratified random sampling was done for students and



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

purposeful sampling for key informants. Data was collected from 200 students and key informants representing 23 service providers from School of Nursing, School of Medicine, School of Public Health Biomedical Sciences and Technology, School of Business and Economics, ODEL and 2 regulatory institutions. Key findings revealed that the capacity of ODEL for orientation, training and e-learning support for students and service providers is fairly robust, however, further capacity building of students and faculty is required. Further, there is a significant socio-economic gap among students creating a barrier to inclusive access to e-learning education, with a reported monthly household income of K.sh3,000 and below (63.4%), no access to electricity at home (31.5%) and little or no network coverage at places of residence (52.6). Major constraints to effective e-learning for students are insufficient bundles (50.8%) and poor network coverage (30.9%). Other constraints include unaffordable e-learning equipment (8.3%), insufficient training in e-learning (8.3%) and lack of electricity at home. The quality of internet network coverage was found to be best on campus (72.7%) and poorest at home (42.6%). The coverage at workplace accounted for (53.6%). These constraints imply that the delivery of e-learning may not benefit all students, as some face challenges of accessing the various platforms. For faculty members, the major challenges encountered were disruptive network (23.8%), lack of bundles by students (14.3%) and unstable network (14.3%). Findings from regulators indicate robust support for e-learning in universities, however, significant gaps need to be addressed regarding practical sessions offered by applied and medical sciences. Therefore, the study recommends that students be facilitated with sufficient bundles in order to help them participate in e-learning efficiently. Best practices include enhanced technical skills, stable internet networks, expansion of e-learning infrastructure, blended learning and effective collaboration with regulatory bodies to achieve improved quality standards and inclusive access to e-learning.

**Keywords:** Alternative, E-learning, COVID-19, Institutions, MMUST, ODEL, STEM.

### Climate Change Education: The Road to Sustainable Development

*Prof. Josephine K.W Ngaira*

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#### Abstract

Climate change and climate change education are global challenges which must be addressed through a combination of local, national and global learning strategy, mindset shift and deliberate action lines. The UN Sustainable Development Goals and UNESCO's Global



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Education Monitoring Report 2020 informs this understanding of the role of education in addressing climate change challenges. Climate change education must be firmly embedded in National Education Agendas, the concept is supported by the SDG 4.7 (Education for sustainable development), and SDG 13.3 (Education for climate protection and climate adaptation). Whereas Education is a climate issue, climate scientists are aware that global carbon emissions need to sink to zero by 2050 in order to stop continued changing climate. In order to achieve this milestone, the global community must radically change their lives and economies because sustainability can only be learned but not imposed. Education for sustainable development and global citizenship must be integrated into; National education policies, education curricular, Teacher education and Student assessment. In order to achieve the 17 sustainable Development Goals by 2030, everybody must be educated on how to participate in the adaptation and mitigation strategies because they are call by the United Nations to the global community to act in order to end poverty, protect the planet earth and ensure that by 2030, all people enjoy peace and prosperity. Climate change affects all the sustainable development goals; therefore, citizens can be educated to adapt and mitigate using some of the following methodologies; social media campaigns such as (posters, bill boards, pamphlets, videos), GIS and mapping, Climate smart agriculture, field demonstrations, rooftop water harvesting and class and laboratory experiments. In conclusion, climate change and climate change education must be addressed through a combination of local learning and mindset change.

**Keywords:** global citizen education, SDGs, integrated learning.

### ICT Integration in Learning of Physics in Secondary Schools in Kenya: Systematic Literature Review

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#### Abstract

ICT integrated active learning has proven to tremendously improve learners educational outcomes and their classroom engagement unlike the traditional classroom approach. This can be attributed to the fact that





## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

active learning shifts the learning process and activities from being teacher focused to become more learner-centered and is guided by the learning ability of the students. Through this, learners get to experience the learning process in their own pace. So, despite the existence of differences and multiplicities in terms of learning styles and achievement levels in a classroom, through active learning, the learners are in full control of the learning process and they can engage with the learning materials at their own level of understanding, review confusing concepts, or break the sessions' learning content into bits that they can easily comprehend. For instance, in teaching and learning of Physics, the instruction methods have been demonstrated as the major reason for the decline of its performance and less populous among students in Kenya. This paper, therefore, explores the need to enhance the teaching and learning of Physics in secondary schools by adopting learner-centered teaching methodologies, and providing a systematic review of frameworks for the integration of technology towards enriching active class learning. Then we leverage these insights coupled with field experience to derive and design a framework for ICT integration in teaching and learning of Physics in developing countries (case of Kenya). The proposed framework is learners centered and eliminates the learner barriers due to personalities, temperaments among others. The proposed framework is a hybrid framework that harmonizes the reviewed frameworks by reinforcing their strengths and bridging their weaknesses and emphasizes the process of acquisition of skills and competencies by the learners, and enhancing the curiosity to actively participate in classroom activities irrespective of learners' individual differences. The review adopted the scoping review technique to map the key concepts underpinning the study to the main sources of the literature.

**Keywords:** Physics, Active Learning, ICT integration.



## Enhancing the Learning of Secondary School Mathematics through online Pedagogy

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### **Abstract**

Multiple online technologies have increasingly become inevitable pedagogical approaches in the current 21st century education system. These have been adopted or adapted due to the COVID-19 pandemic that caused partial and total lockdowns all over the world. The learning of mathematics is therefore gradually shifting from the traditional approaches to the blended web-based platform as the medium of instruction. Different web-based platforms and Apps have been developed to meet the ever-increasing demand for effective learning of science, technology, engineering and mathematics (STEM) education. The teachers' roles are also changing to suit technological advancement. Thus, innovative and appropriate learning approaches have been adapted by developing and equipping mathematics teachers with suitable pedagogical content knowledge through continuous professional development courses. The main objective of this research was to identify the effectiveness of online pedagogy in learning mathematics in Ugandan secondary schools. The mixed method research approach was adopted. Quasi-experimental non-equivalent control group design was used. The participants were eight mathematics teachers whose age ranged from 34 to 51 years ( $M=40.125$ ,  $S.D=5.817$ ) with a teaching experience of 9 to 25 years ( $M=15.125$ ,  $S.D=5.743$ ). The results revealed that integration of online pedagogy in learning mathematics influenced students' motivation and active participation and their grades. This research provides insight and also recommends effective implementation, digital competence, collaboration and application of online pedagogy in learning secondary school mathematics and beyond.

**Keywords:** E-learning, online pedagogy, secondary mathematics



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## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### Effect of Resource-Based Instructions on Pre-service Biology Teachers' Academic Achievement

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#### Abstract

This study tested the effect of animations, small-group laboratory activities as resource-based instructions on pre-service biology teachers' academic achievement. The study used quasi-experimental of non-equivalent group, pre and post-test control group design. Two experimental groups and one control group were used. The Control group (N=60) was taught by the traditional method, the first experimental group (N=55) by animation-based instruction, and the second experimental group (N=59) by small group laboratory activities. The data were collected using a pre-service biology Teachers Achievement Test, which showed a reliability of .51. We found that both instructional methods improved pre-service biology teacher academic achievement with a very high statistically significant difference ( $p < .001$ ). However, the group's mean scores comparison revealed no statistically significant difference between traditional and animation-based instruction. In contrast, a statistically significant difference existed between the control group and small-group laboratory activities group ( $p < .001$ ,  $d = 0.977$ ,  $<g> = 0.173$ ), and between the animation group and small-group laboratory activities group ( $p < .001$ ,  $d = 0.934$ ,  $<g> = 0.157$ ). Therefore, based on their significant contributions and their high effect sizes, animation-based and small group laboratory activities are recommended to improve pre-service biology teachers' academic achievement in biology.

**Keywords:** Resource-based instruction, animations, small-group laboratory activities, achievement, college students



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### Biology Instructional Resources Availability and Extent of their Utilization in Teaching Pre-Service Biology Teachers

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#### Abstract

Education of pre-service science teachers necessitates inquiry and resource-based instruction to ensure the production of both hands-on and mind-on skilled science teachers. This becomes possible when a variety of instructional resources regularly support the teaching process. This study aimed to identify the types of available biology instructional resources and their extent of use in teaching pre-service biology teachers. The study used a descriptive survey research design and was conducted in three private Universities selected from that offering education in Rwanda. Eighty-two pre-service biology teachers and five biology lecturers participated in the study. Observational checklist of biology instructional resources and questionnaires aided the collection of data analyzed by frequency counts and percentages. The findings revealed that biology instructional resources like classroom chairs, chalkboards, laboratories, microscopes, centrifuge, slide projectors, biology textbooks were available while resources like a class whiteboard, classroom overhead projectors, electrophoresis unit, recorders, Polymerase chain reaction machines, among others, were absent. The findings also revealed low-level use of available biology instructional resources in teaching pre-service biology teachers. The implication is the likelihood of producing less competent future biology teachers. The provision of adequate biology instructional resources, as well as the monitoring of their use in teaching biology, was recommended.

**Keywords:** Availability, extent of utilization, biology instructional resources, pre-service biology teacher



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### Effect of Collaborative Concept Mapping Teaching Strategy on Students' Performance in Mathematics in Selected Secondary Schools in Bomet County, Kenya.

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#### Abstract

Achievement level in Mathematics in Secondary Schools in Kenya is still low despite numerous interventions. Conceptual understanding has emerged in recent discoveries as the critical factors contributing to the continued inertia in achievement in the subject. This paper reports a study that sought to establish the effect of Collaborative Concept Mapping (CCM) teaching strategy on secondary school students' development of cognitive domain. Specifically, the study sought to investigate if there was any significant difference in Students' performance in mathematics when taught using Collaborative Concept Mapping Teaching Strategy and the Conventional Methods of Instruction. The study is based on constructivist theoretical framework and used the Quasi-experimental Solomon Four-Fold research design. The sample for the study comprised 161 form three students and 4 teachers of mathematics from 4 randomly selected sub-county co-educational secondary schools in the 4 sub-counties of Bomet County. The four co-educational schools were randomly assigned into two experimental (E1& E2) and two control (C1& C2) groups. Students in the experimental group were taught using Collaborative Concept Mapping (CCM) Teaching Strategy for three weeks while the control group was taught using Conventional Methods of Instruction. The Circles Concept Performance Test (CCPT) was used to collect the required data from the participants. Descriptive and inferential statistics were used in data analysis which included frequencies, mean, t-test and ANOVA. All the statistical tests were subjected to a test of significance at alpha ( $\alpha$ ) level of 0.05. The results revealed that there was statistically significant difference in mathematics performance in favour of CCM between students exposed to Collaborative Concept Mapping teaching strategy (CCM) and those taught using Conventional Method of Instruction. From the findings it can be concluded that the level of performance in the learning of mathematical concepts is marked higher when the students are taught using the Collaborative Concept Mapping Teaching Strategy (CCM) than when the conventional method is employed. Based on the findings, recommendations



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## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

were made on the need for teachers to integrate Collaborative Concept Mapping Teaching Strategy (CCM) teaching strategy in the mathematics instruction to enhance conceptual understanding and improve performance in the subject. There is also need for teacher training institutions to incorporate CCM as one of the strategies in mathematics instruction and that the serving teachers can be retooled to enable them to integrate CCM teaching strategy effectively in Mathematics learning. Mathematics curriculum developers need to restructure and integrate CCM among learner-centred strategies in Mathematics education.

**Keywords:** Collaborative Concept Mapping, Performance, Mathematics

### Effectiveness of Scaffolding Instructional Technique on Students` Learning Outcomes In “The Mole” Topic in Chemistry In Secondary Schools In Bungoma County Kenya

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#### **Abstract**

The dismal performance in chemistry continues to affect the country’s growth in terms of technological knowhow and this has negatively impacted on the realization of millennium development goals (MDG’s) and attainment of vision 2030. The poor performance has been pegged on the pedagogical approaches used in the teaching and learning of chemistry and therefore, need for improved teaching methods to enhance its performance in Kenyan secondary schools. The paper reports findings of a study that sought to investigate the effectiveness of Scaffolding Instructional Technique (SIT) on secondary school students’ learning outcomes in chemistry in selected secondary schools of Bungoma County, Kenya. The study focused on students’ participation and engagement and achievement in chemistry subject. This study used a Quasi-experimental Solomon Four-Fold research design and involved the form three students and teachers in secondary schools of Bungoma County, Kenya. Using Stratified and Simple random sampling techniques, the 300 students selected from 16 schools were randomly assigned to four groups. All the four groups were taught the same chemistry content on the topic, The Mole. However, two experimental groups received their instruction through the SIT mode while the other two were taught using the Conventional methods. Both the pre-test and post-test were administered to the control and



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

experimental groups prior to and after instruction in the course that lasted for duration of four weeks. A comparison of the response variables (participation and engagement and achievement) was made between the two forms of instruction. Data collected using the achievement test, interviews and observation schedules was analyzed using of both descriptive and inferential statistics that included frequencies, percentages, means and standard deviations and an Analysis of variance (ANOVA). The results showed that there were statistically significant mean differences in student's participation and engagement and achievement in Chemistry subject between students taught using Scaffolding Instructional Technique (SIT) and those taught using Conventional Methods of instruction. The students taught The Mole concepts using the scaffolding instructional technique performed better than the students taught using conventional methods of instruction. The results showed that the students taught using Scaffolding Instructional Technique indicated that they were able to relate new information to the old, shared ideas and were able to recall information and hence enhanced their achievement in the Chemistry subject. From the findings it can be concluded that the level of learning outcomes in Chemistry concepts is marked higher when the students are taught using the Scaffolding Instructional Technique than when the conventional method is employed. The findings may be utilized by the education stakeholders, school administrators and the government in formulating relevant educational policies that may enhance teacher efficiency and improve performance in the chemistry subject at the secondary school in Kenya.

*Keywords: Scaffolding, Instruction, Achievement, Engagement and Participation*

### **Implementation of the Financing Locally Led Climate Action Programmes (FLLoCA) will Enhance Local Resilience to Impacts of Climate Change**

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#### **Abstract**

Kenya is largely dependent on its natural resources to spur economic development. This in effect makes our country vulnerable to the impacts of climate change. Climate change impacts have grave implications for poverty reduction efforts, water availability, food



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

security, and health among other challenges. The focus of Kenya's activities to date have not been in the area of *funding* adaptation to the potential impacts of *climate*. However, Kenya is a party to the United Nation Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and Paris Agreement. The Paris Agreement aims to strengthen the global response to the threat of climate change, in the context of sustainable development. The Agreement also set out a global goal of mobilizing USD 100 billion per year up to 2020 to support mitigation and adaptation activities in developing countries. This amount has been agreed on in COP 26 in Glasgow this year and to be sustained upto 2025. Kenya has been a regional leader in developing comprehensive climate change act, 2016 climate policy and legislation 2018 that championed the establishment of climate change fund. As a result of the devolved system of government, most of climate change related development activities in Kenya are now being implemented at county level. In view of this, several assemblies have enacted County Climate Change Acts thus setting stage for establishment of County Climate Change Funds (CCCCF). This is a climate change governance mechanism set to increase finance for local climate action. The County Climate Change Fund (CCCCF) consists of climate legislation enacted by county governments and a county-controlled fund that finances climate projects identified and prioritised by local communities. It is on this backdrop that the government has recieved funding from worldbank through Financing Locally Led Climate Action Programmes (FLLoCA) that seeks to strengthen local resilience to the impact of climate change, natural hazards, and other shocks/stressors by building local capacity to plan, budget, implement and monitor resilience investments in a way that promotes collaborative partnerships between communities, national and county governments. This paper seeks to provide an indepth analysis of local projects that communities can implement in order to further enhnace capacities of local communities to mitigate effects of climate change at the same time improve their livelihoods. It also recommends issues to be included in the policy formulaton and support processes being put in place at both the National Government and County Governments in Kenya.

**Keywords:** Climate Change, Climate finance, Climate resilience, Local Communities

### Students' Academic Performance in Stem Subjects and Related Factors: A Case of a STEM Model Boys' School in Nandi County, Kenya

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#### Abstract





**SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS  
EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)**

This study aimed at establishing students’ academic performance in Science, Technology, Engineering and Mathematics (STEM) subjects and Related Factors in a STEM-Model Boys’ School in Nandi County, Kenya. The purpose of this study was to examine how students perform in internal examinations and during National examination, with more emphasis on STEM subjects (Mathematics, Chemistry, Biology and Physics). The objectives of the study were to establish: the extent of students’ academic performance in a STEM-Model Boys’ school in Nandi County, Kenya; the relationship between students’ discipline and their academic performance; the relationship between students’ performance in internal examination and their performance at National Examination and the relationship between students’ performance in Kenya Certificate of Primary Education (KCPE) and their academic performance at Kenya Certificate of Secondary Education (KCSE) in a STEM-Model Boys’ school in Nandi County, Kenya. This study was guided by Causal Comparative Ex-post Facto Research Design. The target population of the study was: 239 students who were at form four in 2020 academic year; the Director of Studies (DOS) and the Deputy Principal. A sample size of between 5 and 30 students was used, depending on the analysis that was done. The sample was obtained by use of simple random sampling technique. The DOS and the deputy principal automatically participated in the study. A questionnaire, an interview schedule and a document analysis schedule were used to collect data. Piloting of the instruments was done to validate them while test-retest method was used to test for the reliability of the research instruments. Data were analyzed using descriptive and inferential statistics. It was found out that the school averagely performs well as the mean-score of form 4 class was above 7.0 (KCSE 2020) and that no A (plain) grade has been achieved for over five years. Quality grades are yet to be achieved as the school had the leading student with grade A- (minus), with average grades in STEM subjects. Majority of the students scored between grades C+ (plus) and D+ (plus) in examinations. Students’ performance in STEM subjects are below a mean of 6.0 and this indicate that most learners are not able to secure STEM careers at post-secondary levels of education. From the hypotheses tested, it was established that students’ discipline also goes proportionally with academic performance; a linear relationship was found to exist between students’ performance in internal examinations and their performance at KCSE; students’ performance at KCPE and KCSE were found to have an inverse relationship where it was established that a student who scores high at KCPE tends to relax at high school and scores low at KCSE. The findings of this study will inform the Center for Mathematics, Science, and Technology Education in Africa (CEMASTEA) and



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

Ministry of Education (MoE) on the extent of performance of STEM-model schools in Kenya. Teachers and students too will get informed on their performance and have a projection to careers.

**Keywords:** Examination, Performance, Discipline, Relationship and Subjects

### **Mental Health and Special Educational Needs: Exploring their Relationship in the Management of Challenging Behaviours among Learners with Autistic Spectrum Disorders in Western Kenya**

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#### **Abstract**

Autism spectrum disorders (ASDs) is a complex, heterogeneous neurodevelopmental disorder characterized by difficulties in social communication, restricted or repetitive interests or behaviours (stereotypies), with possible impairments or delays in intellectual and language development. Learners with autism spectrum disorders (ASDs) are at a higher risk of co-occurring mental health problems. Practitioners working with learners with Autistic Spectrum Disorders (ASDs) often feel ill prepared to manage challenging Behaviours presented by this group of learners. Quite often, when practitioners are faced with cases of challenging Behaviours, they mostly use a maladaptive coping strategy which often leads to delinquency resulting into school dropout. This is often exacerbated by a wider confusion when a typical behaviour is attributed to diagnosed learning Difficulty rather than being recognized as symptoms of mental health problems. Co-occurring mental health conditions are common in autism, impairing quality of life. Reported prevalence of co-occurring mental health conditions in people with autism range widely. Improved prevalence estimates, and identification of moderators are needed to enhance recognition and care, and to guide future research. The purpose of this study was to determine the relationship between mental health and identified Special learning Needs in management of challenging behaviours presented



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## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

by learners with ASDs in Western Kenya. Objectives of the study were: To investigate the Relationship between Practitioners' Attribution of Challenging Behaviour and the Choice of Challenging Behaviour Management Strategies by learners with ASDs in Western Kenya ; determine the Relationship Between Practitioners' Cognitive Perception of Challenging Behaviours and the Choice of Challenging Behaviour Management Strategies among learners with ASDs; explore the Correlation between practitioners Perception of Causes of Challenging behaviour and choice of challenging behaviour management strategies among learners with ASDs ; explore the practitioner's perception of comorbid between Learners with ASDs mental health problems and ASDs ; establish the relationship between mental health and identified special Needs in learners with ASDs in Western Kenya; determine the correlation between mental health problems and challenging behaviour presented by learners with ASDs ; determine the effects of challenging behaviour presented by learners with ASDs on mental health of practitioners in western Kenya; and to determine the relationship between strategies used in management of challenging behaviour and the perception of the causes of challenging behaviour presented by learners with ASDs in Western Kenya. Descriptive survey and correlation designs were used. target population was 1094 teachers, 56 assessment personnel and 35 mental health workers in western Kenya. Saturated sampling technique was used. Pilot study was carried out which consisted of 106 teachers teaching learners with ASDs, 5 mental health workers and 9 assessment personnel in South Rift valley of Kenya. The reliability coefficient was set at 0.70 and above at alpha level of 0.05. Data was collected using questionnaires and interview schedules Correlation coefficient analysis, inferential statistics, and regressions were used to analyze quantitative data. Qualitative data from interviews was organized and categorized into themes which were reported thematically. The findings of the study indicated that practitioners attributed challenging behaviour to be caused by biomedical, learned behaviour and reinforcement of the behaviour and physical state of the learner with ASDs albeit at different magnitudes. Practitioners perceived behaviour as having negative consequences both to the learners who present it and the practitioners managing it which had a big influence on choice of challenging behaviour management strategies. There was a strong correlation between perception of challenging behaviour and choice of challenging behaviour This was illustrated by time line episodic and choice of least restrictive management strategies such as intensive interaction ( $r=0.7101$ ), development of social stories( $r=0.33001$ ) and behavior therapy model( $r=0.42105$ ). Based on findings that most practitioners attributed challenging



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

behaviour as rooted in biological factors there is need to train them to conceptualize challenging behaviour as a socially constructed process based on interaction between what the learners do, their settings and how the behaviour is understood and given meaning. This would enable the practitioners re-examine their perception of what constitutes challenging behaviour and how it can be effectively managed.

**Keywords:** Mental health, special Needs, Autism Challenging behavior management

### What is in a name: from DSM IV to DSM V in relation to ASDs

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#### Abstract

Autism spectrum disorders (ASDs) is a new DSM-5 name that reflects a scientific consensus that four previously separate disorders are actually a single condition with different levels of symptom severity in two core domains. ASDs now encompass the previous DSM-IV autistic disorder (autism), Asperger's disorder, childhood disintegrative disorder, and pervasive developmental disorder not otherwise specified. This is a drastic departure from DSM IV and is likely to affect conceptualization of autism particularly in triad of impairments in social communication, social relations and restricted repetitive behaviours. This has a wider implication on identification, assessment diagnosis and educational intervention of autism more than just a change in the name from autism to ASDs.

**Keywords:** DMS IV, DMS V, Autism, ASDs, intervention

### Neuroscience and Education: Unlocking the potential of students with Learning difficulties

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## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

### Abstract

21<sup>st</sup> century has witnessed a paradigm shift in the field of neuroscience with much emphasis on the working of the brain. It should however be noted that this field is predominantly in the hands of neuroscientists and clinical psychologists. There is urgent need for team work, networking and collaboration between neuroscientists, clinical psychologists, teachers and parents to approach, understand and utilize knowledge gained in neuroscience to improve learning and development for all learners in general and students with learning difficulties in particular. The knowledge gained by this synergy can give these practitioners an opportunity to approach and understand learning in a wider perspective. The point of departure in this paper is that neuroscience knowledge can be used in better understanding of childhood development, adapting classes to facilitate learning, spacing learning for optimal absorption, cognitive tutoring targeting rewarding learning styles and in coporation of social activities and integrating technology in class

**Keywords:** neuroscience, learning, learning difficulties

### Creating Wealth and Wholesome Environment Through the Utilization of Agricultural Waste In Livestock Production

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### Abstract

Three experiments were carried out to evaluate the feeding value of some agricultural wastes in poultry nutrition with the aim of reducing cost of production, agricultural wastes in circulation and pollution of the environment. Five treatment diets were formulated for growing turkey poults (Experiment 1) by replacing expensive dietary maize with rice milling wastes at 0, 25, 50, 75 and 100%. One hundred (100) turkey poults were placed on these diets in a completely randomized design with each diets having 20 birds per treatment, replicated twice. The experiment lasted 12 weeks (4-16 weeks). In experiment 2,



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

centrocema, pawpaw, and calopogonium leaf meals were partially (13.64%) used as a replacement for the expensive dietary soyabean meal in broiler finisher diets. One hundred and twenty (120) Anak Broiler birds were used for this trial which lasted four weeks(4-8 weeks), while in experiment 3, two agricultural wastes (cowpea hull and maize offal) were partially (30%) used to replace the expensive dietary maize in laying hens in a completely randomized design. The results obtained showed that the productive performance of turkey poultz were enhanced ( $P<0.05$ ) in terms of final weight gain, nutrient utilization, efficiency and economic benefits. In experiment 2, growth performance of broiler finisher birds fed various leaf meals showed significant ( $P<0.05$ ) difference in the mean final weight and feed intake. The results of the third experiment showed that dietary inclusion of cowpea hull and maize offal at 30% improved ( $P<0.05$ ) mean egg production per bird, egg weight (g/bird), percent hen-day production and feed efficiency. In conclusion, the inclusion of these wastes in poultry nutrition enhanced productive and economic efficiency. It also addresses some of the challenges being faced by waste disposal in our communities.

**Keywords:** Creating Wealth, Wholesome Environment, Agricultural Waste and Livestock Production

### **Exploring the Possibilities of Preservice Mathematics Teachers 3-D Designing and Printing Manipulatives to Support Teaching and Learning of Mathematics**

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#### **Abstract**

Positioning teachers as implementers of curricular materials designed by others is convenient, but it comes with the potential to collapse the space of possibilities for how teaching and learning might occur. With increased access to digital design and fabrication technologies, new opportunities are generated that challenge this presumption and disrupt the consequent denial of agency that it entails. By positioning teachers as designers of their own curricular resources, we invite opportunities for their explorations of innovation at the intersection of content, pedagogy, and design. As researchers accepting greater responsibility for the preparation of teachers for work in diverse contexts, this work



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

explores and supports structures of teacher preparation that cultivate the imagination of more humanistic forms of mathematics teaching. Thus, this study reports on an investigation into the nature of prospective teachers' design activity as they were tasked with the Making of mathematical manipulatives. We share findings from the analysis of this activity that conveys the diversity of design decisions, rationales, and mediating resources that it entailed. The implications of these findings for teacher preparation are considered.

**Keywords:** Making, Preservice Teachers, 3-D Designing, STEM Education

### **The Glocalized Form of Makerspaces: A Focus on Socio-Critical Literacies and Third Space Creation in Culturally Responsive Making**

*Emmanuel Nti-Asante*

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#### **Abstract**

Instead of celebrating and honoring the intellectual roots of maker education, many of its advocates are reinventing the same ideas and repackaging them into discourses that embrace the agendas of corporations and national bureaucracies, leaving youths, communities of color, and low-income communities empowerment and agency as an afterthought. To change the narrative, culturally responsive making, and computing, researchers introduced e-textiles and ethnocomputing. However, after many successful years of research on culturally-responsive making and computing, the devil is still in the details. Such researches document only the introduction of the computations and circuitry into indigenous making practices. They have rarely reported the STEM thoughts hidden in the authentic cultural artisan's methods which center staged the introduction of analyses and circuitry. Many of such design justice approaches that are supposed to be more inclusive, participatory, and democratic have the bulk of the benefits to professional designers and their institutions. Hence, communities whose raw materials and practices informed such design justice mainly do not access the design. I suggest that culturally responsive making and computing researchers focus on socio-critical literacies and third spaces created in their inquiry. This way, they would approach the glocalized form of making. Glocalized making extends on the premise of culturally responsive making and computation. Such that before



## SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION INTERNATIONAL CONFERENCE (STEMEIC2021)

the lived experiences of underrepresented communities are included in the algorithmic and computational development cycle for equitable use of technology, the possibility of learning through their repertoires of practices should be explored.” This exploration provides access and not just inclusion for an equitable form of learning to such communities through their repertoire of practices.

**Keywords:** Glocalized making, design justice, and agency, developing countries, maker movement, culturally responsive making

### **Eight steps to conducting a comprehensive literature review: Example of privacy literacy 2.0.**

*Slimane Aboulkacem*

Sam Houston State University

#### **Abstract**

With technological advancement, privacy has become a concept that is difficult to define, understand, and research. Social networking sites, as an example of technological advancements, have blurred the lines between physical and virtual spaces. Sharing and self-disclosure with our networks of people, or with strangers at times, is becoming a socially acceptable norm. However, the vast sharing of personal data with others on social networking sites engenders concern over data loss, concern for unintended audience, and an opportunity for mass surveillance. Using a dialectical pluralism lens and following the comprehensive literature methodological framework, the purpose of conference presentation is to map and define what it means to be a privacy literate citizen. The goal is to inform privacy research and educational practices. I will share the findings of my study that revealed that placing the sole responsibility on the individual user to manage their privacy is an inefficient model. Users are guided by unmasked and hidden software practices, which they do not fully comprehend. Another finding is the noticeable increase of citizen targeting and liquified surveillance, which are accepted practices in society. Liquified surveillance takes any shape; is both concrete and discrete; and it happens through complete profile data collection as well as raw data aggregation. Privacy management, as a research model or management approach, does not prevent data from leaking nor does it





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stop surveillance. For privacy to be successful, privacy engineering should include citizens' opinions and require high levels of data transparency prior to any data collection software design.

**Keywords:** Privacy literacy, surveillance, data, Research methods, research audit, analysis, data collection and management.

### Exploring Teaching Using Technology in University Education: Challenges and Opportunities

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#### Abstract

The increase in the availability of technological hardware such as phones, tablets, iPad, laptops, desktop computers, Smart Learning Boards, and projectors, Learning Management Systems (LMS) such as Moodle, the presence of Internet connectivity and the increase in the demand for university education are constantly shaping the manner in which teaching and learning takes place in the institutions of higher learning, more so after the Covid-19 pandemic. Technology is constantly changing the education landscape by ensuring that the traditional way of curriculum delivery and implementation is given a new approach. This article seeks to explore the challenges and opportunities of teaching using technology in a university setup. This paper begins by defining technology, technology integration then explains what it takes in order to integrate technology into university teaching. It considers the advantages and disadvantages of technology integration, the challenges of using technology in learning, the opportunities that it offers. It concludes by suggesting a way forward for a befitting technology integration into teaching and offers some recommendations.

**Keywords:** Learning Management Systems (LMS), Technology Integration



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### Improving the Quality of Language Teachers to Support Stem Education

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#### Abstract

The place of language in STEM education cannot be disputed since it is the channel through which knowledge is learnt and shared. This inevitably places the language teacher at the center of making great contributions to how students learn and what they learn. Since STEM education is hinged on the 4Cs-creativity, communication, critical thinking and collaboration, there is need to ensure the quality of the language teacher if these aspects are to be developed in learners. This article is a report on an action research that involved twelve teachers of English in Bungoma South sub-county, who participated in leading their own professional development while establishing the collaborative strategies that they can use to do this. The data presented here was collected using questionnaires, interviews, observation guides and reflective journals kept by both the teachers and the researcher. The findings show that there are a number of collaborative strategies that teachers can use to improve their classroom practice and increase learner experiences. The major conclusion of this study is that if teachers of English are equipped with collaborative strategies like classroom lesson observation, peer coaching, team teaching and lesson study, then they can improve their classroom practices. While the sample size for the study was small, the findings reveal significant information that can be applied in many contexts worldwide. The ultimate goal of this paper is to bring out practical collaborative strategies that can ensure continuing learning for teachers that can hopefully improve the language experience of their learners.

**Keywords:** Teacher professional development; Classroom practices; Language and STEM; Collaborative strategies.



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