



# MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

## 3<sup>RD</sup> INTERNATIONAL STEMEIC VIRTUAL CONFERENCE, 2022

### THEME

*Building Resilient and Sustainable Systems for STEM Teaching,  
Learning and Research in Post Covid-19 Era*

### BOOK OF PROGRAMME AND ABSTRACTS

**WEDNESDAY, 16<sup>th</sup> - FRIDAY 18<sup>th</sup>  
NOVEMBER, 2022**



**Dr. Peter Wanyaga Muthoka EBS MBS**

**Chancellor**

## **WELCOMING ADDRESS**

As a chancellor of this great University, it gives me great pleasure to be a part of this congregation of scholars and researchers as we launch the 3<sup>rd</sup> STEM education virtual international conference being hosted by the largest school in this University – the School of Education. This is a truly unique platform for us to come together and shape the future of STEM Education Learning and Research in the Post Pandemic Era.

The most exciting part of this conference is that we are gathered here to talk about Science, technology, engineering and mathematics: disciplines that are known to **build confidence, hone critical thinking of individuals and** the most critical enabler for sustainable development of communities . STEM does not only pave way for the most lucrative and exciting careers in the world but is currently regarded as' **jobs for the future** .As a University of Science and Technology we are keen in harnessing our efforts to build strong STEM resilient societies as part of our University mandate in training the next generation of STEM enthusiasts , job creators but also renown researchers for sustainable development.

We appreciate the ***Dean SEDU and his committee*** for thoughtfully initiating this scholarly interaction on STEM teaching Learning and Research in the post Pandemic Era. You have created an opportunity for early career scholars in different schools to acquire research and dissemination experience as well as meeting other scholars. The art of composing a paper for presentation before a wider audience than the usual familiar faces; the ability to listen critically to ideas from others, and the experience of meeting senior

faculty from this and other places are all useful activities in inculcating the culture of scholarship and conferring. I notice that the Conference theme allows multidisciplinary conversations and sub-themes as well, captures contemporary issues in STEM scholarship such as SMART technology and Artificial Intelligence which have become styles of everyday operations.

During our presentations, we will be investigating relevant issues and suggesting some answers, and/or even asking more questions. I have looked at the papers in the programme and they are interesting, relevant, and varied, both in terms of disciplinary coverage but also in the mix of the scholars.

I have no doubt in my mind that this will be a very memorable experience for those who are attending a Conference for the first time. For those of us who are seasoned in the area, it is an opportunity to create an enduring legacy in mentorship for research and dissemination for the early-stage academics and researchers in our younger faculty and the students present.

I wish you all a great academic interaction  
GOD bless MMUST



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

I take this opportunity, on behalf of the Council of Masinde Muliro University of Science and Technology (MMUST) to welcome you all to this University and to the Virtual International Conference (STEMEIC 2022). In hosting this conference, MMUST is playing its role of not only in disseminating knowledge but also of being a solution to the myriad of challenges we face as a society especially related to Science Technology Engineering and Mathematics.

As we grapple with post COVID-19 and its effects, we must not lose sight of other issues affecting our society. Every day, in the continent of Africa and beyond, populations require interventions that would improve their lives and turn around their respective situations. This can be achieved by integrating governments, policymakers, researchers and scholars from universities and other research institutions to provide solutions. The conference, whose theme is "*Building Resilient and Sustainable Systems for STEM Teaching, Learning and Research in Post Covid-19 Era*" aligns itself to offering solutions for improved lives and livelihood. This conference's thematic areas are aligned to the Government of Kenya's Development Agenda on Universal Health Care (UHC), Food Security, Affordable Housing and manufacturing among others.

As this conference takes off, I urge all of us to go beyond the excellent presentations into policies and innovations that can be implemented. As scholars, we are aware of the various institutions, nationally and internationally, dedicated and willing to fund competitive and winning proposals that would cause an impact in the society. I therefore, urge all of us to focus our research findings on such endeavours.



**Prof. Solomon I. Shibairo  
Vice Chancellor, MMUST**

I take this opportunity to welcome you to Masinde Muliro University of Science and Technology (MMUST) and to Kakamega Kenya. This conference provides a very unique opportunity for all of us because of its scope. It has attracted delegates from various parts of the world; people with wide-ranging knowledge on the issue of Science Technology Engineering and Mathematics (STEM) education.

The Covid-19 pandemic has reinforced the importance of technology. With more people using Zoom, Meet, Teams and other tools to connect with family members and co-workers, it is even more important to equip students to use and develop technology. This years' theme: "Building Resilient and sustainable systems for STEM Teaching, Learning and Research Post Covid-19 era" will thus see presentations on online learning and the use of such technologies post Covid-19. STEM education provides skills that make people more employable to meet demands of the labour market. With STEM jobs being the jobs of the future, MMUST has decided to be on the forefront in matters STEM to address opportunities, and any challenges to enable institutions and personnel develop knowledge around STEM.

As a university, we endeavor to work towards developing human resource that will bring positive influence to the society. We have also developed collaborations with organizations that deal with research and a number of staff have won grant proposals.

As we host this conference, we look forward to meet and discuss STEM issues, as well as listen to other people's views with regard to STEM and STEM education.

Once again welcome to Masinde Muliro University of Science and Technology in the tropical rain forest of Kakamega. Welcome to Kenya



**Prof. Charles Mutai**  
**DVC, Planning, Research and Innovation**

It gives pleasure to welcome you all to the 3<sup>rd</sup> International STEMEIC Virtual Conference 2022. The 2022 conference theme *Building Resilient and Sustainable Systems for STEM Teaching, Learning and Research in post Covid-19 Era*" resonates with the current need for education practitioners, researchers, academics and students to share their valuable experiences on reforms in Science, Technology, Engineering and Mathematics (STEM) education through research and innovation to contribute to the achievement Sustainable Development goals. The conference will provide a platform for networking among participants' from various backgrounds and has the potential to inform a policy and best practices in education In Kenya and beyond.

The Division of Planning, Research and Innovation endeavours to have many more of such research conferences in future. Through the Directorate of Research and Postgraduate Support (DRPS), as well as the School of Education, the University has provided the necessary support to ensure our researchers and innovators are funded to engage in cutting-edge research and innovation.

I am delighted to note that our research efforts are becoming more collaborative with many partnerships transcending both organizational as well as national borders. MMUST is involved in both national scale consortia as well as many bilateral research partnerships with research agencies.

I wish you fruitful and engaging deliberations during the three-day conference. May God bless you all!



**Prof. Peter Bukhala**  
**Director, Research and Postgraduate Support**

It is my pleasure to welcome you all to the 3<sup>rd</sup> STEMEIC International Conference hosted by the Directorate of Research and Postgraduate Support. The importance of STEM in the national development has been documented and this year's theme of the conference resonates well with the national vision and aspirations. In the post-covid era, resilience and sustainability are the key issues and STEM is core to education. If we have to provide for the needs of this century and beyond, the education sector is expected to reengineer the way business is done and to provide innovative approaches that resonate well with the z-generation. This means that learning and teaching have to be revamped to provide for flexible programming.

The COVID years have shown us that open schools, self-paced learning and discovery have to be adopted to ensure learners can achieve set objectives for a dynamic world. The post-covid era will challenge all stakeholders in terms of how learning can be packaged to meet new demands. Science and technology will therefore play an important role in shaping how communities navigate around the challenges of the 21<sup>st</sup> century. It is my hope that the researchers who will be sharing their findings in this conference will provide evidence-based solutions to the needs of the society.



**Prof. Moses W. Poipoi (Ph.D)**  
**Dean, School of Education.**  
**Associate Professor of Educational Psychology**  
**Email: [deansedu@mmust.ac.ke](mailto:deansedu@mmust.ac.ke)**

I take this opportunity to welcome you to this Science, Technology, Engineering and Mathematics Education International Conference (STEMEIC2022) that is hosted by the School of Education. As a School we are committed to encouraging quality research in different fields, we believe that, through this conference there will be even more scholarly collaborative research, community outreach and partnerships. The university through the School of Education has initiated to modernize teacher education through transformed education and be on the cutting edge in teacher preparation, focusing on alternative teacher education practices that will address reflective teaching approaches, prepare the 21st century learner and prepare teachers with the 21<sup>st</sup> Century pedagogical skills which ensure that each and every learner receives the attention and support needed to acquire deeper levels of knowledge and understanding. Teacher education should also equip teachers with skills to teach for the future labour market, teach values and skills that allow for the physical, spiritual, moral and intellectual development of persons for the progress of society, the economy and the environment. Once again, I invite you, as researchers, to engage one another on a variety of topics, issues and research outputs across Departments, Schools and Disciplines.



**Dr. Catherine M. Aurah**

Senior Lecturer, Department of Science and Mathematics Education

**Director, International Relations, and Academic Linkages (DIAL)**

&

**STEIMIC Conference Chairperson**

It is my pleasure to warmly welcome you to the 3<sup>rd</sup> Annual Conference of STEM in Education in Kenya, at Masinde Muliro University of Science and Technology. As a university and in particular, School of Education, Department of Science and Mathematics Education, we do recognize the necessity of this conversation in our increasingly networked world. The theme for this year's conference, "**Building Resilient and Sustainable Systems in STEM Teaching, Learning and Research in Post-Covid Era**", is particularly appropriate for this conference. This is where we, researchers and scholars, and other professionals gather to share about how resilient and sustainable systems can advance STEM education to become accessible to all learners of whatever circumstance such as gender, age, ethnicity, learning need or economic status. This year's conversations come at a critical moment in Kenya when curriculum reforms are ongoing. National governments are scrambling to find solutions to issues surrounding STEM education post covid-19 era. Because the challenges impact an increasingly broad set of stakeholders around the world, effective solutions must cut across both countries and sectors.

We hope this event will foster a global, cross-sector dialogue that will shed light on STEM issues and prompt actionable solutions to the unique challenges of STEM education in a networked world. The diversity of specializations and related themes will enable us to achieve our objective. About 70 authors and attendees, from six countries including unique Keynote speakers, will show us their recent developments in varied fields in the world of STEM education. With a record number of participants expected this year, we are delighted to see that these annual conferences becoming larger and more substantial every year. I am equally excited about the record number of sessions, and wide variety of ideas that scholars and practitioners will bring into our fold. This richness of ideas bodes well for transformations and creativity in the field of education.

I am also particularly excited about the upcoming presentations from our keynote speakers on a variety of topics. We greatly appreciate our partners, Diversity Education Institute, Texas USA, and Sam Houston State University, Texas USA, for their dedicated service since the very beginning of this conference, STEMEIC, in 2020. This conference would not be possible without generous help from them and other people. I am thankful to the conference organizing committee members for the time, energy and thought that they have invested in organizing the conference and the numerous volunteers without whose generous contributions this conference would not have set another new record number of presentations and number of participants. I am truly grateful to the University Council, Management, and Director, Research for supporting the conference. We thank the University for funding the conference. We also appreciate the cadre of sponsors supporting this conference both in kind and financially. I thank you participants for enriching these annual conferences with your presence. Thank you for lending your voice to this important and timely conversation. I look forward to the contributions of our speakers and participants alike to developing innovative solutions to the dynamic and unprecedented challenges in education.

As is a tradition with STEMEIC conferences – I hope you will enjoy the content, renew old friendships, make new friends, get new ideas, and above all, have a good time.

## STEMEIC 2022 KEYNOTE/GUEST SPEAKERS



**Deepa Chari, PhD**

**Reader**

**Homi Bhabha Centre for Science Education**

**Tata Institute of Fundamental Research**

**V. N. Purav Marg, Mankhurd, Mumbai 400 088 India**

<https://www.hbcse.tifr.res.in/people/academic/deepa-chari>

**TOPIC: "Improving Classroom Environments for Student-centered Learning in STEM Subjects/Courses: Case of Physics"**

Deepa Chari is a faculty member at the Homi Bhabha Centre for Science Education (HBCSE), TIFR, India. At HBCSE, she is researching about students' science identities and how institutional practices can support science identity development. Deepa is also active in many national and international diversity initiatives aimed to enhance the representation of under-represented groups in physics, in higher education.

Deepa earned her MS in medical physics and Ph.D. in physics education from the Dublin Institute of Technology, Ireland in 2014. Subsequent to PhD, she moved to the United States of America in 2015 for her postdoctoral research at the Physics Education Research Group of Kansas State University. There, she examined students' problem-solving practices in advanced physics courses. In 2016, she started working on the American Physical Society's "Bridge to Doctorate program". In this program, Deepa explored the trends in PhD admission practices of university departments and studied their effects on graduate diversity in physics discipline. Deepa, until 2019, also worked as a postdoctoral

research fellow at the STEM Transformation Institute of Florida International University. She worked closely with university teachers on improving classroom environments for student-centered learning.

Deepa joined HBCSE in September 2019. At HBCSE, she is the national coordinator of the Vigyan Pratibha program— a student nurture and teacher capacity-building program. The program has successfully networked teachers from 80+ schools and developed a range of activity-based educational resources in high school science and mathematics.

Deepa is a member of the organizing/ academic bodies of many institutional programs. The Vigyan Vidushi- one such program designed for training and mentoring of female physics postgraduates where Deepa conducts workshops on the gendered issues in physics every year. She is also a part of the Gender in Physics working group (GIPWG) of the Indian Physics Association, and through it she is playing a key role in the organization of the International Conference in Women in Physics 2023 to be hosted at HBCSE.

Deepa has published her research in various journals like the American Journal of Physics, Physical Review Physics Education Research, European Journal of Physics, Journal of Engineering Education, and Journal of qualitative research methods



**Mrs. Jacinta Akatsa**

**Director, CEMASTEA**

**TOPIC: “Reorienting STEM Teaching and Learning in Africa: Performance-Sparking Models”**

Mrs. Jacinta Akatsa, HSC, is one of Kenya's premiere educators for over 30 years now, currently serving as the Director at the Centre for Mathematics, Science and Technology Education in Africa where she provides strategic leadership at the Centre as a Pan African institution whose mandate is to provide continuous professional development of teachers in STEM education. She is a resourceful and driven project manager with experience in spearheading the continental programs that supports policy development in mathematics and science education in Western, Eastern, Central and Southern Africa.



**Prof. Rajgopal Sashti**

Director of Grants & Sponsored Programs/Advisor, Fellowships and Scholarships  
Columbus State University (**Retired**)  
University System of Georgia  
**Columbus/Atlanta, Georgia**  
**USA**  
[rajfulbright@gmail.com](mailto:rajfulbright@gmail.com)

**TOPIC: Best Practices to Secure External Funding -“Research” and “program” grants and “fellowships.”**

Beginning Fall 2015, Raj Sashti started his new role as Advisor, Fellowships and Sponsored Programs at the Sam Nunn School of International Affairs in the Ivan Allen College of Liberal Arts, Georgia Institute of Technology, Atlanta, Georgia - Georgia Tech. In terms of accomplishments, he was awarded a Fulbright Specialist Grant in Fall 2017 by the J. William Fulbright Board of Foreign Scholarships. In 2016, he was selected to join the Roster of Fulbright Specialists as an academic and professional expert for period of five years (2016-2021) by the Institute of International Education's (IIE)/Council for the International Exchange of Scholars (CIES) and was invited to serve on the peer review team for the Fulbright Program. Over the years, he has assisted undergraduate and graduate students to secure prestigious Fulbright and other fellowships and internships and raised the visibility of Nunn School with the Atlanta Consul General Corps.

Before joining Tech, Raj Sashti served as the Director of International Education, International Program Development and the Nine University and College International Studies Consortium of Georgia at Southern Polytechnic State University (2009 - 2015). A recipient of three Fulbright Scholarships (to Germany,

Japan and Brazil), over the years, he has worked at Clayton State (2004 - 2008) and Columbus State (1990-2004) universities of the University System of Georgia as an Associate Professor of Geography and Director of Grants and Sponsored Programs. In addition, he was also employed at the American Embassy/ USAID and the University of Wisconsin College Year in India Program in New Delhi, India.

Sashti is the recipient of more than \$5,000,000 in direct and matching grants from the United States Department of Education, the United States Department of State, the Institute for International Education and other non-profit organizations. During his 45 years of tenure in higher education, he has directed more than three dozen Fulbright program funded faculty development projects in Europe; East, Southeast and South Asia; Africa; the Middle East; and Latin America; and other foreign language and international studies grants. His teaching and applied research interests include international education, training and development, and inter-linkages between Western and non-Western societies.

Aside from his leadership roles in academics and administration, Sashti has served as an international education consultant to such well known schools as the University of Pittsburgh, California State University (Sacramento), North Carolina State University, the University of Tennessee, Wittenberg University (Springfield) and the University of Alaska (Fairbanks).

In connection with his professional activities, Sashti has travelled extensively around the globe sponsoring, directing and establishing linkages to develop and implement programs in England, Germany, Finland, Spain, Russia, Hungary, the Czech Republic, Latvia, Lithuania, Japan, China, India, Taiwan, South Korea, Hong Kong, Thailand, Malaysia, Singapore, Indonesia, Cambodia, Vietnam, India, Brazil, Argentina, Chile, Mexico, Peru, Egypt, Israel, Turkey, South Africa, Zambia, Ghana, Ivory Coast, Australia and New Zealand.

Tokyo Denki University (Japan), Beijing Normal University (China), the Indian Institute of Management (Bangalore), Tamil Nadu Agricultural University (India), and Columbus State University have presented Raj Sashti with "Awards of Honor" to recognize his contributions to promote greater international understanding through educational and cultural exchange.



Prof. Andrey Koptle  
Associate Professor  
Sam Houston State University.  
Director of the Center for International Education  
School of Teaching and Learning, College of Education  
[axk022@shsu.edu](mailto:axk022@shsu.edu)  
+1 (936) 294-1140  
<http://www.tsus.edu/>

**TOPIC: “Enhancing STEM Teaching and Learning Through Artificial Intelligence and Smart Technology”**

Dr. Andrey V. Koptelov is an Associate Professor of the College of Education at Sam Houston State University. He is the Director of the Center for International Education at the College of Education at Sam Houston State University. He graduated from Kirov State Pedagogical Institute in Russia in 1982 and defended his Ph.D. dissertation focused on educational technology at the Academy of Pedagogical Sciences in Moscow, Russia. Dr. Koptelov moved to Houston in 2001 where he taught Technology Applications at Fonville Middle School in Houston ISD. This school serves for under-represented communities including large amount of migrants. In 2010 he started designing and developing educational computer games focused on STEM with his middle school ESL and EFL students. In 2011, the National Science Foundation of America (NSF) awarded one of his projects that was presented in Washington, D.C., at the NSF Annual Conference. In 2011 and 2012, Dr. Koptelov's students had the highest scores on the Technology Literacy Assessment in Houston ISD among the 59 campuses that were

tested. In the fall of 2012, Dr. Koptelov became an Assistant Professor at Sam Houston State University in Huntsville, Texas, USA. His research interests center on integrating technology in teaching and learning. Dr. Koptelov has published extensively and presented at numerous international, national, and state conferences. He has more than 70 publications in Europe and the USA. Dr. Koptelov has more than 15 years of teaching experience in K-12 and more than 20 years teaching in a higher education. Dr. Koptelov collaborates with teachers, schools, and other universities nationally and internationally in matters of integrating modern technologies in education. He also collaborates with educators from Costa Rica, Russia, Belarus, Armenia, Japan, China, Kenya, Tanzania, Thailand, Korea, Ireland, Australia and other countries.



**Professor Samson Madera Nashon**

THE UNIVERSITY OF BRITISH COLUMBIA   
**Faculty of Education**

Department of Curriculum and Pedagogy

**TOPIC: Redefining STEM Research: The Place of Qualitative Approaches and Action Research.**

Dr. Samson Madera Nashon is Professor of Science Education at the University of British Columbia (UBC), Canada. Professor Samson Nashon is the current Head of the *Department of Curriculum and Pedagogy* (EDCP) at UBC. Throughout his more than 21-year tenure at UBC, he has established multiple and extensive working relationships with scholars and universities world-wide. At UBC, he is an active member of the African Awareness Initiative (AAI) Board; African Studies Minor Program Board (Faculty of Arts); and International STEM Association Advisory Board. Prof. Nashon's research focuses on ways of teaching and learning in diverse contexts. His area of specialization focuses on nature of learning environments and students' alternative understandings that have roots in cultural backgrounds and curricula and are accommodative of students with varying degrees of abilities.

Professor Nashon's experiences with curricular reform processes in Kenya, United Kingdom, and Canada foreground his educational research. He graduated with a BEd in Physics and Mathematics from the University of Nairobi (1984) and a Master of Education (MEd) and Doctor of Education (EdD) degrees in Science Education from the University of Leeds (UK) and University of Toronto (Canada) in 1989 and 2001 respectively.

Professor Nashon's research is characterised by: *Understanding the nature of science curriculum and instruction*; *Understanding the science learner*; and *understanding the deep meta-level mechanisms of science learning*. Since 2001, Professor Nashon has published/co-published over 50 refereed journal papers; over 22 refereed conference proceeding papers; over 75 refereed conference presentations; and 9 refereed book chapters. To date Professor Nashon has mentored over 35 PhDs and 55 Masters Students in the capacity of principal supervisor, co-supervisor or committee member. Some of the students Professor Nashon has supervised are now serving in academic positions at various world class universities while others have taken up key public service engagements in their respective home countries.

In addition to the research projects, with most located in Kenya, Professor Nashon has also been involved in education based humanitarian or professional development projects including serving as UBC Coordinator of "Daadab Refugee Camp Teacher Education Program". Through the love for his home country, Professor Nashon facilitated a collaborative of Kenyatta (Kenya), York (Canada), UBC (Canada) and Moi (Kenya) Universities to develop and implement a very successful two-year university based Diploma in Teacher Education by recruiting student teachers from Dadaab refugee and host communities. Thus, Professor Nashon uses an education lens to engage in world discourses that endeavor to seek out solutions to complex global issues through qualitative and quantitative based research approaches including action research (AR) strategies.



Prof Tawanda Runhare (PhD, Pretoria)  
Faculty of Humanities, Social Sciences and Education  
Interim Director: School of Education  
Education Building Office GF13, Bag X5050  
Thohoyandou 0950  
**Phone:** +27 159629094 **Cell:** +27 833879903/659424237 **Fax:** +27 159624749  
**Email:** [tawanda.runhare@univen.ac.za](mailto:tawanda.runhare@univen.ac.za) / [runharet@yahoo.co.uk](mailto:runharet@yahoo.co.uk)

#### TOPIC: Revamping Teacher Education in the Context of STEAM

Tawanda Runhare is an Associate Professor, a PhD Graduate from University of Pretoria in Education Policy Studies, current Director of the School of Education, in the Faculty of Humanities, Social Sciences and Education at the University of Venda, South Africa. He has interest in, published widely and presented conference papers on socio-economic and gender equity issues that influence educational access, participation, and outcomes. Tawanda is the lead author of the UNICEF Country Report on Gender Issues in Education and co-editor of Sociological Foundations of Education in Africa, a book published in 2021 by Oxford University Press, Southern Africa. His research is founded on the backdrop of experience in education as a high school teacher and principal, regional and national chief examiner, teachers' college senior lecturer, university lecturer, senior lecturer, associate professor, head of department, postgraduate and postdoctoral supervisor, vice/acting dean and director of education. He was an expert reference member for the Human Sciences Research Council (HSRC) research project on mainstreaming gender and socio-cultural inclusion in global change South Africa and consultant for UNICEF and UNESCO on gender and education.



Prof. Hussein Golicha  
Deputy Vice Chancellor, Academics and Students Affairs  
MMUST  
[hgolicha@mmust.ac.ke](mailto:hgolicha@mmust.ac.ke)  
**TOPIC: Demystifying Physics**

Prof. Hussein S. A. Golicha holds a doctorate degree in physics, specializing in Chemical Physics from Egerton University, Masters in Physics from Kenyatta University and Bachelors in Education, Maths Physics, from the University of Nairobi. His areas of academic and research interest are in the fields of Chirality (handedness of nature) and material science. He has supervised post graduate students to successful completion. His major scholarly contribution was his role in the study of Chiral molecules using liquid crystals as hosts, not to forget his contribution to teaching and learning of physics at secondary level through his books. As a hobby Prof. Golicha likes writing fiction, has a novel: "the tongue between the teeth" and the Blog: <https://drgolicha.wordpress.com>

Prof Golicha is currently the Deputy Vice Chancellor Academic and Student Affairs at Masinde Muliro University of Science and Technology (MMUST). Before joining (MMUST) in 2021, Prof Golicha served as Deputy Vice Chancellor Academic and Student Affairs, at Garissa University. He is currently the Deputy Vice Chancellor Academic and Student affairs, MMUST.

## **PANEL DISCUSSION**

### **Critical Literature Review in Academic Writing and Scientific Publications**

#### **Panellists:**

- 1. Dr Catherine Aura**
- 2. Dr David Barasa**
- 3. Dr Rose Opiyo**
- 4. Dr Edwin Kanda**

#### **Moderator**

**Prof Peter W. Bukhala**



Ms. Penina Kimani  
Chief Digital Officer Longhorn Publishers PLC  
Cell phone +254708588574

### **TOPIC: Digitizing Content and the happening in the Market**

Penina spends her time thinking about equity within the education system and the role technology can play to promote it. Penina is the Chief Digital Officer of Longhorn Publishers, the only publicly listed publishing corporation, and the largest publishing house in East and Central Africa. She is committed to enhancing collaborative learning in institutions using technology, data and analytics to ensure each learner achieves their potential. Her strong belief in the transformative power of education led her to create applications that promote collaboration, efficiency, and transparency for both learners and teachers. She previously co-founded Sproutfy Learning a mobile and web administrative tool for schools. Her previous experience teaching A-Level economics and business studies at a learning center in Nairobi provided great insights into the challenges teachers are facing. She has 10 years of experience building products, teams and scaling solutions. She previously worked for impact investing organisations in Montreal and Boston. She studied Finance and Strategic Management at McGill University, Montreal, Canada.



Prof. Bonaventure Wanjala Kerre, Ph.D.

University of Eldoret, Kenya

[bwkerre@gmail.com](mailto:bwkerre@gmail.com)

**TOPIC: Scientific and Technological Literacy: The Missing Link in Basic Education  
for All**

Today, the 21<sup>st</sup> Century is well acclaimed to be Scientific and Technological globally. However, a closer examination of most curricula offered at Basic Education level are still very much rooted in the well famed 3Rs as the foundation upon which education is anchored. Whilst much credit may be given for the inclusion of scientific literacy in basic education in developed countries, not much can be ascribed to technological literacy in the same countries and, particularly, in developing countries. In this paper, a closer examination reveals the missing link in which basic literacy has not embraced scientific and technological literacies as critical elements in the provision of wholesome basic education. It is an imperative in the preparation of citizens of any country for full participation and contribution toward the betterment of their quality of life. It is, thus postulated and demonstrated that basic education today must fully embrace the five literacies of the 3Rs and the 2 STs to meaningfully contribute to and be in control of the 21<sup>st</sup> Scientific and Technological Century we live in today.

## DAY ONE: WEDNESDAY, 16<sup>TH</sup> NOV 2022

TIME	ACTIVITY	RESPONSIBLE
	<b>Chair of Session: Prof. Moses Poipoi      Rapportuer: Dr. Jason Nganyi</b>	
0800-0830	Log-in and Registration	Secretariat
	<b>OFFICIAL OPENING OF THE CONFERENCE</b>	
0830 - 0900	<b>WELCOMING REMARKS</b> <b>Dr. Catherine Aurah</b> -Chair STEMEIC 2022 <b>Prof. Moses Poipoi</b> – Dean School of Education	Dr. Catherine Aurah
	<b>Prof. Charles Mutai</b> – Deputy Vice Chancellor (Planning, Research, and Innovation)	Prof Peter Bukhala
	<b>Prof. Hussein S. A. Golicha</b> – Deputy Vice Chancellor (Academics & Students Affairs) <b>Prof. John Kuria Thuo</b> – Deputy Vice Chancellor (Administration & Finance)	Prof. C. Mutai - DVC (PRI)
0930-1000	<b>OPENING REMARKS</b> <b>Prof. Solomon Shibairo</b> - Vice Chancellor	
	<b>Dr. Musangi Jane Mutua</b> - Chairperson of Council	Vice Chancellor, MMUST
	<b>Dr. Peter Wanyanga Muthoka</b> - Chancellor	Chairperson of Council, MMUST
1000-1130	<b>Dr. Deepa Chari, PhD</b> Reader Homi Bhabha Centre for Science Education Tata Institute of Fundamental Research V. N. Purav Marg, Mankhurd, Mumbai 400 088 India <a href="https://www.hbcse.tifr.res.in/people/academic/deepa-chari">https://www.hbcse.tifr.res.in/people/academic/deepa-chari</a> <b>TOPIC:</b> <b>Improving Classroom Environments for Student-Centered Learning in STEM Subjects/Courses: Case of Physics (Plenary)</b>	
	Group Virtual Photo/Break	DCCM

BREAKAWAY SESSIONS	
Hall One	
SYMPOSIA ONE	
STEM EDUCATION IN THE CONTEXT OF COMPETENCY BASED CURRICULUM	
Moderator: Dr Teresa Okoth	Rapporteur: Dr Paul Ogenga
1200-1220	<b>Ongeti Karren Ohanga, Isaac Ipara Odeo &amp; Elizabeth S. B. Abenga:</b> Language of Instruction under the Competency-Based Curriculum of Kenya: Policy, Practice and Performance
1220-1240	<b>Jason Nganyi, Pamela Buhere, Judah Ndiku, Teresa Okoth, Stephen Odebero, Eunice Majanga &amp; Rose Opiyo:</b> Training Needs Assessment of Non-Teaching Staff in The Provision of Quality Competency Based Curriculum in Public Secondary Schools in Western Region, Kenya
1240-1340	<p style="text-align: center;"><b>Panel Discussion</b></p> <p style="text-align: center;"><b>Critical Literature Review in Research and Publications</b></p> <p style="text-align: center;"><b>Moderator: Prof Peter Bukhala</b></p> <p style="text-align: center;"><b>Panellists:</b></p> <ul style="list-style-type: none"> <li>• Dr Catherine Aura (Systematic and Desktop Review for Publishing)</li> <li>• Dr. Edwin Kanda (Systematic and Desktop Review for Publishing)</li> <li>• Dr Rose Opiyo (Critical Review for Proposal and Thesis Development)</li> <li>• Dr David Barasa (Common Mistakes in Critical Reviews)</li> </ul> <p style="text-align: center;">(Plenary)</p>
DAY 1	<p style="text-align: center;"><b>SYMPOSIA TWO</b></p> <p style="text-align: center;"><b>TEACHER PROFESSIONAL DEVELOPMENT IN STEM EDUCATION</b></p> <p style="text-align: center;"><b>Moderator: Dr Bill Ouda</b>                           <b>Rapportuer: Dr. Edwin Kanda</b></p>
1340-1400	<b>Esther Sila, Peter Odera and Poipoi:</b> Teachers Self-Efficacy, Leadership Approaches And Academic Performance Of Secondary School Learners In Kakamega County.
1400-1420	<b>Korofia Jacob Shango , Nakhabi Lucy Musinzi :</b> The Influence of Teachers' Motivation on Academic Performance of Students With Learning Difficulties In Secondary Schools in Kakamega North Sub County, Kenya
1420-1440	<b>Berita Singoro:</b> School Based Support System Implementation: The 21st Century Teacher Professional Development Systems that Seeks to provide Training in Subject Matter for Teachers in Mt. Elgon Sub County.

Chair of Session: Dr. Ronald Michieka		Rapporteur: Ruth Songok
1440-1500	<b>Andanje Margaret Ochango:</b> Psychological and Social Resilience as Predictors of Role Satisfaction Among Teachers in Secondary Schools in Bungoma County	
1520-1540	<b>Burudi Florah Khahudu, Prof. Aggrey M. Simiyu, Prof. Kennedy Bota:</b> Student Teachers' Perceptions of Teaching Practice in Public Teacher Training Colleges in Kenya	
1540-1600	<b>Romano Okwi Elingit:</b> Effects of The Challenges Faced By Technical Education Teachers on Graduate Service Delivery: A Case of County Based Polytechnics in Kenya.	
1620-1700	<p style="text-align: center;"><b>Prof. Samson Madera Nashon</b>            Department Head &amp; Professor of Science Education            Faculty of Education   Department of Curriculum and Pedagogy   University of British Columbia            2125 Main Mall   Vancouver, BC, Canada V6T 1Z4  <b>Key note:</b>  <b>Redefining STEM Research: The Place of Qualitative Approaches and Action Research.</b>  <b>(Plenary)</b></p>	

BREAKAWAY SESSIONS	
DAY 1	<p style="text-align: center;"><b>Hall Two</b>  <b>SYMPOSIA THREE</b>  <b>ACCESS, EQUALITY AND INCLUSION IN STEM EDUCATION AND RESEARCH</b></p>
	<p style="text-align: center;"><b>Moderator: Dr Rose Opiyo</b>                           <b>Rapporteur: Purity Muchere</b></p>
1230-1250	<b>Agnes M. Wahome1,Christopher Yegon and Victoria Gioto :</b> Gender Dynamics in Placement of Government Sponsored Students to STEM Degree Programs
1250-1310	<b>Epari Ejakait, Ogenga Paul Akumu, Musera Geoffrey Ababu and Werunga Ronald Kikechi:</b> A Comparative Analysis of Scores in STEM-Related Subjects Between Female and Male Students at Primary and Secondary School Levels in Kenya

1310-1330	<b>Leonard Latan Imbosa, Eunice Majanga, James Bill Ouda</b> Re-entry Policy and Retention of Expectant Students and Teen Mothers in Public Secondary Schools in Vihiga Sub-County, Kenya
1330-1350	<b>Eliud Makunda Shikanga, Francis Muyekho and James Bill Ouda.</b> Teacher Related Factors and Enrolment of Students in Agriculture in Secondary Schools in Kenya
1350-1450	<p style="text-align: center;"><b>Prof. Mike Kuria</b>          CEO, The Commission Secretary / Chief Executive Officer.          Commission for University Education          Red Hill Road, Off Limuru Road, Gigiri.          P.O. Box 54999 – 00200, Nairobi, Kenya          Phone: +254 – 020 – 7205000, +254–780-656575          Email: <a href="mailto:info@cue.or.ke">info@cue.or.ke</a></p> <p style="text-align: center;"><b>Key note:</b></p> <p style="text-align: center;"><b>The Status of STEM-related Programmes in Kenyan Universities (Plenary)</b></p>
<b>Chair of Session: Dr Wangila Erick</b> <b>Rapporteur: Joan Lyanda</b>	
1450-1510	<b>Wekullo Caroline:</b> Institution Type, Selectivity, and Financial Aid: An Examination of Institutional Factors Influencing First-Time Students Retention in Public Universities
1510-1530	<b>James Okou:</b> Factors Influencing Student Completion Rates in Bukura Agricultural College in Western Kenya
1530-1550	<b>Rose Nafula Wanjala:</b> Strengthening Gender Equity in Technical Vocational Education and Training: Challenges and Priorities in Developing Countries
<b>Hall Two</b>	
<b>SYMPOSIA FOUR</b>	
<b>COLLABORATION AND PARTNERSHIPS IN STEM EDUCATION AND RESEARCH</b>	
<b>Moderator: Dr. Pamella Buhere</b> <b>Rapporteur: Dr Epari Ejakait</b>	
1530-1550	<b>Manasi Echaune &amp; Robert Kati:</b> Reimagining University Education Towards 21st Century Competences: Reflections from Kibabii University Students
1550-1610	<b>Elizabeth Lusweti, Edwin Kanda, Faith Gachuhi, Caleb Kibet &amp; Loise Okiya:</b> Role of TVET Institution in Promoting Jua Kali Sector in Kenya
1610-1630	<b>Ambale C. Kennedy, James B. Ouda &amp; Kenneth Otieno:</b> Mental Health and Suicidal Ideation among Students of Public Secondary Schools in Kenya

## DAY TWO: THURSDAY, 17<sup>th</sup> NOV 2022

TIME		RESPONSIBLE
0800-0830	Log-in and Registration	Secretariat
	<b>BREAKAWAY SESSIONS</b>	
DAY 2	<b>HALL ONE</b> <b>SYMPOSIA FIVE</b> <b>STEM FOR IMPROVED HEALTH</b>	
<b>Moderator:</b> Dr. Catherine Aurah		<b>Rapporteur:</b> Victor Ndinda
0830-1050	Mrs. Jacinta Akatsa, Director, CEMASTEA <b>Keynote:</b> <b>“Reorienting STEM Teaching and Learning in Africa: Performance-Sparking Models”</b> <b>(Plenary)</b>	
1050-1110	<b>Felistus Nyamoma, Moses Poipoi &amp; Samuel Maragia:</b> Influence of Co-curricular practices on prevention of substance abuse among secondary school students in Kakamega County – Kenya	
1110-1130	<b>Kennedy Bota Judith Minayo Ang’alika:</b> Effect of Student’s Self-Efficacy, Emotional Intelligence and Motivational Levels on Academic Performance among Learners in Public Day Secondary Schools in Kisumu County	
1130-1150	<b>Bakesia Grace, Olayo Rose, Mengich Gladys &amp; Opiyo Rose:</b> Prevalence of Depression among Adolescents in Secondary Schools in Kakamega County- Kenya	
1150-1210	<b>Gladys J. Mengich:</b> Implementing a Competence- based programme: a case for health professions education programme in MMUST	
1210-1230	<b>Jared Makori Bundi, Moses Poipoi &amp; Everlyne Morema:</b> Socioeconomic Factors Influencing Health Care Providers’ Psychological Responses During The Covid-19 Pandemic At JOOTRH, Kisumu County, Kenya	



	<b>DAY TWO BREAKAWAY SESSIONS</b>
<b>DAY 2</b>	<p style="text-align: center;"><b>Hall TWO</b></p> <p style="text-align: center;"><b>SYMPOSIA EIGHT</b></p> <p style="text-align: center;"><b>DIGITAL TECHNOLOGIES, ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND BIG DATA</b></p> <p style="background-color: #c0a080; color: black; padding: 5px;"><b>Day 2 Moderator: Prof.Kennedy Bota Rapportuer: Ruth Songok</b></p>
0950-1010	<b>Moochi,C.N. &amp; Makworo, E.O:</b> E-Readiness in The Application of The Big Five Technologies in Instruction among Secondary School Teachers in Nyamira County, Kenya.
1010-1030	<b>Joseph Masinde Wangila:</b> Association between Students' Self-Efficacy and Achievement in Electrochemistry when Taught using Software-Oriented Concept Mapping
1030-1050	<b>Tabitha Nyongesa &amp; Lamek Ronoh:</b> Building Resilient and Sustainable Systems for STEM Teaching, Learning and Research in Post Covid-19 Era in Kenya
1050-1110	<b>Briam O. Oguta:</b> Building Resilient and Sustainable Systems for Stem Learning in Post Covid – 19 Era. A Study in Artificial Intelligence in Stem Education
1110 - 1150	<p style="text-align: center;"><b>Ms Peninna Kimani</b></p> <p style="text-align: center;">Chief Digital Officer Longhorn Publishers PLC PO BOX 18033-00500 FUNZI ROAD. Industrial Area Nairobi Kenya Phone: +254708588574</p> <p style="text-align: center;"><b>Keynote: Digitization of STEM: Digitizing content and the happenings in the Market (Plenary)</b></p>
<b>DAY 2</b>	<p style="text-align: center;"><b>DIGITAL TECHNOLOGIES, ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND BIG DATA</b></p> <p style="text-align: center;"><b>Moderator: Dr Eng Edwin Kanda                      Rapportuer: Purity Muchere</b></p>
1150-1210	<b>Argan Wekesa and Mwendwa A. Caleb :</b> Online teaching and assessment in mathematical sciences: tools and quality assurance strategies
1210-1230	<b>Aliyi Hassen Mohammed:</b> Improving computer programming skill of computer science students at university level

1230-1250	<b>Mukenya, Wanjala Martin &amp; Beatrice Shikuku:</b> Infrastructural And Technical Support For Teachers Use of ICT in Mathematics Instruction In Secondary Schools In Bungoma County
1250-1310	<b>Sussy Nafula Werunga, Peter Odera &amp; Samuel Maragia:</b> Extent to Which Learning Strategies Predict Academic Performance of Primary School Pupils in Migori County, Kenya
DAY 2	<b>CREATIVE AND INNOVATIVE PEDAGOGIES FOR STEM TEACHING AND LEARNING</b> <b>Moderator: Dr. Teresa Okoth</b> <b>Rapporteur: Dr. Jason Nganyi</b>
<b>BREAKAWAYS SESSION HALL 2</b>	
1410-1430	<b>Aradi Duncan &amp; Wekullo Caroline:</b> Effect of Kenya Institute of Curriculum Development Virtual Programs on Students' Learning Outcomes in STEM Subjects within public Secondary Schools in the Kakamega South Sub-county
1430-1450	<b>Eliud Oure Oyoo;</b> Effective Competency Based Assessment Model for Secondary Schools – Collaborative Approach in Post COVID 19 Era
1450-1510	<b>Aurahh, C. M; Cassady, J.C.; &amp; McConnell, T. J:</b> Genetics problem solving in high school testing in Kenya: Effects of metacognitive prompting during testing
1510-1530	<b>Songok Ruth Jepchirchir &amp; Ongunya Raphael Odhiambo:</b> Environmental Education Pedagogy and Students' Achievement in Sustainable Conservation of Environment in Secondary Schools in Narok County, Kenya
1530-1550	<b>Kathukumi Ken, Moses Poipoi &amp; Rose Opiyo:</b> Effects of COVID-19 Related Stress on Academic Performance of Academic Staff in Public Universities in Western Kenya
1550-1610	<b>William W. Toili:</b> Role of Steam Education in Promoting Competency Based Curriculum in Kenya
1610-1710	<b>Prof. Bonaventure Wanjala Kerre, Ph.D.</b> University of Eldoret, Kenya <a href="mailto:bwkerre@gmail.com">bwkerre@gmail.com</a> <b>Key note:</b> <b>Scientific and Technological Literacy: The Missing Link in Basic Education for All.</b> <b>(Plenary)</b>

## DAY THREE: FRIDAY 18<sup>TH</sup>, NOVEMBER 2022

REVAMPING TEACHER EDUCATION IN THE CONTEXT OF STEAM		
Moderator: Dr. Paul Ogenga	Rapporteur: Ms. Joanne N. Lyanda	
TIME	ACTIVITY	RESPONSIBLE
0800-0830	Log-in and Registration	Secretariat
	<b>HALL ONE</b>	
0830-0900	<b>Martin Wanjala:</b> Facilitator's Role in Professional Learning Communities Working with Mathematics Teachers	
0900-1010	<p style="text-align: center;"><b>Prof. Tawanda Runhare</b>            Interim Director, School of Education;            Faculty of Humanities, Social Sciences and Education.            University of Venda            Email: <a href="mailto:taawanda.ruhhare@univen.ac.za">taawanda.ruhhare@univen.ac.za</a> / <a href="mailto:runharet@yahoo.co.uk">runharet@yahoo.co.uk</a></p> <p style="text-align: center;"><b>Key note:</b>  <b>Revamping Teacher Education in the Context of STEAM</b>  <b>(Plenary)</b></p>	
1010-1030	<b>Herbert Amunavi Obeywa, Teresa A. Okoth-Oluoch, Rose Atieno Opiyo &amp; Aggrey Mukasa Simiyu :</b> Efficacy of Assessment Strategies in Early Childhood Development Education Curriculum Implementation in Kenya	
1030-1050	<b>Kisiang'ani Bahati &amp; Rose Atieno Opiyo:</b> Not All Was Doom in Stem Teacher Professional Development in The Wake of Covid-19 Pandemic: A Case of Kibabii University	
1050-1110	<b>Okono Elijah Owuor, E.A. Abenga, E.W. Wangila &amp; J. O. Shiundu:</b> Implications of Integration of Laboratory-Based Instruction on Students' Achievement and Classroom Interaction in Learning of Physics in Secondary Schools in Kenya	
DAY 3	<b>REVAMPING TEACHER EDUCATION IN THE CONTEXT OF STEAM</b>  Moderator: Dr Rose Opiyo      Rapporteur: Edwin Simiyu	
1110-1130	<b>Hellen Lumadede, John O. Shiundu &amp; Moses W. Poipoi:</b> Teacher And Student Perception of The influence of Examination on Students'	

	Motivation and Academic Achievements in Public Secondary Schools in Kakamega County, Kenya
1130-1150	<b>A. Mungasia, J.B. Ouda &amp;, K. Otieno:</b> Teachers' Self-Efficacy and their Performance Appraisal in Public Secondary Schools
1150-1210	<b>Catherine Aurah &amp; Tom J. McConnell:</b> Comparative Study on Pre-Service Science Teachers' Self-Efficacy Beliefs of Teaching in Kenya and the United States of America; USA
12.10-'1230	<b>Wangila Eric &amp; Buhere Pamela</b> : Efficacy of Computer-Based Instruction on classroom Learning environment: A Case of Rural Secondary schools in Bungoma and Kakamega Counties, Kenya
1230-1450	<p style="text-align: center;"><b>Prof. Edgington William</b>            Professor of Education            Ag. Chair, Department of Curriculum and Instruction            Co-Chair of International Research and Operation            Sam Houston State University  <a href="mailto:wedgington@shsu.edu">wedgington@shsu.edu</a> +1 936 294 1213</p> <p style="text-align: center;"><b>Key note:</b></p> <p style="text-align: center;"><b>Comparative and Global Education: The place of STEM Education (Plenary)</b></p>
1450-1600	<p style="text-align: center;"><b>Prof. Rajgopal Sashti</b>            FULLBRIGHT SPECIALIST,            Advisor, Fellowships and Sponsored Programs            Sam Nunn School of International Affairs            Georgia Institute of Technology (Retired)            Atlanta, Georgia, USA</p> <p style="text-align: center;"><b>Workshop Topic:</b></p> <p style="text-align: center;"><b>Best Practices to Secure External Funding “Research” and “program” grants and “fellowships.”</b></p> <p style="text-align: center;"><b>(Plenary)</b></p>
1600	<b>VOTE OF THANKS AND OFFICIAL CLOSING</b>

## **SUB-THEME: 1. STEM EDUCATION IN THE CONTEXT OF COMPETENCY BASED CURRICULUM**

### **1.1 Language of Instruction under the Competency-Based Curriculum of Kenya: Policy, Practice and Performance**

Ongeti Karren Ohanga, Isaac Ipara Odeo & Elizabeth S. B. Abenga

Masinde Muliro University of Science and Technology

Corresponding email address: [kongeti@mmust.ac.ke](mailto:kongeti@mmust.ac.ke) Tel. 0720669061

#### **Abstract**

*The Competency-Based Curriculum (CBC) in Kenya has adopted the existing educational language policy for lower primary school which stipulates that the language of instruction in lower primary Grade 1 to 3 in rural settings should be the learners' First Language or Mother Tongue and English or Kiswahili in urban settings. English becomes the medium of instruction and language of examinations in all settings from Grade 4 onwards. This policy creates adoption problems for teachers and learners. Teachers may not be speakers of the learners' Mother Tongue. The purpose of this study was to establish the actual language practice in lower primary school Grade 1 to 3 in relation to declared policy and to evaluate its relationship with learners' academic achievement. The objectives of the study were: to establish the actual status of educational language policy and language practice in lower primary schools and to assess the relationship between the language of instruction and scores of Grade 4 learners in English and Mathematics subjects. The study area was Kakamega County, which was selected based on being a county with a fair mix of urban, rural and semi-urban schools. This study adopted a correlational design. Multistage sampling was used to select 175 primary schools from a population of 1,120 primary schools and 10,767 Grade 4 learners. Questionnaires were administered to 75 teachers and mean scores of Grade 4 assessment results were obtained from 1,076 learners. Descriptive and inferential statistics were used to analyse data. Findings indicate a gap between policy and practice in lower primary school. There is a strong correlation between the language of instruction at lower primary school and learners' academic achievement at Grade 4 in English and in Mathematics subjects. For quality of outcome in the learners' Grade 4 School-Based Assessment (SBA), under the Competency-Based Curriculum, a policy shift is recommended to unify the language of instruction in the CBC framework.*

## **1.2 Effects of COVID-19 Related Stress on Academic Performance of Academic Staff in Public Universities in Western Kenya**

Kathukumi Ken, Moses Poipoi & Rose Opiyo

Masinde Muliro University of Science and Technology  
Corresponding author email: [kenkathukumi@gmail.com](mailto:kenkathukumi@gmail.com)

### **Abstract**

*In the 21<sup>st</sup> century, universities and colleges in Kenya and beyond have emerged as hubs of knowledge acquisition, scholarly and career development. However, since the onset of Covid-19 pandemic, these roles have to be interrupted. With unexpected closure of learning institutions at all levels, working online has been the lime light of the era in many academic activities including research, symposiums, conferences and students supervision. Academic staff have trouble in carrying out their mandate within which their troubles have somehow culminated to stress. Stress related to Covid-19 pandemic has gone further to affect their academic performance. The aim of this study was to find out the effects of Covid-19 related stress on academic performance of academic staff in public universities in western Kenya. A cross-sectional descriptive design was adopted. Semi-structured questionnaire was used to collect data and purposive sampling was used to select the two Universities in Bungoma and Kakamega counties namely, MMUST and Kibabii University. A multistage sampling technique was used to select the respondents. The target population was 700 academic staff, however after applying Yamane's formula the sample size consisted of 248 staff. The research findings show that there was weak negative correlation of p-0.218 alpha 0.05 between the extents Covid-19 related stress and academic output. This implies that the introduction of new teaching approaches and methodologies, adherence to Covid- 19 guidelines, cut- of social ties and face-to-face collaborative research activities affected academic staff publication in refereed journals, supervision of undergraduate and postgraduate students, attendance of scholarly conferences and symposiums. The study concluded that during the COVID-19 pandemic, the academic output of the academic staff was significantly affected. It was recommended that curriculum developers in Kenyan Universities under the guidance of Commission for University Education should develop programs and courses on Instructional Design for Online Learning; also, Universities in collaboration with Ministry of Education should set aside emergency funds to support higher education calendar activities on and after pandemics.*

**Key Words:** Covid-19, MoE, Academic Staff, Academic Staff

## **1.3 Role of Steam Education in Promoting Competency Based Curriculum in Kenya**

William W. Toili

Masinde Muliro University of Science and Technology

Corresponding Email Address: [twanjala@mmust.ac.ke](mailto:twanjala@mmust.ac.ke)

### **Abstract:**

*Education and training are important cornerstones of “Kenya Vision 2030”. New schools, the development of vocational training, the promotion of digital literacy and a fundamental revision of curricula are just some of the issues being addressed. The latest educational reforms are being addressed under the auspices of “Competence Based Curriculum” (CBC). But while these reforms may be necessary, they need to be anchored in a proper framework that may lead to the achievement of the intended objectives. The framework will only be adequate if it incorporates the ideals of the STEM and STEAM movements currently being embraced by many countries in the world. In our current 8-4-4 educational system students aren't achieving in most subjects; especially mathematics and science. Our children don't see the connection between what they do in the classroom to what they can do when they grow up nor how their academic achievement can get them there. If we want to create our future workforce, there is a need for stakeholders in the education sector to consider integrating the STEM/STEAM models alongside the much-touted. The benefits of STEAM Education in terms of knowledge, skills, and attitudes are overwhelming and resonate with those propagated by CBC. Thus, this paper argues that STEAM Education perfectly informs the structure and organization of CBC and the two cannot divorce each other.*

# **Training Needs Assessment of Non-Teaching Staff in the Provision of Quality Competency Based Curriculum in Public Secondary Schools in Western Region, Kenya**

Jason Nganyi<sup>1</sup>, Pamela Buhere<sup>2</sup>, Judah Ndiku<sup>3</sup>, Triza Okoth<sup>4</sup>, Stephen Odebero<sup>5</sup>, Eunice Majanga<sup>6</sup> and Rose Opiyo

Masinde Muliro University of Science and Technology

Corresponding Email Address: jnganyi@mmust.ac.ke

## **Abstract**

*The purpose of the study was to establish the training needs assessment of non-teaching staff that would enhance quality education in the implementation of Competency Based Education. The paper addresses the various components of training for non-teaching staff that will support handling of learners in the Competency Based Curriculum and the general learners' health, safety and security in schools. These aspects when well handled by non-teaching staff promote teaching and learning. Several Studies have been done on training of non-teaching staff in institutions of higher learning but very limited in secondary schools where it is needed most. This research was conducted in public secondary schools within Western region of Kenya in the counties of Kakamega, Busia, Bungoma and Vihiga. The study sampled 355 participants comprising of 43 principals and 312 non-teaching staff. For proper sampling, Schools were proportionately sampled based on categories that include national, extra-county, county, sub-county, girls, boys', mixed, boarding, boarding and day and day schools. The findings would be significant in addressing the challenges that would be encountered by non-teaching staff in handling young learners joining high school. The findings indicated that both the principals and non-teaching staff were in agreement that training of non-teaching staff was very important in promoting work performance. There was statistically significant relationship between budgets and work performance as well as training and work performance. There was also statistically significant relationship between in service training in different types of schools and work performance. Very few non-teaching staff attend training after employment. However there was a challenge in funding on training as most schools had limited resources and therefore could not budget for such trainings. It is recommended that training should be enhanced and funding be enhanced.*

**Key words:** Training, needs assessment, competency, curriculum, health, security and safety

# **1.5 Efficacy of Assessment Strategies in Early Childhood Development Education Curriculum Implementation in Kenya.**

Herbert Amunavi Obeywa, Teresa A. Okoth-Oluoch, Rose Atieno Opiyo & Aggrey

Mukasa Simiyu

Masinde Muliro University of Science and Technology

Corresponding email address: [obeywaherbert@yahoo.com](mailto:obeywaherbert@yahoo.com)

## **Abstract**

*The purpose of this study is to assess the efficacy of assessment strategies in ECDE curriculum implementation. The study objective was to evaluate the effectiveness of the assessment strategies in promoting learners' readiness for primary education. The study was guided by curriculum implementation theory by Gross (1971), Ecological Systems Theory of Bronfenbrenner revised by Guy Evans (2020) and Stufflebeam's CIPP evaluation model (2003). The study adopted a descriptive survey design. The study population comprised CSO's, Section Heads, ECDE centres-in-charge and teachers. A sample size of 178 respondents was calculated by Yamane's (1967) formula. Cluster, stratified and simple random sampling was done to apportion individual members of the groups. Data was collected using interview schedule, questionnaire, and Focus Group Discussions (FGD). Qualitative data was analyzed using content analysis and presented in narrative form. Quantitative data was analyzed using descriptive statistics such as frequencies and percentages and findings presented in pie charts, graphs and tables. Inferential statistics was done using parametric and non-parametric tests. Linear regression analysis at 5% significance level was used to test the null hypothesis. P=0.296, hence the study fails to reject the null hypotheses that selection and utilization of assessment strategies have no statistically significant effect on learners' readiness for primary education. These findings may be used by the County Government in designing, planning, funding to deliver quality ECD services. The National Government may use them in policy formulation and regulation to ensure effective supervision and management of centers to realize learners' readiness for school.*

**Keywords:** Efficacy, Assessment Strategies, Curriculum Implementation, Learners' preparedness.

## **SUB-THEME: 2 TEACHER PROFESSIONAL DEVELOPMENT IN STEM EDUCATION**

### **2.1 Teachers Self-Efficacy, Leadership Approaches and Academic Performance of Secondary School Learners in Kakamega County**

Ester Sila, Peter Odera & Moses Poipoi

Masinde Muliro University of Science and Technology

Corresponding Email Address: [esilastar@gmail.com](mailto:esilastar@gmail.com)

#### **Abstract**

*Teachers are charged with the responsibilities of leadership management of schools in Kenya. Teachers, as decision-makers, are continually faced by problems of managing school resources and funds. Since principals have a lot of responsibilities, it is necessary that they be well informed on aspects of good leadership. Despite the government's efforts to ensure that there is effective management of schools several cases of uninformed decision making, poor leadership approaches and dishonesty have been reported in several learning institutions which may influence the final academic performance of the learners. Some of the sub-standard academic students' performance has been linked to lack of self-efficacy of teachers in their profession. Self-efficacy is one among the eight core competencies in the Competency Based Curriculum (CBC). Other studies have addressed the issues of teacher's leadership approaches in schools, however. The purpose of this study was to ascertain the level to which teacher's self-efficacy affect learner's academic performance. The study adapted the non-experimental research design which is the ex-post-facto survey research design and correlation research design. Data was collected by use of questionnaires, interview schedules, document analysis and focus group discussion. Qualitative data was received in verbatim, transcribed and reported in themes and sub-themes. Quantitative data was analysed using descriptive statistics such as frequencies and percentages while inferential statistics involved linear regression. The study established that teacher's self-efficacy affect secondary school learners' academic performance.*

**Key Words:** Teacher's Self-efficacy (a CBC Competency), Learner's Academic Performance.

## **2.2 School based Support System Implementation: The 21<sup>st</sup> Century Teacher Professional Development Systems that seek to provide Training in Subject Matter for teachers in Mt. Elgon Sub County.**

Berita Singoro.

Kibabii University

Corresponding Email Address: [bsingoro@gmail.com](mailto:bsingoro@gmail.com)

### **Abstract**

*The School based support system SBTSS is the sub-component of Secondary Education Quality Improvement Project(SEQIP) whose intent was to train teachers in subject matter as well as pedagogical content knowledge and also support science, mathematics and English(SME) teachers in their professional development. For fully implementation of the programme, principals and subject teachers are key. The purpose of SBTSS programme was to improve learning outcomes in the region which was selected as a case in need of improvement in teaching and learning due to dismal performance in KCSE examinations. There is therefore need to conduct this study in order to ascertain whether; The SBTSS programme has enhanced the teacher professional development and whether there is improvement in retention of students in upper primary and transition to secondary schools in Mt. Elgon sub-county. The study adopted descriptive survey research design, principals, deputy principals and the subject teachers were selected from 20 schools. Purposive sampling technique was used to select schools and respondents for the study. The subject teachers were selected according to the subjects they teach using proportionate stratified sampling technique. The instruments for data collection were the questionnaires, interview schedules and content information. The study revealed that more need to be done in the allocation of teaching and learning material. There is also need for change of attitude in technology use so as to achieve the intended purposes of SBTSS programme. The study recommended that there should be more allocation of resources such as ICT and e-learning in the region in order to realize enhanced teacher professional development and retention of students in schools.*

**Key Words:** SBTSS, Teacher professional development, Retention of students, Resources.

## **2.3 The Influence of Teachers' Motivation on Academic Performance of Students with Learning Difficulties in Secondary Schools in Kakamega North Sub County, Kenya**

Korofia Jacob Shango, Nakhabi Lucy Musinzi, Nyabuto Esther & Kabesa Stellah  
University of Eldoret  
Corresponding Email Address: [jakorofia@gmail.com](mailto:jakorofia@gmail.com)

### **Abstract**

*Teacher motivation is an essential component of learning as it enhances the learning process thus ultimately influencing students' academic performance. The academic performance of students can be regarded as interplay between the teaching and learning processes. Teachers' motivation is pivotal in enhancing classroom excellence that is generally measured through students' academic performance. However, the academic performance of students with learning difficulties has been a pertinent issue in the education circle. This group of learners have continued to show a low academic performance which can be attributed to poor instructional strategies occasioned by insufficient motivational strategies for teachers. The purpose of this study was to determine the influence of teachers' motivation on academic performance of students with learning difficulties in secondary schools in Kakamega North Sub County. In its quest to achieve the set objectives, this study employed a descriptive survey design. The population of study was drawn from 120 teachers and 22 principals in the 50 registered secondary schools in Kakamega North Sub County. A sample of 44 schools was selected using stratified random sampling method. Yamane's formulae were used to determine the sample for this study. This study was guided by Herzberg's two factor and McClelland achievement theories. Structured questionnaires were used to collect quantitative data whereas qualitative data was collected by use of structured interview schedules. Descriptive statistics through computation of mean, percentages and standard deviation was used to analyse the data collected. Spearman's rank correlation analysis with an aid of computer software IBM SPSS version 21 was used to ascertain the influence of teachers' motivation on academic performance of students with learning difficulties. A five stage framework analysis approach was used to analyse qualitative data. The study revealed that increase in teachers' motivation has a positive influence on academic performance of students with learning difficulties. More specifically, increasing teachers institution work environment, reducing teachers work load to manageable levels and providing regular in service training for teachers enhances teachers performance hence improving student's academic performance. From these findings , the study*

*recommends that teachers motivation aspects such as in service training, improving institution work environment and maintaining manageable workload should be beefed up to enhance the academic performance of students with learning difficulties.*

**Keywords:** Learning difficulties, Teacher motivation and academic performance.

## **2.4 Teachers' Self-Efficacy and their Performance Appraisal in Public Secondary Schools**

J.A. Mungasia, J.B. Ouda & K. Otieno

Masinde Muliro University of Science and Technology, Kenya

Corresponding Email address: [joatsiaya@gmail.com](mailto:joatsiaya@gmail.com)

### **Abstract**

*This paper aimed to assess the effect of teachers' self-efficacy on their performance appraisal in public secondary schools in Sabatia Sub-County, Vihiga County, Kenya. The study, anchored on the social cognitive theory, adopted correlational and descriptive survey research designs. Stratified random sampling was used to select 12 schools and 227 teachers for the study based on category of school, status, and gender. Principals of each sampled school and the Sabatia Sub-County Teachers' Service Commission director were purposively sampled. Data for the study was collected using questionnaires, interview guide, and document analysis guide. Quality assurance of research instruments ensured through piloting, content validity and test retest for reliability. Quantitative data was analyzed using SPSS (version 25.0) descriptively and inferentially, while qualitative data was analyzed thematically. The findings showed the R-value from the model summary of the regression between self-efficacy and performance appraisal was 0.617. The R square value was 0.381, which implied 38.1 % effect on self-efficacy was attributed to teacher appraisal. The findings show significant effect of self-efficacy on performance appraisal. Therefore, performance appraisal for teachers needs to be enhanced since it plays a significant role in boosting their confidence, thus their self-efficacy.*

**Keywords:** Performance Appraisal, Self-Efficacy, Secondary Schools, Kenya

## **2.5 Psychological and Social Resilience as Predictors of Role Satisfaction among Teachers in Secondary Schools in Bungoma County**

Andanje Margaret Ochango, Moses Poipoi & Joel Ongutu

Masinde Muliro University of Science and Technology

Corresponding address: [margaretanje9@gmail.com](mailto:margaretanje9@gmail.com)

### **Abstract**

*Teachers in Bungoma County are at risk of low levels of role satisfaction due to increased workload and escalating cases of indiscipline, poor academic performance and personal life issues of students that require their attention. In spite of all the interventions to ensure role satisfaction, it is evident that the effects of low level of role satisfaction are high and still growing. To reverse this trend, it is upon this background that this study seeks to examine psychological and social resilience as predictors of role satisfaction among secondary school teachers in Bungoma county. It will be guided by resilience and herzberg theories. It will target 7,712 teachers, 385 principals from the secondary schools and also 13 sub-county qasos in Bungoma county. The sub-counties and schools that will participate in the study will be selected by stratified sampling. The teachers will be randomly sampled from the selected schools. The sample size of the study will be 365 teachers, 192 principals and 12 sqasos. Data will be collected using the teachers' questionnaire, principal's questionnaire (pq) and the sub- county qasos questionnaire. Pilot study will be conducted to establish validity and reliability of research instruments. Reliability coefficient of 0.7 and above will indicate a reliable instrument. Data will be presented using frequency tables, pie charts and graphs. Data analysis will be done by both descriptive and inferential statistics. Descriptive statistics will be used to analyze quantitative data. Inferential statistics that will be used will be a two-way anova. Qualitative data will be analyzed thematically. It is expected that the study will come up with guidelines to be used by the ministry of education and the teachers service commission to help teachers develop psychological and social resilience required for role satisfaction.*

**Key words:** Resilience, Role, Satisfaction

## **2.6 Student Teachers' Perceptions of Teaching Practice in Public Teacher Training Colleges in Kenya**

Burudi Florah Khahudu, Aggrey M. Simiyu & Kennedy Bota,

Masinde Muliro University of Science & Technology,

Corresponding Email Address: florahkhahudu@gmail.com.

### **Abstract**

*This study investigated the student teacher's perceptions of teaching practice in Public primary teacher training colleges in North rift valley region, Kenya. The study was guided by Functionalism theory of Attitudes (FAT). The study used Mixed Methods research design based on Ex post facto and Descriptive survey. The study population consisted of 1000 student teachers, 85 lecturers, 380 mentors and 66 head teachers. Purposive sampling was used to select 26 lecturers and 20 head teachers, stratified random sampling to select 114 mentors and 300 student teachers. Data were collected using questionnaires and interview guide. Test-retest method was employed to establish the reliability of the instruments. Content validity was used to ensure the instrument was valid. Qualitative data were transcribed and reported as emerging themes while quantitative data were analyzed using the mean, standard deviation, Chi-square, Analysis of Variance (ANOVA) and F-Statistic using the Statistical Package of Social Science (SPSS) version 23.0. The perception of teaching practice among student teachers was positive. However, head teachers were indecisive when it came to student teachers' perceptions of teaching practice. It is hoped that this study might shed light on teaching practice programmes which will be significant to the ministry of Education, teacher training institutions, teacher trainees, lecturers and researchers who may be interested in further studies in this area.*

**Key words:** Perception, teaching practice, teacher training colleges, Kenya

## **2.7 Effects of the Challenges Faced by Technical Education Teachers on Graduate Service Delivery: A case of County Based Polytechnics in Kenya**

Romano Okwi Elingit  
Kisii University, Kenya

Corresponding Email Address: [elingitokwi@yahoo.com](mailto:elingitokwi@yahoo.com)

### **Abstract**

*Globally, technical education and vocational training comprises formal, non-formal and informal learning for the world of work and the emphasis of the curriculum on the acquisition of employable skills . This education is very vital in transforming the country's economy and creating more jobs aimed at improving not only the living standards of the people but also to industrialize the nation. Kenya like other countries has this type of institutions but the instructors face a myriad of challenges which can affect the quality of service delivery of its graduates especially the county based polytechnics . The study therefore examined Effects of the Challenges Faced by Technical Education Teachers on Graduate Service Delivery: A case of County Based Polytechnics in Kenya under the key objectives . Specific objective one focused on effects of intrinsic motivation on curriculum coverage , specific objective two focused on effects extrinsic motivation on curriculum coverage , specific objective three focused on effects of level of education on graduate quality and service delivery and the fourth objective examined effects of career progression on graduate service delivery. This study was a desktop research based on secondary data available on the website newspapers, articles journals and books . This study is faster and comparative in nature. The findings of the study reveal that intrinsic motivation encourages the trainer to be innovative hence help in producing quality graduates for quality service delivery, extrinsic motivation helps in ensuring the teacher meets his basic needs so any delay results in job boycotting strikes among other negativities which affects syllabus coverage and quality of graduates . On the issue of career progression and level of education of trainers , the evidence is very clear it does affect the quality of graduates as it produces half baked graduates because you give what you have or paid for. The study therefore recommended provision of motivation to promote quality graduates for quality service delivery and promote employing qualified people for the job with promotion opportunities.*

**Key words:** Challenges, Technical Education, Graduates, Service Delivery.

## **2.8 Not All Was Doom in STEM Teacher Professional Development in the Wake of Covid-19 Pandemic: A Case of Kibabii University.**

Kisiang'ani Bahati & Rose Atieno Opiyo

Corresponding Email address: [dorcaspahati@gmail.com](mailto:dorcaspahati@gmail.com)

### **Abstract**

*Teacher Professional Development (TPD) in Science, Technology, Engineering, and Mathematics (STEM) education is pivotal in boosting a society's economy due to essential careers its professionals occupy in industries. The better part of 2020, Covid-19 pandemic try tested operations of higher education institutions forcing teaching, learning, schedules and daily operations to conform to the new norm. STEM teacher professional Education operations radically shifted into unfamiliar modes- whose effects are yet to be explored This study investigated the impact of Covid-19 pandemic on TPD in STEM education in Kibabii University, and sought to establish student teachers experiences of sudden shift from face-to-face to digital education, and proposed recommendations for University policy makers to support sustainable systems for learning in post Covid-19 pandemic era. It employed a case design, targeting 100 students, 10 lecturers of Biology, Chemistry, and Physics teaching bachelors and master's degree courses, and 10 laboratory instructors as respondents. Cluster, simple random, and purposive sampling techniques were used to select students, lecturers, and laboratory instructors respectively as respondents for the study, to collect data. It included 30 students exposed to Focused Group Discussion (FGD) followed by semi-structured interviews with 4 lecturers and 4 laboratory instructors. Data collected from the discussions with the students and interviews with lecturers and laboratory instructors were analysed qualitatively, under identified themes. Results reveal that online learning led to several benefits for students, such as high lecture attendance, better time management, and flexibility in their studies. However, the shift from face-to-face to online learning caused communication barriers between teachers, students, and instructors, financial constraints and low academic performance. The study concludes that blended learning should be embraced by each party in the bid to improve theory and practice in TPD at the University. However it requires efficient ICT infrastructure, adequate training for all users and effective digital platforms .Recommendations for post-Covid-19 learning therefore include blended learning modes, designed budget for digital learning platforms, unified selection of digital learning platforms across courses, and training support.*

**Key words:** STEM, Teacher Professional Development, Resilience, Higher Education

## **2.9 Facilitator's Role in Professional Learning Communities Working with Mathematics Teachers**

Martin Wanjala

Masinde Muliro University of Science and Technology

Corresponding email address: [msibweche@yahoo.com](mailto:msibweche@yahoo.com)

+254726073324

### **Abstract**

*This paper describes the concept of facilitation in a professional learning community of mathematics teachers. It focuses on the practices and moves of facilitators and the relationship between facilitator moves and depth of content in conversations of a PLC. It also focuses on the differences in facilitator's ability, practices and moves. Data from PLC's of four different facilitators is used to reveal the facilitator's moves and ability to focus on the mathematics content in a professional learning community. The data for this study is based from four learning communities working under the MIPIP project. The project works with mathematics teachers who work together to better understand instructional practice, focus on acquisition of data in terms of evidence from the actual teaching experience, understanding learner thinking behind errors and how teachers handle the errors during instruction (Brodie, 2013). The qualitative data used in the analysis includes audio and video-recordings and transcripts of the sessions analyzed using the studio-code software and presented in terms of script reports and qualitative descriptions. The results show that there were differences in the facilitator's practices and moves and which had an influence on the depth of mathematics content in conversations of a PLC. This report provides information on appropriate and relevant practices and moves for facilitators and the instructional design of professional learning communities.*

**Key Words:** Facilitator moves, roles, professional learning communities  
mathematics



## **SUB-THEME: 3. ACCESS, EQUITY AND INCLUSION IN STEM EDUCATION AND RESEARCH**

### **3.1 Re-entry Policy and Retention of Expectant Students and Teen Mothers in Public Secondary Schools in Vihiga Sub-County, Kenya**

Leonard Latan Imbosa, Eunice Majanga & James Bill Ouda<sup>2</sup>

\*Corresponding Author: Leonard Latan Imbosa

Email: [Latanil300@gmail.com](mailto:Latanil300@gmail.com)

#### **Abstract**

*Vihiga Sub-county, having one of the highest teenage pregnancy rates in Kenya, presented a scenario that warranted an investigation with respect to the re-entry policy. Therefore, the purpose of this study was to establish the impact of the re-entry policy on the retention of expectant students and teen mothers in public secondary schools. The study adopted a descriptive survey research design. Target population comprised of 28 school principals, 28 teachers, and 150 students, one children's officer, one county statistics officer and one sub-county director of education. The study sampled 10 guidance and counselling teachers, 10 principals, 1 children's officer, 1 sub-county director of education, 1 county statistics officer and 50 students who were selected using purposive sampling approach. Data was collected using interview schedules, questionnaires and document analysis. A pilot study was conducted in two schools in Vihiga sub-county, which were excluded from the actual study. Qualitative data from interviews were analyzed thematically and presented in form of quotations and narrations while quantitative data from questionnaires were analyzed using descriptive statistics. The study revealed that the re-entry policy was a major positive step towards achieving retention of expectant and parenting students. However, lack of copies of the policy in schools in Vihiga sub-county substantially affected effective policy interpretation and implementation for optimal retention. The study recommended that the government should disseminate copies of the re-entry policy document in secondary schools, conduct continuous public awareness and closely monitor its enforcement. In addition, track re-integrated learners for appropriate psychosocial, financial and material support both at school and community levels.*

**Key words:** Re-entry policy, Retention, Expectant students, Teen mothers, psycho-social support, Teenage pregnancy.

## **3.2 Gender Dynamics in Placement of Government Sponsored Students to STEM Degree Programmes**

Agnes M. Wahome Christopher Yegon & Victoria Gioto<sup>3</sup>

Kenya Universities and Colleges Central Placement service

Corresponding email address: [ceo@kuccps.ac.ke](mailto:ceo@kuccps.ac.ke),

### **Abstract**

*The sustainable development goals (SDGs) goal number 5 on gender equality envision provision of equal opportunities to all gender in order to ensure full and effective participation in leadership at levels of decision making in political, economic and public life. To achieve this endeavour, a number of initiatives have been identified as critical in creating an enabling environment for equal gender participation. Such initiatives include; legal reforms, addressing retrogressive practices, provision of quality education and training, enabling use of technology particularly Information communication technology (ICT) to promote empowerment. Gender equality has also been infused in others such as Goal number 4 on quality education. The African Agenda 2063 ensures attainment of the full potential of women and youth by delivering seven aspirations. Aspiration number six targeting people driven development where women are fully involved. One of the principles of governance to be adhered in the achievement of the Kenya Vision 2030 is gender equality. The Ministry of Education through Kenya Universities and Colleges Central Placement Service (KUCCPS) is keen in supporting gender equality through education and training by ensuring equal access, equity relevant and inclusive education. Science technology engineering and mathematics (STEM) plays a great role in empowering learners in attaining quality and relevant skills for employment creation to promote social, economic and political development.*

*Global development agenda greatly focuses on Science and Technology education as one of the prioritized sector components. KUCCPS mandate is enshrined in SDG Goal 4 which provides that actors ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Kenya Vision 2030 will not be achieved without involvement of all gender in the uptake of STEM at all levels of education. The Ministry of Education through Kenya Universities and Colleges Central Placement Service (KUCCPS) aims at ensuring equal access, equity and inclusive education in STEM, in order to realize social, economic and political development. KUCCPS contribution through set policies among many is the affirmative action and strategies for instance with STEM mentorship for girls. However, due to poor grades in*

*science subjects at KCSE limiting students from meeting the requirements to pursue STEM courses, this has not been achieved. This has implications on attainment of our International, Regional and National development objectives as well as in achieving gender equity in all opportunities. Objectives: The main objectives of this study is to establish Gender dynamics in placement of Government sponsored students to STEM degree programmes. More specifically the study will establish the uptake of STEM programmes in degree courses and analyse the distribution of students placed in the specific sectors of STEM from 2020 to 2022. Research design: This study will make use of quantitative descriptive research design. Methodology: The Methodology to be used will be a desk review of Secondary data on placement of students under government sponsorship to answer the research questions. The total placement for the cycle 2022/2023 is N=123,963 for degree programme. Scope: The Scope of the study will be GoK sponsored students in public and private universities from 2020 to 2022. It is envisaged that the outcome of this study will make recommendation in the uptake of STEM courses centred on gender aspects.*

### **3.3 A Comparative Analysis of Scores in STEM-Related Subjects Between Female and Male Students at Primary and Secondary School Levels in Kenya**

Epari Ejakait<sup>1\*</sup>, Paul Ogenga Akumu<sup>1</sup>, Geoffrey Ababu Musera<sup>1</sup>, Ronald Werunga Kikechi<sup>2</sup>,

<sup>1</sup>Masinde Muliro University of Science and Technology, Kakamega, Kenya.

<sup>2</sup>Mt. Kenya University, Kenya

Corresponding email address: [ejakait@mmust.ac.ke](mailto:ejakait@mmust.ac.ke)

#### **Abstract**

*Available statistics suggest a low uptake of Science Technology Engineering and Mathematics (STEM) programmes by female students at university level compared with their male counterparts. In 2016 for instance, less than 15% of the students enrolled in universities in Kenya were studying STEM subjects. Out of these, just about 31.37% female students were enrolled in architecture, 22.27 in computing, 16.53% in engineering and 31.84 in math and statistics compared with 68.63%, 77.73%, 83.47% and 68.16% respectively for their male counterparts. As a result, there are policy proposals that aim at having at least 40% of enrolment in STEM programmes at the university being female<sup>3</sup>. The objective of this paper is to*

*compare academic scores between female and male students in STEM-related subjects at primary and secondary school levels in Kenya. We advance the argument that female students comparatively score lower than their male counterparts in STEM-related subjects at primary and secondary school levels. We use HLM on a dataset of 3550 students nested within 720 teachers nested within 120 schools, 30 each in Kirinyaga Central, Nandi South, Gem, and Tetu Sub-Counties to compare scores between female and male students in math and science in the Kenya Certificate of Primary Education (KCPE) examination of 2019. We also use data from STEM intervention programmes in 23 model secondary schools in Rift Valley, Western and Nyanza regions of Kenya to compare scores between female and male students in Math, Physics, Chemistry, Biology and Computer Studies in the Kenya Certificate of Secondary Education (KCSE) examination between 2015 and 2019. Using a three-level hierarchical linear model with 3550 students nested within 720 teachers nested within 120 primary schools, our results suggest that female students score 0.18 ( $p<.001$ ) standard deviation units below their male counterparts in mathematics and 0.21 ( $p<.001$ ) in science. Controlling for secondary school-level variables such as classification, location, teacher experience and qualification, multiple regression results suggest that female students comparatively score below their male counterparts in all STEM-related subjects for the five years under consideration (2015-2019). For Math, their results are lower although not significantly different, statistically, for 2015, 2017, 2019 but are for 2016 by 40.14 ( $p=.016$ ) standardized grade points and 2018 by 80.73 ( $p=.010$ ). Their scores are lower in Biology for the five years although significantly different, statistically, only in 2017 by 97.38 ( $p=.008$ ). Their results are also significantly lower, statistically, in Physics for all the five years under consideration: 2015 by 60.57 ( $p=.003$ ), 2016 by 62.85 ( $p=.014$ ), 2017 by 50.50 ( $p=.016$ ), 2018 by 74.96 ( $p=.039$ ) and 2019 by 85.56 ( $p=.025$ ). This trend is replicated in Chemistry albeit only with significantly lower standardized grade points, statistically in 2016 by 50.05 ( $p=.026$ ). Computer studies is not any different with their scores being lower for the five years under consideration, with only 2017 being significantly lower, statistically by 23.71 ( $p=.011$ ). It is recommended that the teaching of STEM-related subjects at primary and secondary school levels should strive to bridge the achievement gap between female and male students. Further, since physics is the core subject for the engineering cluster of programmes at the university level, female students will continue to be 'excluded' from such programmes if their 'under achievement' in the subject continues unabated at secondary school level. The gridlock in their scores in physics, and indeed other STEM-related subjects should be identified and addressed.*

**Key words:** STEM; Math, Science, Physics, Chemistry, Biology, Computer Studies, Hierarchical Linear Modelling; KCPE, KCSE.

### **3.4 Institution Type, Selectivity, and Financial Aid: An Examination of Institutional Factors Influencing First-Time Students Retention in Public Universities**

Wekullo Caroline S.

Corresponding email address: [cwekullo@mmust.ac.ke](mailto:cwekullo@mmust.ac.ke)

#### ***Abstract***

*First-time student retention has become of greatest priority to higher education administrators seeking to increase revenue from tuition and completion rates. The statistics show that only 40% of first-time students persist from the start of institution to graduation. While decades of research have been conducted to investigate the factors influencing student retention, most of these researches have focused on students' attributes, pre-college characteristics, and socioeconomic. There is significantly limited information on how institutional characteristics contribute to first-time students' retention, yet institutional behavior and environment are key determinants of students' retention and success. Also, institutional administrators and students are increasingly becoming interested in knowing how their institutional characteristics influence student retention. This study examines the effects of institutional type, selectivity and institutional financial aid on retention rates at 4-year public research universities. Using a two-way analysis of variance (ANOVA), the study also examines the interaction effect of institutional selectivity and the percentage of students with financial aid on retention across institution types. The study found institution type to significantly associate with the retention rates in both low and high-selective institutions. High-selective institutions have high retention rates on average. The results of the analysis also showed that the effect of the percentage level of students with financial aid on retention rate does not depend on the institution selectivity level. The study presents significant practical implications for institution leaders, policymakers and students in enhancing student retention and in decision-making process.*

**Key Words:** retention, first-time students, four-year public higher education, institutional characteristics, institution selectivity, ANOVA

### **3.5 Factors influencing Student Completion Rates in Bukura Agricultural College in Western Kenya**

James Okou

Bukura Agricultural College, Kakamega, Kenya

Corresponding email address: james.okou26@gmail.com

#### **Abstract**

*Completion rate is a data point indicating what percentages of students who start an instructional program at school are able to complete (Göritz. 2014). This paper presents a comprehensive study of factors influencing student completion rates in Bukura Agricultural College (BAC). Data was collected using an in-depth telephone interview. The current completion rate established was very low (69.3605%). This low rate indicates late completion, high dropout, high repetition rate or a combination of all these factors (Reiling & Strøm 2015). The main factors identified were (a) Study deferments due to lack of fees-55.40% (b) Examination repeats/retakes-32.60% and (c) Other reasons (Employed in to police and other organizations, joining other Institutions of learning, chronic ailments affecting their general health)-12.00%. Recommendations are made to ensure mechanisms for early detection of dropout cases are put in place and supported to ensure students pursue their training to completion in record time.*

### **3.6 Strengthening Gender Equity in Technical Vocational Education and Training: Challenges and Priorities in Developing Countries**

Rose Nafula Wanjala

Shambarere Technical Training Institute, Department of Agriculture, Kenya

Corresponding Email address: rose.wanajala@gmail.com

#### **Abstract**

*Gender equality is a basic human right. Article 1 of Universal Declaration of Human Rights, adopted by the UN General Assembly stated that "All human beings are born free and equal in dignity and rights". The Beijing Declaration and the Platform for Action adopted unanimously by 189 countries, was an agenda for women's empowerment and is now considered the key global policy document on gender equality. It set strategic objectives and actions for the advancement of women and the achievement of gender equality in 12 critical areas of concern. Economists affirm that there is a high positive relationship between education and development. This relationship is*

*more pronounced when women receive education as it benefits also those they influence economically, politically and socially. Despite the progress made over the years in enhancing access, equity, retention, quality, completion rates and gender parity in education and training in Kenya, the Technical, Vocational, and Education Training (TVET) subsector continues to experience low female enrolment in Science, Technology, Engineering and Mathematics (STEM) based courses .The social and economic trends predicate the need for reforming the TVET Systems in different Developing Countries with a view to have a new development pattern which holds a culture of economically, environmentally and socially sustainable development. Considering the myriad problems facing Developing Countries, TVET is not only important, it is a prerequisite. The strengthening of Gender Equality programmes in education is urgent and aims at improving access and enrolment of women into technical education. This paper analyzes the effectiveness of female participation in TVET STEM courses focusing on establishing the factors contributing to the status-quo in Kenya and how TVET could be used to set priorities and alleviate these problems .Suggestions on the way forward were made. The paper is a desk review of data from online sources published in various journal articles and organizational websites.*

**Keywords:** TVET, Sustainable Development, Gender, Equity, STEM

### **3.7 Teacher Related Factors and Enrolment of Students in Agriculture in Secondary Schools in Kenya**

Eliud Makunda Shikanga, Francis Muyekho1 James Bill Ouda  
Masinde Muliro University of Science and Technology (MMUST), Kenya

Corresponding Author: [shikangaeliud@gmail.com](mailto:shikangaeliud@gmail.com)

#### **Abstract**

*Agriculture is one of the optional subjects done in secondary schools in Kenya. This suggests that students' enrolment in the subject is influenced by a number of factors. This study aimed to establish teacher related factors influencing enrolment in agriculture in secondary schools in Kakamega North Sub-county, Kakamega County, Kenya. The study which was anchored on Behaviorism learning theory and Connectivism learning theory adopted correlational research design and descriptive survey design. The population for the study consisted of school principals, school career masters, agriculture teachers, form three students and Parents. Purposive and*

*stratified random sampling was used to select twenty (20) schools, twenty (20) Principals, twenty (20) career masters, twenty (20) agriculture teachers, 300 form 3 students and twenty (20) Parents Teachers Association (PTA) members. Data from the respondents was collected using questionnaires and interview schedules, while observing the necessary ethical considerations. Data collected was analyzed using Statistical Packages for Social Sciences (SPSS) for windows version 25. Qualitative data was analyzed thematically and findings presented. The study established that teaching approach (63.6%) was major teacher related factor influencing enrolment of students in agriculture. The Chi-square test of independence [ $\chi^2$  (36, N=7) = 42.00,  $p = .007$ ], at  $p \leq 0.05$  level of precision, indicated that there is a statistically significant relationship between teacher related factors and enrolment of students in agriculture. The study therefore recommended that agriculture teachers should employ right instructional approaches in teaching and learning of agriculture to inspire more students to pursue agriculture related careers.*

**Key words:** Teacher Related Factors, Enrolment in Agriculture, Secondary Schools, Kenya

## **SUB-THEME: 4. COLLABORATION AND PARTNERSHIPS IN STEM EDUCATION AND RESEARCH**

### **4.1 Reimagining University Education towards 21<sup>st</sup> Century Competences: Reflections from Kibabii University Students**

Manasi Echaune & Robert Kati

Kibabii University

Corresponding Email Adress: [emanasi@kibu.ac.ke](mailto:emanasi@kibu.ac.ke)

#### **Abstract**

*Sustainable higher education systems require inclination towards quality and relevance. To produce graduates who match the demands of the labour market, there is need to equip them with the 21<sup>st</sup> century competences – the competences are the tools that are universally applied to amplify ways of thinking, working and living in the world. These competences include critical thinking, communication, problem solving, collaboration and digital literacy. This study focuses on establishing the mismatch in university curriculum and the demands for the labour market if higher education is reexamined in view of the 21<sup>st</sup> century. The goal of this study was threefold; (i) to establish the profile of university students in 21<sup>st</sup> century competences, (ii) to examine the extent to which university curriculum equips learners with relevant competences, and (iii) identify transformative practices that will enable university education system to meet the demands of the labour market. The study recommends reforms in university education with a mindset to aligning it to Competency Based Curriculum. This can be achieved by engaging policy makers, industry and practitioners to address competence gaps.*

**Keywords:** transformative practices, university education, 21<sup>st</sup> century competences

### **4.2 Role of TVET Institution in Promoting Jua Kali Sector in Kenya**

Elizabeth Lusweti\*, Edwin Kanda, Faith Gachuhi, Caleb Kibet, Loise Okaya.

Masinde Muliro University of Science and Technology

Corresponding Email Address: [elusweti@mmust.ac.ke](mailto:elusweti@mmust.ac.ke)

#### **Abstract**

*The Jua Kali sector falls under the small and medium enterprises (SMEs) which form the backbone of the Kenyan economy. The sector employs over 30 per cent of the working population and contributes 33 per cent to the country's GDP. The collaboration between TVET and Jua Kali sector*

*is premised on a strong linkage of TVET programs. This cooperation between academia and the informal sector promotes entrepreneurship, innovation and economic development. Despite the Jua Kali sector's prolific contribution to the economy, the sector experiences challenges that prevent the achievement of its full potential. These challenges include access to the market, access to relevant financial services such as pensions, insurance and lack of infrastructure. Also, recognition of skills that Jua kali artisans trained informally has acquired. A major concern about the programs provided by the TVET institutions is the duplication of courses even in communities where they are of no immediate use. Also, there is still largely stereotyping of courses such as dressmaking, home economics and hair-dressing which are recognized as women's courses. Therefore, the review examines the current education framework as adopted in the competency-based curriculum. It focuses on the following objectives; Practical attachment and employment framework for TVET students to the Jua Kali sector, a fit-for-purpose curriculum that recognizes apprenticeship training among Jua Kali artisans. In addition, a broader collaboration between Jua Kali and TVET institutions, through commercial partnership.*

**Keywords:** Jua Kali, Technical and Vocational Education and Training (TVET);

## **SUB-THEME: 5 DIGITAL TECHNOLOGIES, ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND BIGDATA**

### **5.1 E-Readiness in The Application of The Big Five Technologies in Instruction among Secondary School Teachers in Nyamira County, Kenya.**

Moochi, C.N & Makworo, E.O

Kisii University, Kenya

Corresponding Email Address: [cmmoochi@kisiiviversity.ac.ke](mailto:cmmoochi@kisiiviversity.ac.ke)

#### **Abstract**

*Presently, ICTs are deemed as a panacea for achieving quality education. As a result, there is a rush to integrating ICTs in teaching –learning at secondary school level with a view to enhancing the quality of instruction at secondary school level. The paradigm shift from use of antiquated technology to modern technology in teaching and learning processes requires the Kenyan teacher to be adept at employing the latter for quality education. Many studies carried out in Kenya have attributed practising teachers' failure to integrate ICTs in teaching-learning to their ill-preparedness. Their ill-preparedness to integrate ICTs in teaching –learning is a threat to realization of quality education for the education environment is incomplete without ICT systems. The purpose of this study was to establish the extent of preparedness of secondary school teachers in Nyamira County in the use of the five big technologies: computers, email, internet, mobile devices, and smart board in teaching-learning processes. The study was guided by Davis' (1986) Technology Acceptance Model (TAM). The model has two constructs which influence .These are 'perceived usefulness' and 'perceived ease of use'. The target population was 1057 secondary school teachers, whereby samples of 370 (30%) teachers were the study participants. The study revealed that not all teachers are comfortable with using the big five technologies in teaching-learning processes and this is attributed to initial training in educational technology systems .As a result, the study recommends that higher teacher training institutions should intensify their training in ICT technologies with special emphasis on practical to make their graduates ready to employ them in teaching –learning and technophile. In the same vein the study also recommends for in-service training for practising teachers to ensure their e-readiness vis- a-vis application of the big five. This is critical to ensuring that the education environment is technologized /digitized to occasion quality teaching for sustainable economic development.*

**Key words:** ICTs, ill-preparedness, integration, panacea and quality.

## **5.2 Association between Students' Self-Efficacy and Achievement in Electrochemistry When Taught using Software-Oriented Concept Mapping**

Joseph Masinde Wangila

Murang'a University of Technology

Correspondence e-mail address: jossemasinde@gmail.com

### **Abstract**

*This study determined the association between Kenyan students' self-efficacy and their achievement in electrochemistry when taught using taught using Software-Oriented Concept Mapping in comparison to the Conventional Instructional Approaches. The study was based on David Ausubel's Meaningful Learning Theory, and was executed via the Quasi-experimental research design, using non-randomized pretest-posttest control group model. A sample of 400 students and 10 chemistry teachers was selected by multi-stage sampling procedure, through a combination of purposive, proportionate stratified and simple random sampling techniques. The study was piloted two weeks to the actual study, in two secondary schools within Kakamega County. A close-ended questionnaire and a standardized achievement test were used to collect the study's raw data. Both research instruments were assessed for their validity using the Rasch Model, and reliability using the internal consistency alpha coefficients method. The study's null hypothesis was tested inferentially at the 0.05 alpha level of statistical significance, using Bivariate Pearson's Correlation. Findings revealed a weak but significant positive association between students' post test self-efficacy and achievement scores [ $r=.228$ ,  $p<.001$  at  $\alpha=.05$ ]. These findings have important instructional implications in the field of Chemistry education.*

**Key words:** Self-Efficacy, Achievement, Concept-Mapping, Electrochemistry

## **5.3 Building Resilient and Sustainable Systems for STEM Teaching, Learning and Research in Post Covid-19 Era in Kenya.**

Tabitha Nyongesa & Lamek Ronoh

Rongo University, Kenya.

Corresponding Email address: tabithanyongesa@gmail.com

### **Abstract**

*The COVID – 19's impact will be ineffaceable since its arrival. Every institution is facing the dearth of it, especially educational institutions. The paramount role to fight the impact of this pandemic should be played by the scientific and technological community. Educational organizations should evade this darkness and build resilient systems compared to the previous education system. The objectives of this paper were to assess the experience of students using digital technologies in higher learning institutions, identify the perceptions of teachers and learners in STEM and the impact of educational big data and artificial intelligence applications in the post covid-19 era. This study adopted cross-sectional research design using qualitative and quantitative data collection methods. Purposive sampling was used to identify respondents for structured questionnaires. The study found that STEM teaching, learning and research experience has been received with negative and positive attitude. The learners' time management skills and familiarity to technology played a big role due to the flexible environment they work in and the conventional learning methods. The learners and teachers had positive experience tackling research due to the exposure to high end technology like machine learning and artificial intelligence. It's paramount to acknowledge that educational technology has given more students a variety of access to educational material. It has made it even more interesting for them to do their research. The impact of this study is evident that there is need to integrate digital technologies into STEM teaching and learning in higher learning institutions by first training the learners and teachers on how to handle the devices and applications involved. It stands out that STEM units in schools should go beyond laboratory experiments and involve big data and artificial intelligence to enhance practicality in the unseen world. The digital revolution is transforming how students learn and do their research.*

**Key words:** STEM, Technology, Artificial Intelligence, Post Covid-19

## **5.4 Infrastructural and Technical Support for Teachers Use of ICT in Mathematics Instruction in Secondary Schools in Bungoma County**

Moses Mukenya, Wanjala Martin & Beatrice Shikuku

*Masinde Muliro University of Science and Technology*

**Corresponding Email Address:** [mosesmukenya60@gmail.com](mailto:mosesmukenya60@gmail.com)

### **Abstract**

*Technology in general has advanced greatly as more computers and curricular materials for utilization of current technology are now available in schools. However, the utilization of these technological tools is not an integral part of the curriculum. The study investigated the kind of technical and infrastructural support needed for instructional use of ICTs in mathematics. The descriptive survey research design was adopted and involved a target population of secondary school mathematics teachers in the three sub-counties of Bungoma: Kimilili, Bungoma North and Bungoma East. A sample 218 including teachers and heads of departments were selected using proportionate stratified and simple random sampling techniques. Using Yamane's sampling technique at 95% confidence interval; the sample size of 218 was obtained. Data was collected using questionnaires, interview and observation schedules. A pilot study was conducted and the data used to validate the instruments and compute the Chronbach's alpha reliability measure which was found as 0.704 for the instrument. Data analysis involved both descriptive and inferential statistics that included frequencies and percentages, means, standard deviations and the t-test. The findings indicated the need for infrastructural and technical support for integration of ICT tools in teaching and learning mathematics. Therefore the ministry of education should formulate policies that aim at ensuring acquisition of ICT infrastructure including computers, instructional software based on mathematics content, technical support to teachers and professional development of teachers in ICT pedagogy.*

**Key words:** Information Communication Technology, Infrastructure, Technical, Instructions.

## **5.5 Online Teaching and Assessment in Mathematical Sciences: Tools and Quality Assurance Strategies**

Argan Wekesa<sup>1\*</sup> and Mwendwa A. Kaleb<sup>2</sup>

<sup>1</sup>The Cooperative University of Kenya (CUK), School of Computing and Mathematics, Department of Mathematical Sciences, Email:[owekesa@cuk.ac.k](mailto:owekesa@cuk.ac.k)

<sup>2</sup>Masinde Muliro University of Science and Technology (MMUST), School of Education, Department of Science and Mathematics Education, Email:[kmwendwa@mmust.ac.ke](mailto:kmwendwa@mmust.ac.ke)

### **ABSTRACT**

*Although COVID-19 pandemic made the need for remote approaches to engagement of students, faculty and support staff in universities more imminent, the use technology to deliver curriculum was already part of the institutional growth roadmap in many universities including The Co-operative University of Kenya (CUK). According to UNESCO, the closure of learning institutions happened in 191 countries, impacting 90% of the world's enrolled learners as at the end of March 2020. Universities responded by resorting to distance education using numerous media. The World Health Organization (WHO) also advised that institutions ought to find ways of advancing business continuity with the COVID -19 around because longevity of the pandemic is unknown. As universities look to respond rapidly to the exceptional learning environment caused by the COVID - 19, there is an imperative need to look at ways to improve operational efficiency by leveraging on technological innovation in the 21st Century teaching, learning and assessment and also to understand the characteristics, the processes, the outcomes and the implications of online practices. The Co-operative University of Kenya was one the first universities to craft measures that aggressively enabled the institution to sustain continuity of core business to a remarkable extent. This paper provides a write up on lessons learnt through analysis of steps taken by CUK to ensure continuity of learning via its Learning Management System (LMS) and in particular how remote teaching and assessment were conducted for mathematical sciences. The paper outlines measures put in place to provide quality assurance for online teaching and assessment in mathematical sciences. The paper show cases the power of tools in Moodle and how integration with mathematical type setting programs can be adapted to enhance quality of tests and integrity of online assessment. Difficulties associated with poor online teaching infrastructure, inexperience of teachers, the information gap and limited information and resources to all students and the complex environment at home are reported. Lack of mentoring and support and issues related to teachers' competencies in the use of digital instructional formats have been identified. While accounts of how CUK responded to the transition from face-to-face to online teaching are relevant,*

*more needs to be done in this regard. For informed and productive online teaching and learning it is important to learn more about its potential and use and go beyond emergency online practices and develop quality online teaching and learning that result from careful instructional design and planning in Mathematical sciences.*

**Key words:** *Online assessment, Online teaching, LMS, Mathematical sciences, Quality assurance*

## **5.6 Building Resilient and Sustainable Systems for STEM Learning in Post Covid – 19 Era. A Study in Artificial Intelligence in Stem Education**

Briam O. Oguta,

Masinde Muliro University of Science and Technology.

Corresponding Email address: briamoguta1997@gmail.com

### **Abstract**

*As illustrated by Henry Ford in the analogy, innovation does not mean working that the society should work only with what has been the norm, such as finding ways of making horses faster. Sometimes, it is necessary to search beyond the norm, develop new ways of doing things. Instead of making horses faster, build the automobile, which will be faster than the horse and take a person from point A to B faster. These principles and approaches have driven the rapid developments in technology experienced over the years, particularly in the education sector. The mention of Artificial Intelligence (AI) brings to mind a supercomputer, a computer with immense processing capabilities, including adaptive behavior, such as inclusion of sensors, and other capabilities, that enable it to have human-like cognition and functional abilities, which improve the supercomputers interactions with human beings. Different motion pictures have been made to showcase the abilities of AI, such as in smart buildings, such as the ability to manage air quality in a building, temperatures, and playing music depending on the sensed mood of the occupants of the space. Within the education sector, there has been increased application of artificial intelligence, going over and above the conventional understanding of AI as a supercomputer to include embedded computer systems. For example, embedded into robots, AI, or computers and supporting equipment enable creation of robots that improve the learning experience of the student, from the most basic unit of education, early childhood education. The web – based and online education, as enumerated in different studies , has transitioned from simply availing materials online or on the web for students to simply download, study, and do assignments to just pass, to include intelligent*

*and adaptive web-based systems that learn instructor and learner behavior to adjust accordingly, to enrich the educational experience.*

## **5.7 Implications of Integration of Laboratory-Based Instruction on Students' Achievement and Classroom Integration in Learning of Physics in Secondary Schools in Kenya**

Mr. Okono Elijah Owuor<sup>1</sup>, E.A. Abenga E.W. Wangila J. O. Shiundu<sup>4</sup>

Masinde Muliro University of Science and Technology, Kakamega, Kenya

Corresponding Email Address: Okonoelijah67@gmail.com

### **Abstract**

*ICT integration in teaching Physics in Kenyan secondary schools cannot be ignored, given the key roles and benefits that ICT affords the teaching and learning processes. Consistent poor performance in the subject currently witnessed at the Kenya Certificate of Secondary Education (KCSE) level in Physics can be attributed to low student motivation and traditional teaching strategies. For instance, in the years 2016, 2017, 2018 and 2019 Kisumu County registered low mean scores of 4.23, 4.98, 4.67 and 4.10 respectively in Physics in KCSE. Therefore there is need for incorporation of more effective teaching strategies for performance in Physics to improve, and for students' interest and attitude in learning the subject to change. Technology-based or enhanced learning leverages all learners, irrespective of their traits or socio-economic station. This study aimed at establishing implications of integration of virtual laboratory-based instruction (VLBI) on students' learning of Physics in Secondary Schools in Kenya. The study was guided by the following objectives: to establish the effect of VLBI on students' level of interaction in classroom and to establish the effect of VLBI on students' achievement. The study adopted quasi experimental research designs. The Physics Teachers were purposively sampled from each selected school. The sample size was 72 teachers and 358 students, summing up to 430 respondents. The paper propose how students in schools that lack primary learning and teaching resources, can still attain the learning objectives using interactive virtual digital simulations, and have a feel of activities that typically takes place in Physical laboratory settings. The blending of virtual labs in teaching and learning elevated students' classroom interaction, achievement and consequently, interpretation and application of the learned concept.*

**Key Words:** Virtual labs, Classroom interaction, Students' achievement.

## **5.8 Improving Computer Programming Skill of Computer Science Students at University Level**

Aliyi Hassen Mohammed

Samara University Afar, Ethiopia

Corresponding Email Address: [aliyihassen9@gmail.com](mailto:aliyihassen9@gmail.com)

### **Abstract**

*Before nine months ago I identified one of my group learners did not understand well computer programming. I decided to carry out exploratory action research project to find out solution for this problem. To guide my exploration I come up with three different exploratory action research questions. First, what strategies do I use in class to teach computer programming? Second, how often do my students practice computer programming in class? Third, what do students think of strategies I use to teach computer programming? To answer those questions I decided to collect data from peer observation and group focus group interview. I organized focus group of six learners and I selected colleagues to observe me while I am teaching in class for three different sessions. I fond from group focus interview “practical session and tutorial should be enriched with activities, feedback and practice opportunities”. In addition, they said, “approaches and techniques used in teaching should be applicable to the content of programming with different paradigms in order to help us to strengthen our basic problem solving skill”. I found from peer observation student practice programming in class with difficulties but rarely and they have lack of understanding programming syntax and semantics. Students have limited opportunities to practice programming two or three times per week. I received those data from peer observation and focus group interview. With those information, I carried out three key actions: I supported my students by teaching syntax and semantics of computer programming before giving them practical tasks to be exercised. Second, I created different small groups and I assigned tasks to each group. This allowed the students to exchange their insights with each other and increased opportunities for practice. Third, I created a coding club to help them learn together and be creative in programming. After I implemented this for six different sessions. I evaluate the result using peer observation and focus group interview. The result showed me learners were able to understand syntax and semantics of computer programming and my students programming skill and their interest to learn and practice programming increased than before.*

## **5.9 Efficacy of Computer-Based Instruction on classroom Learning environment: A Case of Rural Secondary schools in Bungoma and Kakamega Counties, Kenya**

Wangila Eric & Buhere Pamela

Masinde Muliro University of Science and Technology

Corresponding Authors [wwangila@mmust.ac.ke](mailto:wwangila@mmust.ac.ke) [pbuhere@mmust.ac.ke](mailto:pbuhere@mmust.ac.ke)

Studies indicated that introduction of computers in classroom Instruction is a crucial strategy that facilitates effective classroom interaction and immediate learner feedback. However, such studies have not made exploits in schools in rural areas. Focus was on effects of Computer Based Instruction (CBI) on Students' Perception of the classroom environment among rural secondary school learners in Kenya. A Solomon-four quasi-experimental research design was used to investigate the effects of CBI on students' perception of classroom environment as a dependent measure. Four rural secondary schools were purposively selected from Bungoma and Kakamega Counties with a target sample of 200 students. Convenient sampling was done and respondents randomly assigned to treatment groups. A Student Questionnaire was used to collect information from the students. Data analysis was done using both descriptive and inferential statistics. Descriptive statistics involved the use of means and standard deviations and inferential statistics involved analysis of variance (ANOVA). All tests were conducted at  $\alpha = 0.05$  with the help of a computer program, the Statistical Package for Social Sciences (SPSS) version 11.5 for windows. An F – Value of 117.980 whose significance level was 0.000 indicate that the difference in the perception between the four groups of schools involved in the study was statistically significant at an alpha level of 0.05. The findings reveal that, the CBI develops a more positive perception of the Biology classroom environment among rural school learners than the conventional methods. Further, the findings show that students enjoyed the CBI; they learned from CBI; and they wanted to use CBI more often in class. Findings would help educational researchers, planners and secondary school teachers to successfully design and implement various classroom based innovations; and enable revolutionize classroom learning environment to be more engaging and inquiry based.

**KEY WORDS:** Computer-Based Instruction, Classroom environment, Achievement, Rural Schools

## **SUB-THEME: 6. STEM FOR IMPROVED HEALTH**

### **6.1 Mental Health and Suicidal Ideation among Students of Public Secondary Schools in Kenya**

Ambale C. Kennedy, James B. Ouda & Kenneth Otieno

Masinde Muliro University of Science and Technology, Kakamega, Kenya

Corresponding email address: [kennedyambale68@gmail.com](mailto:kennedyambale68@gmail.com)

#### **Abstract**

*According to the 2017 Center for Disease Control (CDC) report, suicide is the second leading cause of death for ages ten to twenty-four globally. Records kept by the Sub-county Director of Butere Sub-county of Kakamega County revealed that between 2015 and 2021, 74 students attempted suicide while four students committed suicide in the Sub-county. The purpose of the study therefore was to assess the effect of mental health on suicidal ideation among students in public secondary school in Butere Sub-county, Kakamega County, Kenya. The study which was anchored on the Interpersonal Psychological Theory adopted ex-post facto research design. The study population consisted of 2564 form four students from 30 secondary schools, 30 teachers in charge of guidance and counseling, 30 deputy principals from 30 public secondary schools in Butere Sub-County and one Sub-County Director of Education. Purposive sampling was used to select 10 guidance and counseling teachers, 10 deputy principals and 1 Sub-County director of education. Stratified random sampling was used to select students from mixed schools while simple random sampling was used to select students from single gender schools to get 176 boys and 170 girls. Data from the students were collected using questionnaires, while that from the deputy principals, guidance and counseling teachers and the Sub-County Director of Education was collected using interview guide. Suicide prevention strategy 2021-2026 by the ministry of health in Kenya and Suicidal behavior among Kenyan youths-Risk factors and prevalence in secondary schools policy documents were also analyzed. Reliability of the instruments was established using split-half method. Qualitative data was analyzed thematically while quantitative data was analyzed using inferential statistics on SPSS version 25. The hypotheses were tested using simple regression. Study findings revealed that the correlation coefficient was  $r=0.751$  with  $p<0.000$  being statistically significant, therefore concluding that mental health and suicidal ideation are negatively related. Good mental health reduces the chances for suicidal ideation. This research recommended that teachers in charge of guidance and counseling should come up with programs aimed at diagnosing mental health disorders and addressing them.*

**Key Words:** Suicidal ideation, Student, Mental health

## **6.2 Effect of Student's Self-Efficacy, Emotional Intelligence and Motivational Levels on Academic Performance among Learners in Public Day Secondary Schools in Kisumu County**

Kennedy Bota & Judith Minayo Ang'alika

Masinde Muliro University of Science and Technology

Corresponding email address: [minayojudith2@gmail.com](mailto:minayojudith2@gmail.com)<sup>2</sup>

### **Abstract**

*Data on performance of form four candidates of the years 2014, 2015, 2016, 2017, 2018 and 2019 show that Public Day Secondary Schools in Kisumu County posted low quality grades in KCSE examinations. This study determined the effect of the student's self-efficacy, emotional intelligence and motivational levels on their Academic Performance. It used Operant Conditioning Theory of motivation to explain learners' psychosocial experiences. It used a cross-sectional design and targeted 3200 Candidates in 80 Public Day Secondary Schools and 80 HoDs (G&C). Fisher et al., (2003) formula was used to select 313 students stratification sampled while purposive sampling was used to select 80 G&C HoDs. A half split half technique determined Cronbach's Alpha Index. Questionnaires were developed for the students while interview schedules were for HoDs (G&C). Data was analyzed through Frequency Counts and Pearson correlation coefficients. The results showed that Self Efficacy influenced Students academic performance by 32.2% ( $r = .322$ ;  $p = .021$ ). Emotional Intelligence influenced Students academic performance by 35.1% ( $r = .351$ ;  $p = .034$ ). Motivational levels influenced students' academic performance by 32.2%. ( $r = .322$ ;  $p = .011$ ) The study concluded that students seemed to underperform in national examinations due to their low self-efficacy, emotional intelligence and motivational levels. It recommended that educational policy formulators, school administrators, sponsors, local civic leaders, parents should invest more in ways that can improve learners' self-efficacy, emotional intelligence and motivational levels to induce good performance in national examinations.*

**Key Words:** Self-Efficacy, Emotional Intelligence, Motivational Levels, Academic Performance

## **6.3 Prevalence of Depression among Adolescents in Secondary Schools in Kakamega County- Kenya**

Bakesia Grace, Olayo Rose, Mengich Gladys & Opiyo Rose  
Masinde Muliro University of Science and Technology

Corresponding Email address: [gbuluma@mmust.ac.ke-](mailto:gbuluma@mmust.ac.ke)

*Adolescence presents behavioral adjustments related to the hormonal changes. This often makes adolescents susceptible to depression, a condition that's very challenging to diagnose. Secondary-school adolescents have academics, physical as well as the social development tasks to juggle with. Global data indicates that mental disorders record 16% of the worldwide burden of disease and ill health with 10-20% of adolescents suffering from mental disorders. Half of the cases of all mental illnesses kick-off at age fourteen and a number these cases are undetected, unreported and untreated. In Kenya, depression prevalence rate is at 43.7% for the overall population and 57.5% among adolescents. The paper aims to determine the prevalence of depression among school going adolescents. This study adopted descriptive cross-sectional survey design. Eleven questions on depression were asked to the students and mean and standard deviation computed based on Kutterer Adolescents Depression Scale- version 11. The Hopelessness Theory of Depression and Dynamic Equilibrium Theory of Subjective Well-Being guided the study. A simple random sample of 456 secondary school going adolescents aged 15 to 19 years were selected from 76 schools through multistage cluster sampling. Consent and ascent forms were obtained, and an ethical clearance were obtained. Descriptive statistics was used to analyze the prevalence of depression among adolescents in secondary schools in Kakamega County. Most of the students were form 2s in mixed Day Schools. The results showed that the prevalence was at 44.5% with a mean age of the students being 17 years. The study concluded that the depression prevalence rate is high among secondary school students. Ministry of Health and Education need to embrace the timely interventions recommended by the WHO to greatly decreases the numbers and rigor of depression.*

**Key Words:** Adolescents, Depression, Prevalence, Secondary Students, Kenya

## **6.4 Influence of Co-Curricular Practices on Prevention of Substance Abuse among Secondary School Students in Kakamega County – Kenya**

Felistus Nyamoma, Moses Poipoi & Samuel Maragia  
Masinde Muliro University of Science and Technology  
Corresponding Email address: nyamfely@yahoo.com

### **Abstract**

*The critical need everywhere in the 21 century world is to prepare students to lead healthy and fulfilling lives by providing them with relevant educational programmes inclusive of co-curricular practices. For effective learning and career development one requires good health and more so a sound mind. The study evaluated influence of co-curricular practices on effectiveness of substance abuse prevention among secondary school students in Kakamega County. It adopted a cross-sectional survey design and multi-stage sampling techniques. Structured questionnaires, focus group discussion guide and interview guide were used to collect data which was subjected to descriptive and then inferential analysis based on correlation and simple regression model using Statistical Package for Social Sciences. It established that simple linear regression model accounted for 9.7% from teachers and 5.5% from students of the variation in the dependant variable and thus a significant predictor, where  $[F (1, 270) = 15.363, P<.05]$  and  $[F (1, 58) = 6.098, P<.05]$ . It established that at 95% confidence limit co-curricular practices have statistically significant influence on effectiveness of substance abuse preventive intervention. The practices range from competitive games and sports, which has the highest influence, followed by time allocated. This aspect is then followed by frequency of participation, down to stars in co-curricular and lastly clubs. Overall, the study concludes that the success of effectiveness of substance abuse prevention is dependent on co-curricular practices.*

**Keywords;** Co-curricular practices, influence, effectiveness, prevention, substance abuse, secondary school student, health care

## **6.5 Implementing a Competence- Based Programme: A Case for Health Professions Education Programme in MMUST**

Gladys J. Mengich

Masinde Muliro University of Science and Technology

Corresponding email address: [gmengich@mmust.ac.ke](mailto:gmengich@mmust.ac.ke)

### **Abstract**

*Competence is derived from possession of a set of relevant attributes such as knowledge, skills and attitudes, called competencies. A competency is a combination of attributes underlying some aspect of successful professional performance (Gonczi et al, 1993). Defining professional competence is the cornerstone upon which a competency-based programme such as Health professions (medical) education (HPE) is built". The competencies for medical teachers should first identify then included in the curriculum. The aim of this paper is to provide suggestions on implementation of competence-based curriculum (CBC) model after identifying the competencies. The main task is to perform a job analysis and focus on achieving the outcomes. Implementing a CBC curriculum require resources relevant to the outcomes to be achieved. After training, the outcomes should be demonstrated by use of innovative assessment, demonstrations and evidences in a portfolio. Assessments in CBC determine student's performance, to complete the course. Students learning are assessed according to their achievements and acquisition of competencies. To proceed to the next level, there must be demonstration of competencies acquired and identified in the programme. Performance is determined by satisfactory standard of doing the job after training. Therefore, student learning is assessment driven. To implement CBC, there is need to review, plan and design the curriculum. In medical practice, rapid change in disease management may result to new techniques, increase in new knowledge and innovations in patient management. CBC model is relevant in training medical teachers in order to prepare them cope with new approaches of teaching and learning and use of innovative methods of assessment. Therefore HPE curriculum should be designed and implemented using CBC model. Hence, require changes in teaching and learning, assessment methods and instructional materials used.*

**Key words:** Competence-based curriculum, health professions education, competencies

## **6.6 Socio-Economic Factors Influencing Health Care Providers' Psychological Responses During the Covid-19 Pandemic at JOOTRH, Kisumu County, Kenya**

Jared Makori Bundi, Moses Poipoi and Everlyne Morema  
Masinde Muliro University of Science And Technology

Corresponding Email Address: [Makorijared.Jm@gmail.com](mailto:Makorijared.Jm@gmail.com)

### **Abstract**

*Corona Virus Disease of 2019 (COVID-19), an infectious has caused distress among various populations including health care providers. This study aimed to assess the socioeconomic factors influencing health care providers' psychological responses during the COVID-19 pandemic at JOOTRH. 202 health care providers participated in the study. Depression, anxiety and social support were measured using validated tools, PHQ-9, GAD-7 and MSPSS respectively. Pearson chi-Square was used to determine the factors associated with the health care providers' psychological responses at  $p \leq 0.05$ , with Odds Ratio and 95% Confidence Interval determined the strength of the association. There was high prevalence of anxiety and depression among health care providers during the pandemic with overall prevalence of depressive symptoms and anxiety symptoms at 57.4% and 59.9% respectively. Age (OR 0.1,  $p = < 0.001$ ), gender (OR 0.4,  $p = 0.002$ ), marital status (OR 4.2,  $p = < 0.001$ ), level of education (OR 0.5,  $p = 0.019$ ), income level (OR 4.6,  $p = < 0.001$ ), living with partner and children (OR 2.4,  $p = 0.002$ ), living with parent (OR 2.7,  $p = 0.001$ ), employment terms (OR 3.3,  $p = < 0.001$ ), were associated with GAD. With regard to depression, age (OR 0.5,  $p = 0.006$ ), marital status (OR 3.2,  $p = < 0.001$ ), years of experience (OR 0.5,  $p = 0.018$ ), living alone (OR 0.4,  $p = 0.002$ ), living with partner (OR 4,  $p = 0.007$ ), living with partner and children (OR 1.7,  $p = 0.045$ ), living with parent (OR 2.5,  $p = 0.001$ ), diagnosis with COVID (OR 2.8,  $p = 0.001$ ), prohibited cultural practices (OR 2.7,  $p = 0.003$ ), low perceived support from family (OR 2.1,  $p = 0.038$ ), high support from family (OR 0.6,  $p = 0.058$ ) were associated with depression. This study enhanced the understanding of psychological responses among health care providers at JOOTRH during the COVID-19 pandemic.*

## **SUB-THEME: 7 CREATIVE AND INNOVATIVE PEDAGOGIES FOR STEM TEACHING AND LEARNING**

### **7.1 Extent to which Learning Strategies Predict Academic Performance of Primary School Pupils in Migori County, Kenya.**

Sussy Nafula Werunga, Peter Odera and Samuel Maragia

Masinde Muliro University of Science & Technology,, Kakamega, Kenya.

Corresponding E-mail address: [sussywerunga@yahoo.com](mailto:sussywerunga@yahoo.com)

#### **Abstract**

*Learning strategies are important in any learning situation as they enable learners to organize and use particular set skills to accomplish tasks effectively and efficiently to attain high academic performance. In Kenya under performance is associated with a number of factors, for example, understaffing in many learning institutions. In Migori County, the average mean score between 2017 and 2019 in Kenya Certificate of Primary Education was 245.54 (49.11%). This is a low mean score and does not reflect proper learning strategies in the county. The purpose of this study therefore was to examine the extent to which learning strategies predict academic performance of primary school pupils in Migori County, Kenya. The study was anchored on achievement motivation theory and social learning theory. Explanatory sequential mixed method design was adopted. Population of the study was 570 teachers and 30,600 standard eight pupils. Sample size was 440 respondents drawn from 60 teachers and 380 standard eight pupils. Purposive sampling, stratified random sampling and simple random sampling techniques were used. Questionnaire and document analysis guide were employed to collect data. A pilot study was conducted among 10 teachers and 40 pupils. Split-half method was used to determine the reliability and its index was 0.83 for teachers' questionnaire and 0.76 for pupils' questionnaire. The researchers ascertained content and construct validity of the research tools. Quantitative data was analyzed using Pearson's correlation coefficient and regression. Descriptive and inferential statistics were used for quantitative data presentation. Qualitative data was reported as themes and subthemes. The findings revealed that learning strategies such as seeking help and rehearsal were statistically significant to academic performance ( $r=.849$ ,  $p\text{-value} = .005$ ,  $< .05$ ). The study concluded that learning strategies improves academic performance. It was recommended that, cooperative and modelling learning strategies should be adopted and used to improve academic performance of primary school pupils in Migori and other counties in Kenya.*

**Key Words:** Academic Performance, Learning Strategies, Predictor, Pupils

## **7.2 Effective Competency Based Assessment Model for Secondary Schools – Collaborative Approach in Post COVID 19 Era.**

Eliud Oure Oyoo, PhD

Rongo University, KENYA.

Corresponding Email address: [eliud.oyoo17@gmail.com](mailto:eliud.oyoo17@gmail.com)

### **Abstract**

*With the rapidly changing systems of education worldwide, there needs to be availed a collaborative approach that is effective and realistic to the changing trend Post Covid 19. Most of the countries in Africa have their education system still struggling with how to produce competent graduates that can withstand the test of time and the changing job market shift. Partly this will depend on the assessment model adopted in the specific curriculum. Currently, there is over-reliance on summative assessment mode which creates room for a lot of reliability and validity issues. There is therefore need for an alternative approach or model that focuses on competency as well as being learner centered. The main objective of this research is to design an assessment model that produces competent and learner friendly graduands from secondary schools. The research methodology is document analysis of relevant literature and observation. The working principle of this model is that the teacher partners with the learner in the assessment process, the assessment is continuous, varied time span, based on readiness of the learner and very flexible to various situations. The teacher and the learner have to come into agreement on when the assessment will take place and on the method to be used. The teacher will have a score card matrix for each registered learner and the learner will also have learner's score card matrix. Both these tools will ensure that a learner's academic progress can be accessed at any time. Many approaches can be used to assess learner's competency.*

**Key words:** Competency, kills, Collaborations, Assessment.

## **7.3 Online teaching and assessment in mathematical sciences: tools and quality assurance strategies**

Argan Wekesa<sup>1\*</sup> and Mwendwa A. Kaleb<sup>2</sup>

<sup>1</sup>The Cooperative University of Kenya (CUK), School of Computing and Mathematics,  
Department of Mathematical Sciences,  
Corresponding author email:[owekesa@cuk.ac.ak](mailto:owekesa@cuk.ac.ak)

<sup>2</sup>Masinde Muliro University of Science and Technology (MMUST), School of Education,  
Department of Science and Mathematics Education,  
Email:[kmwendwa@mmust.ac.ke](mailto:kmwendwa@mmust.ac.ke)

\*Corresponding author

### ***Abstract***

*Although COVID-19 pandemic made the need for remote approaches to engagement of students, faculty and support staff in universities more imminent, the use technology to deliver curriculum was already part of the institutional growth roadmap in many universities including The Co-operative University of Kenya (CUK). According to UNESCO, the closure of learning institutions happened in 191 countries, impacting 90% of the world's enrolled learners as at the end of March 2020. Universities responded by resorting to distance education using numerous media. The World Health Organization (WHO) also advised that institutions ought to find ways of advancing business continuity with the COVID -19 around because longevity of the pandemic is unknown. As universities look to respond rapidly to the exceptional learning environment caused by the COVID - 19, there is an imperative need to look at ways to improve operational efficiency by leveraging on technological innovation in the 21<sup>st</sup> Century teaching, learning and assessment and also to understand the characteristics, the processes, the outcomes and the implications of online practices. The Co-operative University of Kenya was one the first universities to craft measures that aggressively enabled the institution to sustain continuity of core business to a remarkable extent. This paper provides a write up on lessons learnt through analysis of steps taken by CUK to ensure continuity of learning via its Learning Management System (LMS) and in particular how remote teaching and assessment were conducted for mathematical sciences. The paper outlines measures put in place to provide quality assurance for online teaching and assessment in mathematical sciences. The paper show cases the power of tools in Moodle and how integration with mathematical type setting programs can be adapted to enhance quality of tests and integrity of online assessment. Difficulties associated with poor online teaching infrastructure, inexperience of teachers, the information gap and limited information and resources to all students and the complex environment at home are reported. Lack of mentoring and support and issues related to teachers' competencies in the use of digital instructional formats have been identified. While accounts of how CUK responded to the transition from face-to-face to online teaching are relevant,*

*more needs to be done in this regard. For informed and productive online teaching and learning it is important to learn more about its potential and use and go beyond emergency online practices and develop quality online teaching and learning that result from careful instructional design and planning in Mathematical sciences.*

**Key words:** Online assessment, Online teaching, LMS, Mathematical sciences, Quality assurance

## **7.4 Effect of Kenya Institute of Curriculum Development Virtual Programs on Students' Learning Outcomes in STEM Subjects within public Secondary Schools in the Kakamega South Sub- County**

Aradi Duncan and Wekullo Caroline

Corresponding Email address:

### **Abstract**

*Virtual teaching in STEM at various level has slowly been receiving attention globally. With the outbreak of COVID-19 pandemic, institutions of learning across the world, including Kenya, immediately embraced virtual learning to keep students engaged. However, the extent to which these virtual programs influence students learning outcomes is unknown. Using a sample of 351 students from the selected public schools, the study assesses the effect of Kenya Institute of Curriculum Development (KICD) virtual programs on students' learning outcomes in STEM subjects within public secondary schools. Specifically, the study examines the effect of Kenya Institute of Curriculum Development virtual programs on students' academic achievement in STEM subjects. The results of the one-way analysis of variance ( indicated that using KICD virtual programs has a statistically significant effect on students' achievement in STEM subjects within public secondary schools in the Kakamega South sub-county [ $F_{(7, 347)}=42.34, p=.002$ ] .The practical implications for school administrators, policy makers, and ministry of education are discussed.*

**Key Words:** Kenya Institute of Curriculum Development, students' academic Achievement, STEM

## **7.5 Genetics Problem Solving in High School Testing in Kenya: Effects of Metacognitive Prompting during Testing.**

Aurahh, C. M<sup>1</sup>; Cassady, J.C<sup>2</sup>; & McConnell, T. J<sup>3</sup>.

Masinde Muliro University of Science and Technology<sup>1</sup>

Ball State University, USA<sup>2,3</sup>

Corresponding Email Address: [cmusalagani@mmust.ac.ke](mailto:cmusalagani@mmust.ac.ke)<sup>1</sup>

### **Abstract**

*This study investigated the effectiveness of using metacognitive prompts during testing for improving results in a Genetics Problem Solving Test (GPST). The study, a pre-test post-test, control group quasi-experimental design involving 2x2x2 analysis of covariance (ANCOVA) also investigated the moderating effects of gender and school type. A total of 2,138 high school students purposively selected from seventeen high schools in Western province, Kenya, participated in the study using three validated instruments; Biology Ability Test (BAT), Genetics Problem Solving Test (GPST), and Metacognitive Prompting Questionnaire (MPQ). Findings showed that metacognitive prompting (MP) had a significant effect on students' genetics problem solving ability,  $F(1, 2137) = 10.909, p < 0.001$ . The findings also revealed gender differences, with girls outperforming boys on the genetics problem solving test. Furthermore, a significant interaction between metacognitive prompting and school type showed that students in provincial schools benefited from MPs more than students from district schools. This study established a foundation for instructional methods for biology teachers and recommendations are made for implementing metacognitive prompting in a problem-based learning environment in high schools and science teacher education programs in Kenya.*

**Key words:** Metacognition, Metacognitive Prompting, Problem solving

## **7.6 Comparative Study on Pre-Service Science Teachers' Self-Efficacy Beliefs of Teaching in Kenya and the United States of America; USA**

Catherine Aurahh & Tom J. McConnell<sup>2</sup>

Masinde Muliro University of Science and Technology, Kenya

Ball State University, USA

Corresponding email address: cmusalagani@mmust.ac.ke

### **Abstract**

*This study examined and compared science teacher efficacy beliefs of elementary pre-service teachers in Kenya and U.S.A. by surveying 168 Kenyan and 189 US Pre-service teachers through a cross-sectional survey research design. Data were collected using STEBI-B scale, an inventory developed by Enochs and Riggs (1990), with a reported Cronbach's Alpha coefficients as 0.90 and 0.76 for Personal Science Teacher Efficacy (PSTE) and Science Teacher Outcome Expectancy (STOE), respectively. Data were analysed both descriptively (means and standard deviations) and inferentially using a 2 x 2 factorial MANOVA. The dependent variables were PSTE and STOE scores. The independent variables were participant gender and country of origin. Results indicate a significant interaction between gender and country. There was a significant main effect for country but not for gender. With a significant MANOVA, follow-up univariate ANOVA tests indicated a statistically significant difference in the PSTE with USA scoring higher on average and a significant difference in the STOE score with Kenya scoring higher. Implications for teacher education programs are discussed.*

**Keywords:** Elementary; Pre-service; Self-efficacy; science education; teacher education

## **7.7 Teacher and student perception of the Influence of Examination on Students' Motivation and Academic Achievements in Public Secondary Schools in Kakamega County, Kenya**

Hellen Lumadede,m John O. Shiundu & Moses W. Poipoi.

### **Abstract**

*Globally, examinations are a key component of the education system. There is high frequency of tests and examinations in Kenyan education system yet countrywide examination results have been dwindling. The purpose of this study therefore was to establish the teacher and student perception of the influence of examinations on students' motivation and academic achievement. Specific objectives were to; establish teacher perception of the influence of examination on students'*

*motivation; determine teacher perception of the influence of examination on students' academic achievement; establish students' perception of the influence of examination on their motivation; determine the student perception of the influence of examination on their academic achievement; establish the relationship between the frequency of examinations and motivation; to determine the relationship between the frequency of examination and academic achievement and lastly to establish the relationship between student motivation and academic achievement.* Victor Vroom's' *Expectancy Motivation Theory* and Lewi Kurti's *Field Theory* guided the study. Target population comprised of 3970 form four students, 1478 teachers, 389 DoS and 1 CDE. Simple random sampling, purposive, stratified and saturated sampling techniques were used to sample 331 teachers, 72 Director of studies, 694 Students and 1 County Director of Education, respectively. Descriptive survey and correlational research designs were adopted. Data collection instruments were questionnaire, document analysis guide, focus group discussion guide and interview schedule. Data analysis comprised the use of descriptive statistics; percentages, means, frequencies and standard deviations. Inferential statistics included the use of collinearity tests, linear regression, Analysis of variance, Pearson-Product Moment correlation-coefficient ( $r$ ) and Multivariate regression. Qualitative data was transcribed, analyzed and reported according to themes and verbatim. The study revealed that teacher and student perception of the influence of examinations on students' motivation and academic achievement is significant; The study recommended that better approaches of handling examinations and strategies that promote student motivation and academic achievement be adopted especially in the radical changes taking place in education. Therefore, it is hoped that the study may be useful to the Ministry of Education, Kenya National Examination Council, policy makers, teachers, parents, psychologists, and students.

**Key Words** Academic achievement, Examination, Motivation

## **7.8 Environmental Education Pedagogy and Students' Achievement in Sustainable Conservation of Environment in Secondary Schools in Narok County, Kenya**

Songok Ruth Jepchirchir & Ongunya Raphael Odhiambo

Masinde Muliro University

Corresponding email address: rsongok@mmust.ac.ke

### **Abstract**

*Pedagogical factors are essential in creating a productive learning environment which leads to greater academic achievements. Over the past recent decades, developing countries have struggled*

*to break loose from the trap of poverty, diseases and underdevelopment as a result of environmental degradation. Initiatives have been undertaken since 1960s as a response to environmental challenges including adoption and implementation of the NEPAD Action plan specifically Environmental Education (EE). With EE in learning institutions, learners are equipped with knowledge, attitudes, motivations, commitments and skills to work individually and collectively towards solutions to current problems and the prevention of new ones. In Kenya for example, EE has been incorporated into various subject areas in secondary school curriculum. The EE pedagogical strategies are designed to enhance student's participation in management and conservation of the environment. However, the results are not encouraging. The rate at which the environmental resources are degraded is alarming. The net loss of African forests is at 5.3 million hectares corresponding to 0.78% annually. In Narok County, the continued destruction of Mau forests has led to increased loss of biodiversity, soil erosion and water crises. This puts to doubt the ability of secondary school students to sustainably conserve the environment despite the fact that every year students graduate from form four having learnt EE. This therefore suggests that there may be a discrepancy between EE pedagogical strategies and students' achievement in sustainable conservation of environment. Furthermore, little information seems to exist regarding this scenario. This paper will therefore establish the influence of environmental education pedagogical strategies on students' achievement in sustainable environmental conservation at secondary schools in Narok County, Kenya.*

*Key words:* Environmental Education, pedagogical strategies, achievement, conservation

**SUB-THEME: 8 CLIMATE-SMART AGRICULTURE:  
LEVERAGING ON STEM IN THE CONTEXT OF AGENDA  
2063**

**8.1 Sustainable Agriculture: Leveraging Artificial Intelligence Systems in  
Kenya's Agri-food Supply chain**

Enock Gideon Musau

Kisii University Kenya

Corresponding Email address: email:enockmusau@kisiouniversity.ac.ke

**Abstract**

*The agro-food supply chain remains central to the desire by the sustainable development goal no. 2 for zero hunger and sustainable agriculture. Yet Kenya's agri-food supply chain experiences high post-harvest loss due to costs incurred mainly in the first and last-mile logistics. These challenges are being experienced in an era where technology continues to offer avenues for innovativeness and efficiency. Therefore, this report research paper examines how Artificial Intelligence (AI) can improve the agri-food supply chain in Kenya. Specifically, by building on existing information, this paper seeks to underscore the utility of AI in monitoring and controlling farmland outputs, improving supply chain logistics, and addressing fraud and counterfeiting in the chain. The report demonstrates how the Kenyan agri-food supply chain stands to benefit from AI systems and concludes that an end to hunger and the provision of sustainable agriculture requires a change in operations in the agri-food supply chain, including automation and machine intelligence.*

**Keywords:** Agri-food supply chain, Sustainable agriculture, Artificial intelligence, Leveraging.

## **SUB-THEME: 9 THE ROLE OF CREATIVE ARTS, LANGUAGES, AND SOCIAL SCIENCES IN PROMOTING STEM TEACHING AND LEARNING**

### **9.1 Errors in Essay type Writing.**

Akinade, Legitimization Amos

English Language Teacher, Nigeria

Corresponding email address: [amosakinade@gmail.com](mailto:amosakinade@gmail.com),

#### **Abstract**

*The need to enhance good and quality essay writings amidst learners who are within the age of twelve to fourteen prompted the classroom action research which was geared due to the poor performance of my learners in their essay writing. For this research, four exploratory questions were designed, and reflective journal and interviews were adopted as instrument of data collection. However, the research made it known that lack of essay skill and poor reading habit make learners commit a lot of errors. Examples of which are lack of context points, grammatical errors, and improper punctuations. It was equally found out that some learners do not have the ideas of what to write, while those with ideas lack the proper structuring of the ideas into coherent essay. To proffer solutions to the identified problems, I developed an essay outline on principles of good writing, teacher modelling, writing frame and template, and I equally encourage peer feedback in order to expose learners to grade level reading such as newspaper, magazine, storybooks and journals. All these were carried out within six lessons, and the action plan was evaluated using learners' interview at the end of the intervention and two peer observation during and after the intervention. Conclusively, the research revealed that the poor performance of many learners in essay type writing is not a matter of constant practices as many teachers would think, but it is a matter of identifying learner' problem and applying needed strategies that are helpful in bringing about the desired changes in learners' essay performance.*

## **SUB-THEME: 10 CONTEMPORARY ISSUES IN SCIENCE, TECHNOLOGY AND SOCIETY**

### **10.1 Influence of Household Level of Education and Incomes on Food and Water Security in Turkana County, Kenya**

Kaleb A. Mwendwa<sup>1</sup> and Milton B. Adieri<sup>2</sup>

<sup>1</sup> Masinde Muliro University of Science and Technology,

<sup>2</sup> University of Nairobi, Institute of Population and Development Studies,

Corresponding email address: [kmwendwa@mmust.ac.ke](mailto:kmwendwa@mmust.ac.ke)

#### **Abstract**

Globally, food and water insecurities have become a concern for studies since these have been major impediment to economic development. Semi-arid areas are not only climate change exposure hotspots but also a hotspots of climate change impacts because of the unique biological, environmental and socio-economic attributes. There is need for researchers and practitioners to not only pay attention to ecological variables but also the social ingredients that influence food and water insecurity. Studies conducted in these areas seldom include education levels in analysis of social ingredients that influence the dual insecurities. The cross-sectional study with mixed-method in its design was used. Qualitative data collection methods used were used to capture the ideas and lived experiences of knowledgeable stakeholders as regards, water and sanitation; food security and consumption coping strategies; drivers of water and food insecurity. Questionnaires were administered to a total of 442 households (235 male; 177 female) of pastoralists and agro-pastoralists in Turkana Central (TC) and West (TW) sub-counties. The 17 constructs of food insecurity variables were re-coded into binary (0 'Food Secure HHs' and 1 'Food Insecure HHs') outcome where '1' indicated absence of food security i.e. food insecurity and '0' showed food security households. Water insecurity was measured using 7 variables, where the respondents were asked these questions with responses as yes or no and then during analysis, the correct score was assigned water insecure (1) and incorrect score was assigned water secure. 60% -66% of the respondents had some primary education or no education at all in both counties while 24.2% and 8.6% had completed primary school in TC and TW sub-counties respectively. 36.3% and 30.9% of the HH respondents in TC and TW respectively had average monthly income of >1000≤5000 Kenya shillings. Only 2 variables (HH farmers who are pastoralists and/or secure and timely access to fertile land, water and ecosystem services; Farmers

pastoralists who grow climate adapted crops/ breeds) are statistically associated with food insecurity in TC subcounty as compared to 9 variables in TW sub-county that were statistically associated and significant with food insecurity at p-values of \* $p<0.05$ , \*\* $p<0.01$  and \*\*\* $p<0.001$ . In TC subcounty, three water variables were associated with level of education at the household level. They are; treating or filtering drinking water, storing water separately for drinking and washing or cleaning. Unlike in TC, TW Turkana had four variables including the overall water insecurity that are associated with level of education. A household monthly income is strongly associated with severe food insecurity where households with monthly income of at least KES 1000 is 0.5 [95% CI; 0.281, 0.786] times less likely to experience severe food insecurity in Turkana Central but in Turkana West, Household level of income has no effect on the severity of food insecurity . In relation to household head's level of education, irrespective of the sub county it does not influence the severe food insecurity. Therefore, food insecurity is normal at the household level in Turkana County irrespective of level of education of the household head. These results suggest that the number of livelihood sources, education and age of the household head are some of the key determinants of food and water insecurity among the agro-pastoralists.

**Key words:** Education levels, Food Security, Household income, Water security

**10.2 The Influence of Adolescents' Popularity on Academic Performance in Secondary Schools: A Case of Baringo North Sub-County, Baringo County, Kenya**

Sharon J. Rutto<sup>1</sup>, Richard Bosire Ochanda Okero<sup>2</sup>.

Kapropita Girls High School;

Moi University, Kenya

Corresponding email address: [sharonrutto87@gmail.com](mailto:sharonrutto87@gmail.com)

**Abstract.**

Adolescence is a stage during which individuals tend to be highly concerned with their social status in groups. Adolescents may desire to be popular among their peers but at the same time concentrate on their academic performance. This study sought to determine the influence of internal factors of adolescents' popularity on academic performance. The study was guided by goal-framing theory applying the Ex-post facto design. Purposive, proportionate and simple random techniques were used to obtain the

sample. The target population was 8694 secondary school students, out of which 383 were sampled. Data was generated by using students' questionnaires whose reliability was established to be 0.770. The study employed both descriptive and inferential statistics. Pearson correlation coefficient and multiple Linear Regression analysis was conducted at significant level of  $\alpha= 0.05$ . Data analysis was done with the aid of Statistical Package for Social Sciences (SPSS) version 26. The study established that internal factors of adolescents' popularity had a positive significant influence on academic performance of students in secondary schools in Baringo North Sub-county with correlation coefficients of ( $r = 0.547, p < 0.05$ ). The study recommends that as a matter of urgency, guidance and counselling is a critical requirement for adolescent students to mitigate against popularity negative effects on academic performance.

**Keywords.** Adolescent, Internal/External factors, Popularity, Academic Performance.

---

#### **SPECIAL THANKS TO:**

**Dr. Peter Wanyaga Muthoka, EBS, MBS, FKIM, D.ML, MA(ED), BA (Hons)**  
Chancellor, MMUST

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

**Prof. Solomon Shibairo**  
Vice Chancellor, MMUST, the Host

Keynote Speakers  
Invited Guest Speakers  
Invited Moderators and all the participants

## TECHNICAL AND SCIENTIFIC TEAM



Dr Catherine Aurah  
Chair STEIMIC & Local Organizing Committee

Prof Kennedy Bota  
Co-Convenor, Local Organizing Committee



Dr Teresa Akinyi Okoth  
Chair, Secretariat Sub Committee

Dr Paul Akumu Ogenga  
Chair, Scientific Sub Committee



Dr Rose Atieno Opiyo  
Chair, Logistics Sub Committee



Mr Victor Dinda  
Chair, ICT & Hosting Sub Committee



Dr Ronald Michieka  
Chair, Open Con Sub Committee



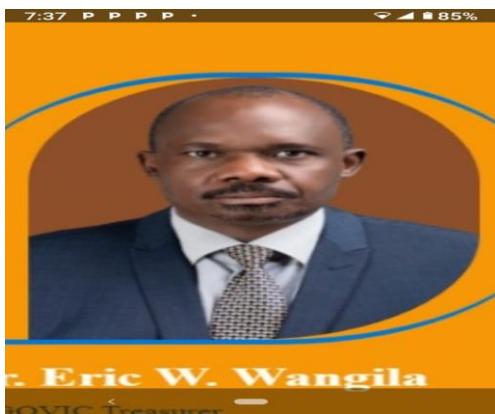
Chair, Publishing Subcommittee



Prof Alice Ndiemma  
Member Hosting committee



Dr Caleb Mwendwa Member Secretariat



Dr Erick Wangila  
Member Sienctific Sub Comittee