



MINISTRY OF EDUCATION

2023 COSMED-X

10th International Conference on
Science and Mathematics Education

"Reigniting the Passion for Innovative Teaching of
Science and Mathematics in the VUCA World"

30 October – 2 November 2023

SEAMEO RECSAM, Penang, Malaysia



PROGRAMME & ABSTRACTS

Programme and Abstracts

OF THE 10TH INTERNATIONAL CONFERENCE ON SCIENCE
& MATHEMATICS EDUCATION

*Reigniting the Passion of Innovative Teaching of Science and
Mathematics in the VUCA World*

30 October – 2 November 2023

SEAMEO RECSAM, Penang, Malaysia



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10th International Conference on Science and Mathematics Education
Programme & Abstracts

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Message from the President, SEAMEO Council



Assalamualaikum.

On behalf of the SEAMEO Council Members, I extend my warmest greetings to the keynote speakers, guests, and delegates of the **10th International Conference on Science and Mathematics Education** in Penang, Malaysia. This is a platform for policymakers, curriculum planners, and researchers to discuss the impact of technological disruptions on education and teaching math and science. As educators, we are responsible for shaping the minds of our learners to develop creativity, critical thinking, and problem-solving skills. Teaching strategies must be responsive to changing times, fostering a culture of research, experimentation, and innovation. Together, let us help our ASEAN learners develop agile thinking mindsets, enabling them to become better problem solvers, strategic thinkers, and wise leaders in the future. I sincerely thank and congratulate the SEAMEO Regional Centre for Education in Science and Mathematics and our conference partners for the success of this conference.

Let us collaborate to advance math and science education in Southeast Asia. Shukran.

Sara Zimmerman Duterte
SARA Z. DUTERTE
Vice President of the Philippines
Secretary of the Department of Education

Message from the Director, SEAMEO Secretariat



I would like to express my appreciation to SEAMEO RECSAM for their efforts in hosting the Tenth International Conference on Science and Mathematics Education (CoSMEd-X) in 2023. This conference demonstrates the Centre's unwavering dedication to advancing science and mathematics education in Southeast Asia and beyond. As the theme of this year's conference is "Reigniting the Passion of Innovative Teaching of Science and Mathematics in the VUCA World", the 10th International CoSMEd-X 2023 has once again served as a platform for educators and researchers to share scholarly papers and engage in discussions with significant matters concerning the advancement and restructuring of science and mathematics education in the volatile, uncertain, complex, and ambiguous (VUCA) world. This conference serves as a platform for the expansion of our network and partnerships. We are confident that CoSMEd-X 2023 will provide a significant opportunity for the exchange of research findings and innovative ideas, the dissemination of best practices, as well as facilitating meaningful interactions between individuals. The interconnection between creative teaching and the VUCA world arises from the fact that an innovative and relevant education imparts individuals with the necessary competencies, abilities, mentality, and adaptability to excel in such an environment. It is imperative to rekindle the enthusiasm for innovative pedagogy in the fields of science and mathematics, as it plays a crucial role in empowering individuals, fostering social advancement, and enhancing global competitiveness. It prepares students to thrive in the 21st century, address complex challenges, and contribute to a better future for everyone. In an environment characterised by volatility, uncertainty, complexity, and ambiguity (VUCA), the pace of change is notably rapid. Innovative pedagogical approaches have the potential to cultivate a deep appreciation for the process of acquiring knowledge. When science and mathematics are presented in an interactive and innovative manner, students are more inclined to cultivate a sustained fascination with these disciplines throughout their lives. The enthusiasm for acquiring knowledge exhibited by individuals can transcend the boundaries of formal education and manifest in their prospective professional endeavors as well as their personal spheres.

I hope that the events will be intellectually stimulating. As we commence this intellectual expedition, let us wholeheartedly adopt the ethos of receptiveness, inquisitiveness, and collaboration that has led us to this extraordinary occasion. We should actively pursue the opportunities available to us in order to acquire knowledge, engage in meaningful exchanges, and establish enduring relationships. I extend my well wishes to SEAMEO RECSAM and its conference partners for a successful CoSMEd-X 2023. I hope that all attending delegates will encounter a fulfilling and rewarding experience as they strive for excellence in the field of science and mathematics education.

Datuk Dr Habibah Abdul Rahim
 Director
 SEAMEO Secretariat

Message from the Centre Director, SEAMEO RECSAM



I am pleased to extend our warmest greetings on behalf of the Committee Members as you embark on this exciting journey of knowledge sharing and collaboration to the Tenth International Conference on Sciences and Mathematics Education (CoSMEd-X) 2023. In addition to providing a forum for regional networking with other educators who share similar interests and challenges, the conference aims to bring together academicians, educators, and pre-service teachers in the region to exchange perspectives on possible future trends and pedagogical innovations in science and mathematics education. The 10th CoSMEd 2023 theme is "*Reigniting the Passion for Innovative Teaching of Science and Mathematics in the VUCA World.*" It is essential that educational paradigms change to reflect the VUCA (Volatility, Uncertainty, Complexity, and

Ambiguity) reality in order to adequately educate students for the opportunities and difficulties of the contemporary world. The themes highlight the imperative need to reinvigorate the enthusiasm of educators and students for teaching and learning Science and Mathematics by employing innovative and adaptable methods that empower students to excel in a world characterised by constant change, uncertainty, complexity, and ambiguity. This conference provides a forum for educators, researchers, and learners to rekindle their enthusiasm for improving their teaching and learning skills, stay ahead on educational trends, network with peers, and gather strategies for addressing the challenges posed by a rapidly changing and uncertain educational landscape. The passion for Science and Mathematics may have waned over time, and it is essential to reignite this passion in order to make the subjects more engaging and effective. It suggests moving away from traditional, rote-based tactics and towards more modern and dynamic strategies that will resonate with students in the VUCA era. The significance of using creative, forward-thinking, and unconventional approaches to teach mathematics and science is highlighted by innovative teaching. Your presence demonstrates your sincere interest and dedication to improving science, mathematics, and technology education for sustainable living. I hope you enjoy the Conference activities, social events, and the sights and sounds of Penang. I would like to thank the Ministry of Education Malaysia, keynote speakers, paper presenters, participants, partners, collaborators, sponsors, and exhibitors on behalf of RECSEM Management and Staff for your invaluable contributions that helped make the 10th CoSMEd 2023 a huge success.

Dr. Shah Jahan Bin Assanarkutty

Centre Director
SEAMEO RECSAM
30 October 2023

10th International Conference on Science and Mathematics Education

Conference Theme

"Reigniting the Passion of Innovative Teaching of Science and Mathematics in the VUCA World"

Conference Rationale

We believe one of the many ways to rediscover and reignite the passion for teaching is to connect and collaborate with others who love teaching. Through these connections, one may continue to grow and try new strategies. We hope to gather 200 in-service and pre-service educators from the SEAMEO region to participate in this conference.

Conference Objective

1. To bring together regional academicians, educators, and pre-service teachers in exchanging insights on potential future trends and pedagogical innovations in science and mathematics education.
2. To serve as a platform for regional networking with other educators with similar interests and challenges, as well as sharing their best practices

Conference Scope

The scope for this conference includes, but is not limited to:

- Teacher competencies and capacity development in Science and Mathematics education
- Partnership in Science and Mathematics education
- Teachers' leadership in Science and Mathematics education
- The future trends and innovation in Science and Mathematics education
- Best practices in sustaining the quality of Science and Mathematics education in the VUCA world
- Advancement of technology in teachers' transformation

Conference Strands

The strands for this conference include, but are not limited to:

1. Passion for Innovative Teaching

- Experiment with different teaching style
- New and creative teaching method
- Techniques to engage student
- Enhance the learning

2. Teaching and Learning in VUCA world

- Adoption to changes
- Foster Creativity
- Emphasize adaptability

3. Classroom Best Practices

- Create a positive learning environment
- Incorporate active learning
- Works in particular situation or environment
- Build relationship

4. Inclusivity and Equality in Education

- Provide a diverse and inclusive curriculum
- Foster a safe and welcoming environment
- Encourage student voice

Pre-Conference Workshop Speakers & Conference Keynote Speakers

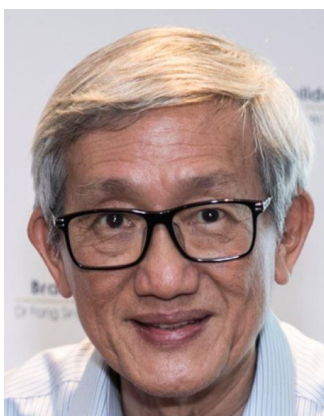


Dr. Janchai Yingprayoon
Demonstration School, Thaksin University, Phatthalung Campus,
Phatthalung, Thailand

Dr. Janchai Yingprayoon is currently the Assistant Professor and Deputy Director, Demonstration school, Thaksin University, Phatthalung Campus, Phatthalung, Thailand. He obtained his Doctor of the Things of Nature (Dr.rer.nat.) in Laser Physics from the Free University of Berlin, Germany. He served as the President of the International Council of Associations for Science Education (ICASE) from 2004 - 2007 and was awarded Distinguished Service Award from ICASE in 2013. Dr. Janchai is a well-known international speaker in science education and has been invited to speak as the keynote speaker and training workshops in different countries around the world. His creativity and great sense of humour make learning science fun and meaningful as it sparks and expands the mind's curiosity. He is particularly interested in teaching science with toys and hands-on activities for children of all ages.

Dr. Graham Walker
Australian National University, Australia

Dr Graham Walker is a science communication teacher, researcher and practitioner based at the National Centre for the Public Awareness of Science (CPAS) at the Australian National University. His work focusses on the interface of science communication and informal STEM learning, capacity building and co-development, emotion and motivation, and communication of social and environmental issues, particularly in settings like science centres, science shows and hands-on workshops. Graham's capacity building initiatives have taken him throughout the Asia-Pacific, Africa and the Middle East, including founding *Science Circus Africa* which has trained more than 500 staff and reached 73,000 people in 10 African countries. He is an avid aficionado of science shows and has performed shows and delivered training globally.



Dr. Fong Ho Kheong
BrainBuilder Academy Pte Ltd, Singapore

Former Associate Professor of the National Institute of Education, Singapore for 24 years and was awarded twice as the best lecturer in the School of Sciences. During the tenureship, he founded the Association of Maths Educators, Singapore (AMES). He is presently in the Board of Governors of Paragon International and Private Schools and the founder and MD of BrainBuilder Academy, Singapore. Dr Fong obtained his Ph D from King's College London, University of London. His Ph D thesis is on research and curriculum development focusing on primary maths education. Dr. Fong has been involved in designing innovative Maths tests and assessments for school examinations and competitions. He has published more than 100 journal articles and school Maths text books. His series of maths text books have been adopted for use in many schools in more than 50 countries globally including in the USA, UK, France, Canada, Spain, the Netherlands, the Middle East and South East Asia. His maths series are also translated into other languages such as Spanish, Chinese and Arabic. His latest 4th edition of MPaH Maths Series has included activities that promote critical and creative thinking skills and teaching children to practice metacognition.

Dr. Wanty Widjaja
Deakin University, Australia

Wanty Widjaja is an Associate Professor in mathematics education at Deakin University, Australia. She is the Associate Head of School for International and Engagement of Deakin's School of Education. Wanty's research focuses on understanding complexity of classroom practices and examining ways to support teacher professional learning and student mathematical reasoning. Two recent and notable Category 1 and 2 grant successes are Australian Research Council (ARC) Discovery Project Primary teachers' adaptive expertise in interdisciplinary maths and science (2021-2024, \$291,422) and Secondary Mathematics and Science initiative for out-of-field teachers funded by Victorian Department of Education. Prior to joining Deakin in 2012, Wanty worked as a teacher educator in Indonesia, and she spent one year as a visiting academic at National Institute of Education in Singapore (2011-2012). She is an active researcher and collaborates with colleagues from the Netherlands, Singapore, Taiwan, Malaysia, and Indonesia on design-based research, mathematical modelling, Lesson Study, and STEM education. Wanty's research is driven by her passion to transform pedagogical approaches in mathematics classrooms. Wanty was involved in delivering professional development sessions for numeracy coaches for networks of schools in the former Western Metropolitan Region in 2013 and for primary mathematics specialists (PMMS) programs in 2015, 2018, 2020, and 2022.



Dato' Dr. Mehander Singh
Connecting Dots Learning (CDL), Malaysia



Dato' Dr. Mehander Singh retired from the civil service in October 2019, with his final position as the Director of *Institut Aminuddin Baki*, Ministry of Education Malaysia (MOE). Dr. Mehander currently supports various organizations as an Education Advisor, which includes the role of Coordinator (Educational Leadership & Management) with Connecting Dots Learning (CDL), an establishment initiated to support the development of education in Malaysia. He began his career in 1980 as a teacher and later served as a lecturer in a number of institutions, including the Royal Military College, Teacher Education Institute and *Institut Aminuddin Baki*. Dr. Mehander who hails from Batu Gajah, Perak completed his teacher training at the *Maktab Perguruan Ilmu Khas* in 1979. He then pursued his Bachelor of Education degree at University Putra Malaysia and later continued with his Master in Education at the University of Houston, Texas in 1994. Dr. Mehander received his *PhD* from University Science Malaysia in 2005. Among his many contributions in education, is his lead role, expertise and ideas in the preparation of the Malaysian Education Blueprint 2013-2025 as one of the specially selected Lab leaders. For his various contributions and services to education, Dr. Mehander was awarded the *Darjah Dato' Paduka Mahkota Perak (DPMP)* which carries the title of *Dato'* by his HRH *Paduka Seri Sultan Perak* in November 2019. In January 2023, Dr. Mehander was appointed as a member of the National Advisory Council on Education by the Honorable Minister of Education, Malaysia.

Professor Dr. Kenneth Phoenix Quah
Metaverse Universe (MVU) Holdings / Phoenix Asia Academy of
Technology, Malaysia

Professor Dr. Kenneth has over 22 years of experience in Higher Education Industry in international education development, teaching, recruitment, training, and managing students. He has more than 20 years of marketing experience in diverse countries such as China, Indonesia, Malaysia, Korea, Mongolia, Iran, Africa Region, South Asia Region & Middle Eastern countries. He has lived in Beijing for over 11 years and traveled to more than 150 cities in China while managing over 200 student recruitment agencies. Since then, he has recruited more than 10,000 international students to Malaysia. He has had enormous success in building international relations, university collaborations, and franchises in Asia. His long-standing career throughout these years and passion for education have inspired him to set a goal in promoting student education internationally across Asia. Mr. Kenneth has also invested his time and resources for more research to develop metaverse technology in education. In the near future, it can be foreseen that teaching and learning would be held in the metaverse. As such, the Metaverse University LLC was established in the United States in January 2022 to deliver education in metaverse. This direction was proven right when the company was recognised as the First Metaverse Universities Campus in Malaysia by The National ICT Association of Malaysia (PIKOM). Mr. Kenneth and his companies has been leading the way in Malaysia to promote teaching and learning in education.



Dr. Mark Tee
Swinburne University of Technology Sarawak Campus, Malaysia

Dr. Mark Tee is a Researcher, Digital Learning Technologist, and Lecturer at Swinburne University of Technology Sarawak Campus. He received his BSc(Hons) in Computer Science from Coventry University in 2005 and served and intermittently contracted in the software development industry until 2018. He completed a Masters in Software Engineering (OUM) and a BEng(Hons) from Swinburne University of Technology Sarawak by 2014. He completed his PhD candidature at the same university in 2018 and joined the Faculty of Engineering, Computing and Science as a Lecturer in the following year. He organized and headed the IoT4Community project as a knowledge transfer initiative for raising awareness of the Internet of Things (IoT) amongst the general public since 2021. He currently holds professional memberships in IEEE, EA, ACS and MBOT, and is an instructor for CCNA and Keysight certification programmes. His doctoral research focused on developing a real-time multi-sensor fusion model for augmenting the human-following navigation of indoor companion robots. His previous activity areas include computer game development, drone technology applications and assistive robotics for injury prevention. Today, he continues to pursue research and industrial applications of IoT, Deep Learning, Assistive Robotics, and Virtual Reality.

Pre-Conference Workshop Sessions on 30th October 2023

Schedule of Pre-Conference Workshops

Science Workshops

Science Workshop #1 | 30 October 2023 (Monday) | Venue: Science Lab 2

0815 – 0900	Low-Cost High-Tech Creative STEM Workshop Presented by: <i>Dr. Janchai Yingprayoon</i> & Moderated by: <i>Dr. Parvinder Singh</i>
1030 – 1100	Tea Break
1100 – 1230	Continuation of Workshop: Low-Cost High-Tech Creative STEM Workshop
1230 - 1400	Lunch Break

Science Workshop #2 | 30 October 2023 (Monday) | Venue: SEAMEO Hall

1400 – 1700	Hands-on Climate Connections: Demonstrations, Activities and Tinkering for Climate and Energy Education Presented by: <i>Dr. Graham Walker</i> & Moderated by: <i>Ms. Sivaranjini Sinniah</i>
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Schedule for Mathematics Workshops

Mathematics Workshop #1 | 30 October 2023 (Monday) | Venue: Mathematics Lab 2

0815 – 0900	Creating Mathematical Items for Assessment and Examination Presented by: <i>Dr. Fong Ho Kheong</i> & Moderated by: <i>Dr. Warabhorn Preechaporn</i>
1030 – 1100	Tea Break
1100 – 1230	Continuation of Workshop: Creating Mathematical Items for Assessment and Examination
1230 - 1400	Lunch Break

Mathematics Workshop #2 | 30 October 2023 (Monday) | Venue: Mathematics Lab 2

1400 – 1700	Exploring Interdisciplinary STEM Experiences through Real-world Problems Presented by: <i>Dr. Wanty Widjaja</i> & Moderated by: <i>Dr. Wan Noor Adzmin Mohd. Sabri</i>
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Schedule for Technology Workshops

Technology Workshop #1 | 30 October 2023 (Monday) | Venue: ICT Lab 1

0815 – 0900	IoT for Bringing Life Back into STEM Classrooms Presented by: <i>Dr. Mark Tee</i> & Moderated by: <i>Dr. Bala Murali Tanimale</i>
1030 – 1100	Tea Break
1100 – 1230	Continuation of Workshop: IoT for Bringing Life Back into STEM Classrooms
1230 - 1400	Lunch Break

Technology Workshop #2 | 30 October 2023 (Monday) | Venue: ICT Lab 1

1400 – 1700	Innovation Business: The Metaverse and Artificial Intelligence Presented by: <i>Prof. Dr. Kenneth Phoenix Quah</i> & Moderated by: <i>Dr. Jeyaletchumi Muthiah</i>
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Abstracts of Pre-Conference Workshops

Science Workshop 1

30 October 2023 (Monday) | 0830 - 1230 | Science Lab 2 | Moderated by: Dr. Parvinder Singh

Low-Cost High-Tech Creative STEM Workshop

Dr. Janchai Yingprayoon

PSU Wittayanusorn Surat Thani School

Thailand

<dr.janchai@gmail.com>

Most students enjoy playing with toys, manipulative materials, and magic. Appropriate recreational items can be found to stimulate intellectual curiosity, to develop problem solving and thinking skills, to promote discovery as well as to unleash creativity. The workshop will show how to make science and mathematics lessons more meaningful, effective, and interesting, how to cultivate intrinsic motivation for learning science, and how to develop thinking abilities, problem-solving skills, and creativity. This workshop is highly interactive with lots of toys and hands-on activities using locally produced low-cost high-tech materials.

Science Workshop 2

30 October 2023 (Monday) | 1400 - 1700 | SEAMEO Hall | Moderated by: Ms. Sivaranjini Sinniah

Hands-on Climate Connections: Demonstrations, Activities and Tinkering for Climate and Energy Education

Dr. Graham Walker

Australian National University, Australia

<graham.walker@anu.edu.au>

This pre-conference workshop will explore hands-on approaches to teaching climate change and energy production. For effective responses to climate change on the local or global level, inspirational and motivational teaching approaches are needed to address these subject areas – student-centred, hands-on pedagogies have huge potential. Participants will learn about key issues in teaching and communicating about climate change, then try a selection of hands-on activities including creative ‘tinkering’ methodologies. The hands-on activities have been designed to use primarily common everyday items to improve accessibility and relevance. Participants also have the option to take part in an associated Australian National University research project to better understand the impact of the activities and how they can best be adapted to local contexts. A teacher resource booklet containing 18 activities (some will be sampled in the workshop) can be downloaded at <http://hdl.handle.net/1885/289738>. Please download a copy of the booklet prior to the workshop.

Mathematics Workshop 1

30 October 2023 (Monday) | 0830 - 1230 | Mathematics Lab 2 | Moderated by: Dr. Warabhorn Preechaporn

Creating Mathematical Items for Assessment and Examination

Dr. Fong Ho Kheong
BrainBuilder Academy
Singapore
<mail@drfonghokheong.com>

Assessment is one of the main features of classroom teaching and learning. The correct assessment (or test) helps to determine the ability of students and take remedial actions to rectify and bring students back on the right track. However, a valid assessment depends on the correct types of questions we designed. This workshop helps learners to design innovative and creative items that can be used in the examination and to create a more accurate test to determine each student's performance. Participants will engage in activities to design their own test items at the level they are teaching. The workshop is suitable for teachers teaching up to middle school levels.

Mathematics Workshop 2

30 October 2023 (Monday) | 1400 - 1700 | Mathematics Lab 2 | Moderated by: Dr. Wan Noor Adzmin

Exploring Interdisciplinary STEM Experiences through Real-World Problems

Dr. Wanty Widjaja
Deakin University
Australia
<w.widjaja@deakin.edu.au>

Teaching STEM in an interdisciplinary way requires educators' willingness, knowledge, and confidence to draw links between different STEM disciplines. Educators' perceptions of interdisciplinary challenges tend to focus on technology aspects or tasks where students construct or design something, but they might struggle to draw a meaningful link to mathematics or science. In this workshop, participants will engage in an inquiry approach to explore the ways in which interdisciplinary learning of science and mathematics can be promoted using a STEM challenge that involves a real-world task. STEM experiences in Australian schools will be shared and discussed. Participants will gain insights into opportunities and challenges involved STEM teaching and learning by analysing students' work samples, and interview data with students and teachers and by participating in a design STEM challenge.

Technology Workshop 1

30 October 2023 (Monday) | 0830 - 1230 | ICT Lab 1 | Moderated by: Dr. Bala Murali Tanimale

IoT for Bringing Life Back into STEM Classrooms

Dr. Mark Tee

Swinburne University of Technology, Malaysia
<mtktsun@swinburne.edu.my>

Teaching & Learning effort in Science and Mathematics throughout the world has become increasingly challenging due to the rapidly shifting environments around our youths today. In most parts, students are surrounded by gadgets and technologies, perceiving their surroundings in a less tactile way compared to previous generations. Therefore, educators today face difficulties in finding a common ground to field examples that relate to fundamental concepts that are both relatable to their students and incite curiosity. The Internet of Things (IoT) is an umbrella term that describes any product or service that combines smart hardware with vast varieties of software through the power of the Internet, which includes smart watches, TVs, home security systems, driverless cars, and more. While not exactly a brand-new idea, IoT progression is moving at an exponential rate, pushing towards cybernetic implants, robot assistants, human-free commuters, and even automated life-support systems for living on Mars. Though students today grew up around embedded IoT, this technology's direction can coincide with popular themes like cosplaying, the Maker movement, hacker culture, and mobile gaming. This presents an opportunity for educators to relate classroom concepts such as 3D space coordinates with how AR games like Pokémon Go allow many players to see the same virtual gym transposed over a real-life location. However, the complexity of IoT applications remains a significant entry barrier to most educators, especially if they do not have a background in electronics and computer programming. This session will serve as a starting point, introducing how IoT can be wielded as a teaching tool in the classroom, by demonstrating a motion-controlled lighting project that can be observed (and controlled) through a mobile app. Participants will have hands-on guidance in setting up a simple IoT development platform called Maker Feather S3 to interface with NeoPixels LEDs and a motion-tracking sensor. An example online IoT dashboard service called Blynk will be used as a control panel, accessible via the Internet on any Computer or Smartphone. This example can be extended in a variety of ways to express Science and Mathematics concepts in real life, through Internet-connected projects including weather stations, room monitors, mobile robots, and more. At the end of the session, resources will be shared on how to learn in-depth programming, sourcing for parts, and accessing a variety of IoT project tutorials from the Internet.

Technology Workshop 2

30 October 2023 (Monday) | 1400 - 1700 | ICT Lab 1 | Moderated by: Dr. Jeyaletchumi Muthiah

Innovation Business: The Metaverse and Artificial Intelligence

Prof. Dr. Kenneth Phoenix Quah

Metaverse Universe (MVU) Holdings / Phoenix Asia Academy of Technology, Malaysia
<kevinquah@phoenixadia.edu.my>

Innovation in the business landscape is undergoing a seismic shift, primarily driven by the convergence of two groundbreaking technologies: the Metaverse and Artificial Intelligence (AI). These transformative forces are reshaping the very core of how businesses approach innovation, ushering in a new era of possibilities and opportunities. The Metaverse, a virtual realm where the physical and digital worlds seamlessly intertwine, stands as a monumental game-changer. It transcends traditional boundaries, offering a dynamic space for companies to redefine their marketing strategies and customer engagement approaches. In the Metaverse, businesses have the canvas to create immersive brand experiences, engaging customers in ways previously unimaginable. Virtual showrooms, interactive product demonstrations, and immersive events are just the tip of the iceberg, as the Metaverse opens up endless avenues for innovative marketing campaigns. At the heart of this Metaverse revolution lies the driving force of Artificial Intelligence. AI serves as the bedrock upon which the Metaverse is built, powering its functionality with advanced algorithms and machine learning capabilities. This dynamic fusion of AI and the Metaverse is a symbiotic relationship, with AI continually enhancing the Metaverse's capabilities and vice versa. AI-driven chatbots and virtual assistants provide personalized customer interactions, while AI-generated content and recommendations optimize user experiences. Moreover, AI's role in data analysis within the Metaverse cannot be overstated. It empowers businesses to gather invaluable insights from user behaviors, preferences, and interactions, enabling data-driven decision-making at an unprecedented scale. Through AI-driven analytics, companies can fine-tune their Metaverse presence, adapt strategies in real time, and cater to their customer's evolving needs and expectations. In conclusion, the Metaverse and AI are steering the course of innovation in business towards uncharted territories. This synergistic relationship between the virtual and the intelligent is reshaping marketing, customer engagement, and data-driven decision-making. As businesses continue to harness the transformative power of the Metaverse and AI, they will unlock new dimensions of innovation, ensuring their relevance and success in this rapidly evolving digital landscape.

Conference Sessions from 31st October to 2nd November 2023

Opening Ceremony

31 October 2023 (Tuesday)
SEAMEO Hall

0800	Registration/Housekeeping Arrival of Guests
0900	Keynote Address 1 "Education for Unknown VUCA World" by Dr. Janchai Yingprayoon
0950	The Arrival of VIP <ul style="list-style-type: none"> • Photography Session • Signing Guest Book
0955	<ul style="list-style-type: none"> • National Anthem - <i>Negaraku</i> • SEAMEO Colours • SEAMEO Song • RECSAM Song • Du'a Recital • RECSAM Forges Ahead Corporate Video
1005	Welcoming Speech by Dr. Shah Jahan Bin Assanarkutty Centre Director, SEAMEO RECSAM
1015	Opening Message & Official Opening Ceremony of CoSMEd-X 2023 by Dr. Richard Chung General Manager, Penang STEM
1025	Science Show
1040	Morning tea

Programme at a Glance

Day 1: 31st October 2023 (Tuesday)

Time	Session
0800 – 0900	Arrival of Guests
0900 – 0945	Keynote Address 1 “Education for Unknown VUCA World” by Dr. Janchai Yingprayoon
0955 – 1045	Opening Ceremony
1045 – 1100	Tea break
1100 – 1200	Opening Ceremony of Makerspace
1200 - 1400	Lunch Break
1400 - 1445	Keynote Address 2 “Fostering Teachers’ Adaptive Expertise in Teaching Interdisciplinary Mathematics and Science” by Dr. Wanty Widjaja
1500 - 1700	Parallel Session 1
1700	End of Day 1

Day 2: 1st November 2023 (Wednesday)

Time	Session
0845 – 0900	Housekeeping
0900 - 0945	Keynote Address 3 “Empower Your Critical Thinking: The Path to Achieve Innovation, Creativity and Success” by Dr. Fong Ho Kheong
0945 - 1000	Tea break
1000 – 1230	Parallel Session 2
1230 - 1400	Lunch Break
1400 - 1445	Keynote Address 4 “Getting All Emotional about Science Communication and Teaching” by Dr. Graham Walker
1500 - 1615	Parallel Session 3
1900 - 2200	CoSMEd-X Banquet Dinner
2200	End of Day 2

Day 3: 2nd November 2023 (Thursday)

Time	Session
0830 – 1030	Parallel Session 4
1030 - 1045	Tea break
1045 - 1130	Keynote Address 5 “Developing Teacher Leadership in Schools” by Dato’ Dr. Mehander Singh Nahar Singh
1130 - 1300	Closing Ceremony
1300 - 1400	Lunch Break
1400 - 1445	Conference Tour

Closing Ceremony

2 November 2023 (Thursday)
SEAMEO Hall

1115	Arrival of Guests
1130	Arrival of VIP Dr. Shah Jahan Assanarkutty Centre Director, SEAMEO RECSAM <ul style="list-style-type: none"> • Photography Session • Signing Guest book
1135	<ul style="list-style-type: none"> • National Anthem – <i>Negaraku</i> • SEAMEO Colours • SEAMEO Song • RECSAM Song • Du'a Recital • Overview of CoSMEd-X
1200	Announcement of CoSMEd-X Awards <ul style="list-style-type: none"> • Platinum Award • Gold Award • Silver Award • Bronze Award <p>Announcement of Best Presenter Award</p>
1220	Closing Remarks by Dr. Shah Jahan Assanarkutty Centre Director, SEAMEO RECSAM
1230	Conference is Declared Closed
	Lunch

Schedule for Keynote Addresses

<p>CoSMEd-X Keynote Address 1 Day 1: 31st October 2023 (Tuesday), 0900 – 0945</p>
<p>'Education for Unknown VUCA World' by Dr. Janchai Yingprayoon <i>Moderator: Dr. Warabhorn Preechaporn</i></p>
<p>CoSMEd-X Keynote Address 2 Day 1: 31st October 2023 (Tuesday), 1400 - 1445</p>
<p>'Fostering Teachers' Adaptive Expertise in Teaching Interdisciplinary Mathematics and Science' by Dr. Wanty Widjaja <i>Moderator: Dr. Nanthini Jayaram</i></p>
<p>CoSMEd-X Keynote Address 3 Day 2: 1st November 2023 (Wednesday), 0900 - 0945</p>
<p>'Empower Your Critical Thinking: The Path to Achieve Innovation, Creativity and Success' by Dr. Fong Ho Kheong <i>Moderator: Dr. Kamalambal Durairaj</i></p>
<p>CoSMEd-X Keynote Address 4 Day 2: 1st November 2023 (Wednesday), 1400 - 1445</p>
<p>'Getting All Emotional about Science Communication and Teaching' by Dr. Graham Walker <i>Moderator: Ms. Bhavani Ramasamy</i></p>
<p>CoSMEd-X Keynote Address 5 Day 3: 2nd November 2023 (Thursday), 1045 - 1130</p>
<p>'Developing Teacher Leadership in Schools' by Dato' Dr. Mehander Singh Nahar Singh <i>Moderator: Ms. Sivaranjini Sinniah</i></p>

Schedule for Parallel Sessions

Parallel Session 1

Day 1: 31st October 2023 (Tuesday) | 1500 – 1700

Venue: Penang Room 1 | Moderator: Ms. Bhavani Ramasamy

1500 – 1515	OPM010: C-BHQ: A Cybergogy Approach on Student's Achievement in Born-Haber Cycle, Chemistry Learning Motivation, and Future-Ready Learning Skills <i>Siti Nor Fazila Binti Ramly</i>
1515 – 1530	OPS024: Enhancing Higher Order Thinking Skills (HOTs) Through Project-Based Learning (PbL) In Preschool Classroom <i>Siew Siew Kim</i>
1530 - 1545	OPM015: Integrating Computational Thinking Skills into Chemistry: Impact on Problem-Solving and Gender <i>Samri Chongo</i>
1545 – 1600	OPI011: Reinforcing Assessment Skills Of Science Teachers Through Project E-Stomata (Enhanced- Science Teachers Observing, Measuring, Assessing, Testing And Analysis Of Learners' Products) <i>Ronaldo C. Reyes</i>
1600 – 1615	OPS052: AP Model: A Visualization Tool For Learning The Application Of Boyle's Law Among Matriculation Students <i>Chow Lai Kim</i>
1615 - 1630	OPS027: A Kirkpatrick Model Evaluation of the Southeast Asian Science Teacher Training <i>Deva Nanthini A/P Sinniah</i>
1630 – 1645	OPS033: Enhancing Understanding Of Redox Reactions Through Practical Engagement: A Study On The Integration Of The Chem Redox Kit With Microscale Teaching Of Chemistry <i>Komathy Veerasingham</i>
1645 - 1700	OPS046: The Effects of Tabletop Games Among Form 4 Students in Critical Thinking Disposition In Learning Periodic Table Of Elements <i>Yip Chin Chin</i>

Parallel Session 1

Day 1: 31st October 2023 (Tuesday) | 1500 – 1700

Venue: Penang Room 2 | Moderator: Dr. Kamalambal Durairaj

1500 – 1515	OPM003: Exploring Students' Perceptions and Abilities in Conditional Probability Problem-Solving <i>Durga Gnanasagaran</i>
1515 – 1530	OPM004: Preliminary Investigation: Teachers' Perception on Computational Thinking Skills for Mathematics Classroom <i>Warabhorn Preechaporn</i>
1530 - 1545	OPM 008: Impact of Digital Teaching Aids on the Academic Performance of Year 4 Pupils in Coordinates <i>Lee Jia Rou</i>
1545 – 1600	OPI009: What We Have Learned about Teachers' Questioning from 100 Mathematics Lessons Visiting? <i>Wei-Min Hsu</i>
1600 – 1615	OPI010: Enhancing Mathematics Teachers' Diagnostic Competence Through The SMART Test Professional Learning: Challenges and Opportunities <i>Miftahul Hidayah</i>
1615 - 1630	OPI012: On The Nullity Of Some Families Of R - Partite Graphs <i>Lyca DC. Marcelino</i>
1630 – 1645	OPS055: Anakku Bitara (Proakbi) Programme: Indicators for Literacy and Numeracy Mastery of Year 5 and Year 6 Pupils <i>Noorzeliana Binti Idris</i>
1645 - 1700	OPM084: The Implementation of Integrated STEM Project-Based Learning (PBL) e-Module <i>Zamhari Azman</i>

Parallel Session 1

Day 1: 31st October 2023 (Tuesday) | 1500 – 1700

Venue: Thailand Room 1 | Moderator: Dr. Nur Jahan Ahmad

1500 – 1515	OPM006: Towards a Framework for Understanding the Meaning of Fractions <i>Rosmawati Binti Mohamed</i>
1515 – 1530	OPS039: Use Of Artificial Intelligence "Checkmath": Helps Improve Mastery Of Numbers And Operations Through A Student-Centered Approach <i>Mohd Akmal Arif Bin Md Yusop</i>
1530 - 1545	OPM002: Educators' Perception of Programming Module on Mathematics Instruction for Primary School <i>Masyithoh Md Zuber</i>
1545 – 1600	OPM007: A Study of Pre-Service Teachers' Interest in Fundamentals of Programming toward Achievement in Decision Mathematics Courses <i>Mohd Shafian Bin Shafiee</i>
1600 – 1615	OPM009: Mnemonics Strategy in Enhancing Graph Sketching Skills <i>Lim Teng Kee</i>
1615 - 1630	OPS042: Teacher Sharing Classroom (Tsc) Basics Computer Science Teacher Towards The Digitalization Of Teacher Education In Perak State (Pilot Study) <i>Anjad Anas bin Abd Malek</i>
1630 – 1645	OPS053: Engagement of Jahai Indigenous Students in Integrated STEM Learning through the Kombucha Tea Fermentation <i>Ahmad Adnan Bin Mohd Shukri</i>
1645 - 1700	OPS071: Virtual Reality Trainers for Students with Disability: Analysis of Students' Motivation and Motor Performance <i>Nur Azlina Mohamed Mokmin</i>

Parallel Session 2

Day 2: 1st November 2023 (Wednesday) | 1000 – 1215

Venue: Penang Room 1 | Moderator: Dr. Warabhorn Preechaporn

1000 – 1015	OPS063: Evaluation of STEMEC Program Implementation in Malaysian Primary Schools: A Pilot Test of Input, Process, and Product Assessment <i>Norfadhillah Binti Yusoff</i>
1015 – 1030	OPM016: Survey on Computational Thinking Skills with Internet of Things (IoT): Assessing Educators' Perspectives <i>Sivaranjini Sinniah</i>
1030 – 1045	OPS059: My Lovely Pet <i>Hasni Yusop</i>
1045 – 1100	OPS064: Higher-Order Thinking Skills in Teaching and Learning of Substance Movements Across the Plasma Membrane <i>Nurashikin Binti Muzafar</i>
1100 – 1115	OPS076: The Integration of Blended Learning with the Digital Platform Wakelet in Organic Chemistry Learning for Matriculation Science Students in Semester 2 <i>Kong Suet Lee</i>
1115 – 1130	OPI028: Assessing General Biology Self-Learning Modules Through A Science-As-Practice Lens <i>Jameelyn M. Maramag</i>
1130 – 1145	OPS075: The Effect of Predicting Observing and Explaining Learning Strategies Integrated Visualization on Conceptual Understanding in Chemical Bonding <i>Nurulhuda Bt A.Ghani</i>
1145 – 1200	OPS025: Implementation Of 4C Elements In Online Project-Based Learning To Assist Students' Communication Skills And Problem Solving Skills For Biology Subjects <i>Ehqa Dhabita Bt. Mohd Nasir</i>
1200 – 1215	OPS083: Involving Students in Developing Atom Model to Enhance their Understanding of the Atomic Structure: An Action Research Project <i>Hazura Ab Bakar</i>

Parallel Session 2

Day 2: 1st November 2023 (Wednesday) | 1000 – 1215

Venue: Penang Room 2 | Moderator: Dr. Jeyaletchumi Muthiah

1000 – 1015	OPS062: Kit Subadd Vismat Application Innovation : A Simple and Fun Way to Learn Addition <i>Norhayati Binti Abd Aziz</i>
1015 – 1030	OPS036: Mastering Differentiation: A Hands-On Approach <i>Sarveswary A/P T.Velayutham</i>
1030 – 1045	OPI017: A Phenomenological Study of Teachers' Professional Learning and Their Understanding of Making Meaning in Mathematics <i>Zingiswa Jojo</i>
1045 – 1100	OPI018: Ethnomathematical Practices in Tahiti (Thysanolaena Latifolia) Farming: Integration for a Localized and Authentic Mathematics Curriculum <i>Wrendell C. Juntilla</i>
1100 – 1115	OPI019: Mathematical Investigation in HyFlex Setup: Affordances and Constraints for Engineering Students' Participation <i>Edrian Peter B. Villanueva</i>
1115 – 1130	OPS056: Numberless Word Problem Strategy In Sentence-Based Mathematics Problem Solving Skills Among Year 5 Pupils <i>Dzaquan Ang Binti Dzaqoff Ang</i>
1130 – 1145	OPM068: The Relationship Between Level of Metacognitive Skills Towards Achievement of Mathematical Problem-solving in Primary School <i>Seow Wen Qiang</i>
1145 - 1200	OPM047: Mastering Division with MD'Teknik Fueling Year Three Students' Math Enthusiasm and Academic Triumph <i>Chin Jack Onn</i>
1200 – 1215	OPS067: Science and Maths in the VUCA World: A Comparative Insight into the UK Professional Standards Framework (UKPSF) and the Kerangka Kompetensi Guru Bidang STEM (KKGB STEM) <i>Wong Minh Chjiat Isabelle</i>

Parallel Session 2

Day 2: 1st November 2023 (Wednesday) | 1000 – 1215

Venue: Thailand Room 1 | Moderator: Dr. Bala Murali Tanimale

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| 1000 – 1015 | OPM014: Monitoring/Evaluating Tool(s) Development for Lifelong Skills-Enhancement e-Programmes as Exemplars to Sustain Quality of Science and Mathematics Education in VUCA World
<i>Ng Khar Thoe</i> |
| 1015 – 1030 | OPS077: Augmented Reality as a Learning Media on Climate Change in Malaysia
<i>Setia Erlila Refman Adrus</i> |
| 1030 – 1045 | OPI008: Lesson Study: The Tale of a Fair Game
<i>Imelda Cristina B. Carcosia</i> |
| 1045 – 1100 | OPS072: Digital Teaching in Enhancing Effectiveness of Students Learning
<i>Rohani Binti M.M Yusoff</i> |
| 1100 – 1115 | OPS065: Affective Factors on Malaysian Preservice Science Teachers Readiness Towards the Delivering of STEM Education
<i>Rabiatul-Adawiah Ahmad Rashid</i> |
| 1115 – 1130 | OPS078: Developing Water Level System Encouraging STEM Skills Among Students
<i>Hartini Bt Hashim</i> |
| 1130 – 1145 | OPS019: From Virtual To Tangible: Enhancing Stem Teaching And Learning With 3D Printed Models
<i>Yong Zi Wei</i> |
| 1145 - 1200 | OPS043: Teacher Education Institute Students' Perspective on Adopting Mobile Learning in Science
<i>Lok Wai Foong</i> |
| 1200 – 1215 | OPS001: The Evaluation Of STEM Makerspace Workshop Using Kirkpatrick's Evaluation Model
<i>Loh Su Ling</i> |

Parallel Session 3

Day 2: 1st November 2023 (Wednesday) | 1500 – 1615

Venue: Penang Room 1 | Moderator: Ms. Deva Nanthini Sinniah

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| 1500 – 1515 | OPS050: From Classroom to Clean Energy: The MinUS-C Module's Impact on Solar PV Education
<i>Muhamad Kamarul Azman Bin Sulaiman</i> |
| 1515 – 1530 | OPM013: The Quality Of Teaching And Learning Of The Lecturers On The Satisfaction Level Of The Institute Of Teacher Education's
<i>Kalaiwani a/p Manoharan</i> |
| 1530 - 1545 | OPM081: Goal Setting as a Metacognition Skill Among Form Four Physics Students
<i>Bala Murali Tanimale</i> |
| 1545 – 1600 | OPI021: Impact of Brain-Based Teaching on the Conceptual Understanding of Newton's Laws of Motion
<i>Rosendo B. Comillo III</i> |

Parallel Session 3

Day 2: 1st November 2023 (Wednesday) | 1500 – 1615

Venue: Penang Room 2 | Moderator: Dr. Wan Noor Adzmin Mohd. Sabri

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| 1500 – 1515 | OPS032: The Effectiveness of APOS-ACE Teaching Approach in Improving the Performance of Understanding, and Application-Analysis in Differentiation Topic among Matriculation Students
<i>Thavarajah A/L Selvarajah</i> |
| 1515 – 1530 | OPS034: Differentiated Learning: Utilization of Alternative Methods to Assist Year Four Students in Mastering Multiplication Skill
<i>Ang Pei Sun</i> |
| 1530 - 1545 | OPM080: STEAMing Ahead: Leveraging Graphing Technology to Foster Mathematical Thinking through Dynamic Exploration of Graphs of Functions
<i>Jeyaletchumi Muthiah</i> |
| 1545 – 1600 | OPS044: Tessellation on Transformation Geometry in Mathematics Classroom
<i>Phang Siaw Ling</i> |
| 1600 - 1615 | OPM049: Ameliorating Lower Secondary Pupil's Mathematical Thinking and Ability through the Design and Development of a Mathematics Guidebook
<i>Chiang Kok Wei</i> |

Parallel Session 3

Day 2: 1st November 2023 (Wednesday) | 1500 – 1615

Venue: Thailand Room 1 Moderator: Ms. Shazmin Kithur Mohamed	
1500 – 1515	OPS021: Safeguarding Intangible Cultural Heritage Through Game-based Learning Using Minecraft Digital Tool <i>Pang Yee Jiea</i>
1515 – 1530	OPS022: Empowering Educators: An International AI, Python, and Robotics Bootcamp <i>Thong Ying Li</i>
1530 - 1545	OPS023: Teaching Standards in Artificial Intelligence (AI) Realm: Challenges in Equipping Students Beyond The Application of Technology in Science Education <i>Azizi Bin Alias</i>
1545 – 1600	OPS029: An Experiential Learning Approach to Develop Graduate Attributes <i>Nur Jahan Ahmad</i>
1600 – 1615	OPI024: Mathematics Teachers' Readiness in Information and Communication Technology (ICT) Implementation for Mathematics Teaching <i>Sulistiawati</i>

Parallel Session 4

Day 3: 2nd November 2023 (Thursday) | 0830 – 1030

Venue: Penang Room 1 Moderator: Dr. Loh Su Ling	
0830 - 0845	OPS060: Titration Experimental Assessment using Digital Science Comic Book <i>Sathia Kumaran A/L Krishnan</i>
0845 - 0900	OPS017: The Effectiveness of Implementing the Multiple Intelligences Approach Enhancing the Malaysian Primary Students' Science Process Skills <i>Suzlipah Binti Sanusi</i>
0900 - 0915	OPS040: Demystifying Delusion And Unveiling The Crypt In Learning Science And Mathematics Via The Dual Language Program <i>Ashairi Suliman</i>
0915 - 0930	OPS045: Development And Usability Testing For Augmented Reality Application, Carbon-Ary For Carbon Compound Topic In Chemistry Subject <i>Izzul Syahmi Bin Che Russlee</i>
0930 - 0945	OPS073: Assessing the Validity and Reliability of a Research Instrument for Measuring Science Literacy, Higher-Order Thinking, and Student Achievement: A Comprehensive Analysis <i>Marina binti Mokhtar</i>
0945 – 1000	OPI007: Advancing the Cultures of Science Teaching and Learning in South African Schools <i>Shaheed Hartley</i>
1000 – 1015	OPS061: The Forward-Backward And Dual-Panel Translation Methods Are Comparable In Producing Semantic Equivalent Versions Of A Computational Thinking Skills Questionnaire <i>Rose Enne Emellia Binti Mohamed Razali</i>
1015 - 1030	OPS069: Validation of An Instrument for Measuring Malaysian Secondary School Students' Science Motivation and Self-Regulation towards Science Learning <i>Wan Mazlina Binti Wan Mehammud</i>

Parallel Session 4

Day 3: 2nd November 2023 (Thursday) | 0830 – 1030

Venue: Penang Room 2 Moderator: Ms. Tiana Mohamad	
0830 - 0845	OPI014: Exploring Project CREATE Mathematics and Peer-Assessed Gallery Walk in Teaching Mathematics <i>Jessie B. Aquino</i>
0845 - 0900	OPS058: Improving the Skills of Adding and Subtracting Length Measurements of Year 5 Arif using Jo Double321 Method <i>Suhaila Binti Ishak</i>
0900 - 0915	OPS016: Analyzing Mathematics Anxiety and Its Related Factors Using DEMATEL Method <i>Jamiatun Nadwa Binti Atak @ Ismail</i>
0915 - 0930	OPS057: Application of Engineering Design Process (EDP) in implementing Integrated PBL for Secondary School Students <i>Suhanna binti Zainudin</i>
0930 - 0945	OPS018: STEAM Education: Understanding and Readiness Among Malaysian Teacher Trainers <i>Sharon Tay Siew Ing</i>
0945 - 1000	OPI029: Project-Based Learning Strategies to Increase Student Creativity Skills in "Kurikulum Merdeka" <i>Sifak Indana</i>
1000 - 1015	OPS074: Authentic Learning in Urban Farming Fertigation Project to enhance Students' Entrepreneur mind <i>Mohd Norawi Ali</i>

Parallel Session 4

Day 3: 2nd November 2023 (Thursday) | 0830 – 1030

Venue: Thailand Room 1 Moderator: Ms. Sanura Jaya	
0830 - 0845	OPS030: Aye Aye, Captain! Let's Embark on an Engaging Virtual Math Learning Journey! <i>Lai Wai Tung</i>
0845 - 0900	OPS035: Relationship Between Constructive Feedback Practices By Appraisal Officers And Performance Appraisal Effectiveness <i>Majelan Bin Sulong</i>
0900 - 0915	OPS037: From Blocks to Code: An Insight Into Students Transitioning From Scratch To Java <i>Siti Sakinah Binti Mohd Yusof</i>
0915 - 0930	OPS038: Teachers' Self-Efficiency and Acceptance Of Technology Stem Against Pedagogy Based on ICT in Schools With Less Students <i>Muhammad Amin Bin Abu</i>
0930 - 0945	OPM082: Advancing Technology Integration in Southeast Asian Education: Empowering Educators with Policy Insights <i>Kamalambal Durairaj</i>
0945 - 1000	OPM066: Rise of Metaverse Literature in Asia-Pacific Countries: Bibliometric Study <i>Walton Wider</i>
1000 - 1015	OPS051: Digital Storytelling Science Creative Module <i>Wan Mohd Faizal bin Wan Mohd Nasir</i>

Abstracts for Keynote Addresses

Keynote Address 1

Day 1: 31st October 2023 (Tuesday) | 0900 - 0945 | SEAMEO Hall | Moderator: Dr. Warabhorn Preechaporn

Education for Unknown VUCA World

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VUCA - (Volatility, Uncertainty, Complexity and Ambiguity) describes the situation of constant, unpredictable change that is now the norm in certain industries and areas of the business or educational world. VUCA demands that we avoid traditional, outdated approaches to management and leadership, and day-to-day working. When there is an important event that affects the lives and well-being of many people in the world. We need to know how to solve that problem. Therefore, education in today's world should be education that prepares us to face things that are yet to come that we do not know or predict before. The COVID-19 outbreak is a good example that makes us aware of how to adapt the education system to face the uncertain future. Education development with a focus on creativity and innovation allows us to solve problems and modify the living system to be able to adapt to various situations to survive. Applications of Innovative Strategies in teaching-learning process using SCAMPER, a technique for developing creativity together with educational innovations, will help us survive in a VUCA world.

Keywords: VUCA, Creativity and innovation, SCAMPER

Keynote Address 2

Day 1: 31st October 2023 (Tuesday) | 1400 - 1445 | SEAMEO Hall | Moderator: Dr. Nanthini Jayaram

Fostering Teachers' Adaptive Expertise in Teaching Interdisciplinary Mathematics and Science

Dr. Wanty Widjaja

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Research has demonstrated that teaching science and mathematics in interdisciplinary ways can enhance learners' engagement and deeper learning of disciplinary knowledge and facilitate the development of twenty-first-century skills such as problem-solving and creative and critical thinking. The shift from disciplinary to interdisciplinary approaches to teaching and learning and the focus on teaching twenty-first-century skills requires teachers to become proficient at the skills themselves and to develop expertise across traditional disciplinary boundaries. Teachers are expected to become adaptive experts who can get accustomed to unfamiliar, unexpected, and complex situations quickly, and apply professional knowledge flexibly, innovatively, and creatively in such teaching situations. Considered as a hallmark of quality teaching, adaptive expertise is essential for teachers to innovate their teaching to enhance student learning and interest, yet little is known about its development. Empirical research on teachers' adaptive expertise has illustrated how teachers learn and develop effective teaching behaviors through situation-specific observations and interpretations of their actions in these situations (Yoon et al., 2019). Yoon et al. (2019) argue that discipline-specific adaptive expertise "addresses the need to not only have acquired content and pedagogical knowledge but to have a deep understanding of it to use such knowledge effectively" (p.892), as well as flexibly and deliberately. This presentation will share insights from a few research projects involving primary and secondary schools in Victoria, Australia. Using cross-case analysis of the interview data, teacher annotations on lesson plans, and video fragments for each lesson sequence, teacher adaptive expertise related to teaching interdisciplinary mathematics and science will be examined. The findings suggest that the levels of teachers' adaptive expertise vary depending on their understanding of science and mathematics and its connections in teaching, but also how they apply this understanding flexibly and deliberately in novel and non-routine teaching and learning situations. This study can contribute to knowledge about teachers' adaptive expertise development in interdisciplinary mathematics and science teaching.

Keywords: Interdisciplinary, creative and critical thinking, adaptive expertise

Keynote Address 3

Day 2: 1st November 2023 (Wednesday) | 0900 - 0945 | SEAMEO Hall | Moderator: Dr. Kamalambal Durairaj

Empower Your Critical Thinking: The Path to Achieve Innovation, Creativity and Success

Dr. Fong Ho Kheong
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Dr. Fong will present some scenarios including solutions to two mathematical problems. The problems are meant to invoke participants' critical thinking which one of the aims of this presentation is. Dr. Fong will also show there are different levels of critical thinking. The higher your reach level, the more likely you achieve higher performance. There are some features of critical thinking that guide participants to practise critical thinking skills. Often, we hear teachers lamenting that their students are not performing to solve mathematical problems. At the end of the presentation following from previous day's workshop, you will find a way that students can now do mathematics. You will also realize the key feature is to enhance our own critical thinking skills that you may be able to develop a pedagogy by practicing critical thinking and metacognition.

Keywords: Critical thinking, mathematical problems, metacognition

Keynote Address 4

Day 2: 1st November 2023 (Wednesday) | 1400 - 1445 | SEAMEO Hall | Moderator: Ms. Bhavani Ramasamy

Getting All Emotional About Science Communication and Teaching

Dr. Graham Walker
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Emotions are a central part of effective science education (Alsop, 2001, 2005; Pekrun, Goetz, Titz, & Perry, 2002) and communication (Davies & Horst, 2016) – they are essential to connect with students and enhance learning – but which emotions are critical and what is the underlying mechanism of eliciting them? This keynote come performance will showcase the role of emotions and motivational states including surprise, interest, enjoyment, awe, curiosity and intrinsic motivation, based on the presenters PhD research, and how they can be enhanced in classrooms, teacher demonstrations, and informal science learning contexts such as science centres. These psychological states will be dissected into components, giving avenues for educators and science communicators to fine tune audiences' emotional responses. These sometimes nebulous emotional states will be illustrated via intriguing, entertaining and interactive demonstrations – you will feel the science! – in a performance that fuses science show presenting with insights from emotion and educational psychology.

Keywords: Emotional, science education and communication, educational psychology

Keynote Address 5

Day 3: 2nd November 2023 (Thursday) | 1030 - 1130 | SEAMEO Hall | Moderator: Ms. Sivaranjini Sinniah

Developing Teacher Leadership in Schools

Dato' Dr. Mehander Singh Nahar Singh

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One of the most debated issues among individuals representing various education systems is pertaining to the quality of education in their respective countries. In this regard, the 2007 McKinsey report mentioned that "the quality of an education system cannot exceed the quality of its teachers". However, we are aware that the quality of an education system is influenced by many factors. At the forefront of these factors is the quality of teacher leadership, which has long been playing 'second fiddle' to school leadership. Traditionally leadership has always been associated with designated positions especially in schools. As such, classroom teachers have always shied away from "leadership" roles, while we are aware that some of the best success stories relate to Science and Mathematics "teacher leaders". Why should a school have one great leader when it can have more? It is the mere existence of quality teachers and teacher leaders that can catalyse and propel the school towards providing quality education. Who are these teacher leaders? Teacher leadership is not only confined to those with titles but rather teachers who are leaders without formal titles. The role of teacher leaders was evident during the Covid-19 pandemic through all the webinars etc. that were conducted to support remote teaching-learning in the midst of the VUCA environment. Hence, it is pertinent that institutions/schools should strive to continue to focus on developing teacher leadership talent with a focus on conceptual, technical and humanistic skills among teachers in the quest to increase this pool of talented teachers who may one day assume the role of school leadership etc. In tandem with this, in the past three years, spearheaded by Edvolution Enterprise, we have instituted the Advanced Leadership Program (ALP) lead by officers from the District Education Office, and in addition, with another team we have developed the Connecting-Dots-Learning (CDL) #cikgubantucikgu initiative in Malaysia. We have embarked on a journey of developing teacher leaders. The results have indicated, that given the empowerment, teachers can build a strong sense of professional capital and autonomy to address school needs, through various teacher led interventions and initiatives. In conclusion "in terms of importance the quality of school leadership cannot exceed the quality of teacher leadership in schools". Teachers cannot take a back seat in curating the best teaching and learning in academic and co-academic activities in schools. We must accept and have trust in our teachers, that they are designed to LEAD.

Keywords: Teacher leadership, quality teachers, "teacher leaders"

Abstracts for Parallel Sessions

Parallel Session 1

Day 1: 31st October 2023 (Tuesday) | 1500 - 1700 | Penang Room 1 | Moderator: Ms. Bhavani Ramasamy

OPM010: C-BHQ: A Cybergogy Approach on Student's Achievement in Born-Haber Cycle, Chemistry Learning Motivation, and Future-Ready Learning Skills

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Gamification, or the use of game aspects in educational situations, has gained popularity as a viable technique for increasing student engagement and academic achievement. This study investigates the impact of gamification, which representing cybergogy approach in transformative teaching and learning (T&L) delivery on students' achievement in the subtopic of Born-Haber Cycle, learning motivation, and the development of future-ready learning skills. The study employs a quasi-experimental pre-test-post-test non-equivalent group design. A sample of 60 students from Penang Matriculation College are chosen and divided into treatment (N=30) and control (N=30) groups through cluster random sampling (intact group). The treatment group participates in gamified learning activities, whilst the control group receives conventional teaching. The outcomes of this study contribute to a better understanding of the effects of gamification on student success and learning motivation. It also investigates the potential of gamification in improving future-ready learning abilities using a cybergogy method. The findings provide valuable insights for educators and instructional designers interested in using gamification as a pedagogical strategy that fosters student engagement, achievement, and readiness for future learning. This research has significance for educational policymakers since it demonstrates the benefits of introducing gamified aspects into instructional design and curriculum development. Gamification can help to cultivate lifelong learners with the necessary abilities to flourish in an ever-changing, technology-driven world by encouraging intrinsic motivation and delivering immersive learning experiences.

Keywords: Gamification/ gamified learning activity, learning motivation, future-ready learning skills, cybergogy.

OPS024: Enhancing Higher Order Thinking Skills (HOTs) Through Project Based Learning (PbL) in Preschool Classroom

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This study investigates the implementation of Project-based Learning (PbL) as a teaching approach to improve Higher Order Thinking skills (HOTs) among preschool children. This case study employed a qualitative approach to collect data using interviews, observation, and documentation. The participants were twenty-five preschool children, aged from 5 to 6 years old at a public school in Klang, Selangor. This selected preschool class teacher with more than three years' experience in implementing PbL and the findings show that PbL has proven to be an effective approach in improving early childhood critical thinking skills. Through the implementation of systematically planned PbL activities, children showed significant progress in their ability to identify problems, generate creative solutions, and consider different perspectives. Based on the study findings, it is recommended that the implementation of PbL in early childhood education follows a structured process. This includes defining clear learning objectives, selecting interesting and relevant project topics, providing necessary materials and resources, and offering guidance and support throughout the learning process. This research contributes to the existing literature by providing insights into the effective implementation of PbL to enhance HOTs in early childhood education. The findings underscore the importance of well-structured planning, implementation, and evaluation to maximize the benefits of PbL.

Keyword: project-based Learning, Higher Order Thinking Skills, preschool

OPM015: Integrating Computational Thinking Skills into Chemistry: Impact on Problem-Solving and Gender

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Problem solving skills are very necessary and need to be applied in the world of education in the 21st century. Because of that, computational thinking (CT) skills introduced in schools is the development of the creativity and critical thinking abilities of students involved in STEM. This study aims to identify the degree of effectiveness of the Computational Thinking-Chemistry (CT-CHEM) Module in the development of CT skills and examine its effects on gender. To that end, this study employed a quasi-experimental design that involved the participation of 85 form four students in Malaysia. Three types of teaching approach the CT-CHEM Module Plugged-in (CTP), the CT-CHEM Module Unplugged + Plugged-in (CTUP) and the conventional method (CM) were systematically designed and implemented. Students' CT skills were measured by using the Bebras task, which validity and reliability were justified, and a two-way MANCOVA was used to analyse the data. The results showed that students' algorithmic skill of CT was significantly higher in the CTP compared to the CTUP and CM groups, but the gender differences did not vary across groups. This study concludes that the integration of CT skills through plugged-in activities will increase their algorithmic thinking skill of CT, reduce the gender gap in STEM fields, further improve STEM education and promote problem-solving skills among students.

Keywords: Computational thinking, Plugged-in, Unplugged, STEM education, Problem solving

OPI011: Reinforcing Assessment Skills of Science Teachers through Project E-STOMATA (Enhanced Science Teachers Observing, Measuring, Assessing, Testing and Analysis of Learners' Products)

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One of the pressing concerns that need to be addressed specifically in the implementation K to 12 science curriculum is classroom assessment. Challenges encountered by the teachers along this include inappropriate or misaligned classroom assessment for the learning competency covered during the teaching-learning process. This study was conducted to reinforce the assessment skills of science teachers through Project E-STOMATA. This likewise identified the assessment methodologies used as well as the perceived advantages and disadvantages of the current assessment methodologies. The mixed-methods of research applying both qualitative and quantitative methods were used. Non probability sampling, specifically purposive sampling, was adopted in the selection of the participants. Results revealed that the top five assessment methodologies always employed by the respondents are multiple-choice questions, use of worksheets, recitation, matching type, and self-assessment. Various parameters are considered by the science teachers in employing assessment methodologies which include ease of use, aligning with the learning competencies, relevance, time for writing and checking, manageability for both teachers and learners, appropriateness to learners, reliability, validity, fairness, and inclusivity. With this, the assessment skills of the teachers in the field can be reinforced through the implementation of the project in science education. Results of this study can also serve as a baseline in crafting policies in science education, specifically on implementing appropriate assessment in science teaching.

Keywords: Project E-STOMATA, Science Assessment

OPS052: AP Model: A Visualisation Tool for Learning the Application of Boyle's Law among Matriculation Students

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This study focuses on the topic of states of matter, specifically examining the movement and attraction of gas particles and the changes that occur at a submicroscopic level. Many student struggle to grasp these concepts, particularly in relation to Boyle's Law. This study aims to improve students' performance by employing the Air Pump (AP) Model as a visualization tool for teaching Boyle's Law. The research was conducted in a quasi-experimental manner, involving 70 Science stream students in a Two-Year Program at a Matriculation College. The participants were divided into two groups: one received instruction using the AP model (the treatment group), while the other group used the conventional method (the control group). Data collection methods includes pre-test, pot-test, interview and questionnaires. Quantitative analysis techniques, such as independent sample t-test and paired t-test, were employed. The findings revealed a significant increase in mean scores for the AP group, rising from 48.29 to 62.29, compared to the control group using the conventional method (CM). The results of the paired t-test showed a significant improvement on the AP group (p-value: 0.000), while the CM group did not exhibit significant improvement (p-value: 0.160). These results suggest that the application of the AP model positively impact students' performance in comparison to the traditional teaching method. Furthermore, questionnaires and interviews indicated that the AP model enhances students' motivation in learning Boyle's Law. This study recommends further exploration of the AP model's applicability in the field of Physics education and instructional development.

Keywords: Chemistry, Boyle's Law, submicroscopic level, visualisation tool, AP model

OPS027: A Kirkpatrick Model Evaluation of the Southeast Asian Science Teacher Training

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This article aimed to evaluate a regional-level professional development course that was hosted by an intergovernmental institutions. The four-week courses were attended by the Southeast Asian science teacher to address the educational challenges at the different context and enhance the teacher's capacity to better support the quality education in the region. To achieve a far-reaching and long-lasting positive effect, this course also encourages the amplification of the course content to respective professional settings through the 'Multiplier Effect' projects. Nineteen (N=19) participants was sampled purposely among the attendees. The three-level of the Kirkpatrick's evaluation model was used to measure the impact of the course. The teaching environment of workshops, knowledge about new teaching and learning methods and behaviour changes during the workshops was gauged. Both qualitative and quantitative data was collected to learn the interim and post course session impact. At the first and second level of Kirkpatrick's model, majority of the participants perceived that the course delivery was positive. The data of the interim impact shows that the participants have acquired mastery of the content of the course with a mean gain of 0.98, from the mean post-test score of 3.67 ± 0.98 and the mean pre-test score of 2.73 ± 0.86 . However, at the third level, the post-program surveys revealed that 50% of participants reported to be actively seeking and seizing opportunities to create positive change within their respective professional settings. The findings shows that, even though there is decrease between the interim and post-course impact, the amplification of the course reaches the targeted community. This in-house assessment provides the feedback to the host institutions, serves as valuable tool for continuous improvement and accountability of resources allocation.

Keywords: Regional training, Southeast Asia, science education, program evaluation, multiplier effects

OPS033: Enhancing Understanding of Redox Reactions through Practical Engagement: A Study on the Integration of the Chem Redox Kit With Microscale Teaching of Chemistry

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Redox reactions, fundamental to chemistry and technology, often challenge students due to their abstract nature. This research explores the effectiveness of integrating the Chem Redox Kit with microscale teaching techniques to deepen students' conceptual understanding of redox reactions. A total of 168 students from SMK Ave Maria Convent, Ipoh, participated in this study. The intervention aimed to enhance students' ability to explain key concepts of redox reaction in various chemical reaction, identify electron transfer processes, and understand the redox reactions occurred in electrolytic cell and chemical cell. Quantitative assessments revealed a significant improvement in students' self-reported understanding, with percentage improvements ranging from 25% to 100%. Qualitative insights from participants highlighted shifts from abstract challenges to practical engagement and clarity in explanation. Challenges faced evolved from struggling with abstract concepts to addressing specific comprehension and application aspects, while experiences with hands-on chemistry kits transitioned from limited prior exposure to positive engagement with the Chem Redox Kit. These findings underscore the pedagogical value of practical, hands-on experiences in chemistry education. The integration of the Chem Redox Kit with microscale teaching techniques not only improved students' comprehension but also boosted their confidence and enthusiasm for redox reactions. This research offers evidence-based strategies for educators to bridge the gap between theoretical knowledge and practical understanding in the realm of redox reactions, ultimately enhancing students' chemistry education.

Keywords: Redox reactions, Chem Redox Kit, microscale teaching, student comprehension, hands-on learning, chemistry education

OPS046: The Effects of Tabletop Games among Form 4 Students in Critical Thinking Disposition in Learning Periodic Table of Elements

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In contemporary education, fostering critical thinking disposition is a paramount goal. Educators have explored a diverse range of instructional methods, including problem-based learning, collaborative activities, and inquiry-based approaches, each meticulously designed to cultivate critical thinking disposition in students. Among these innovative approaches, the integration of tabletop games has notably emerged as a promising strategy for nurturing critical thinking skills. This study investigates the effects of incorporating tabletop games into Form 4 chemistry class and its effects on students' critical thinking disposition. A total of 78 Form 4 students underwent two distinct pedagogical contexts: a control group exposed to conventional instructional methods and an experimental group immersed in tabletop game-based learning. Little Periodic was thoughtfully adapted from "A Game of Elements" and selected as a pedagogical instrument. Comprehensive pre- and post-assessments were administered to gauge changes in critical thinking disposition. The independent sample t-test was methodically employed to examine the differential mean scores between the control and experimental groups. Statistical analysis yielded robust evidence ($p < 0.05$) in favor of the experimental group, indicating that the implementation of tabletop games led to a significant enhancement in critical thinking disposition. Furthermore, students within the experimental group self-reported increased critical thinking disposition and a greater inclination toward critical inquiry. This investigation underscores the potential of tabletop games as efficacious tools for cultivating critical thinking disposition among Form 4 Chemistry students. The findings posit tabletop games as valuable adjuncts to conventional instructional methodologies, offering a tangible means of promoting a disposition toward critical thinking among students.

Keywords: Critical thinking disposition, tabletop games, Little periodic, independent sample t-test

Parallel Session 1

Day 1: 31st October 2023 (Tuesday) | 1500 – 1700 | Penang Room 2 | Moderator: Dr. Kamalambal Durairaj

OPM003: Exploring Students' Perceptions and Abilities in Conditional Probability Problem-Solving

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This study aims to investigate students' perceptions and abilities in solving conditional probability problems. A combination of data collection methods were employed for this study. A semi-structured interview was conducted with six students who were selected through purposive sampling from a matriculation college. The interviews aimed to gain insights into students' perceptions and challenges related to conditional probability problem-solving. Thematic analysis was employed to analyse the collected data. This qualitative approach allowed for the identification of themes and recurring issues in students' responses and problem-solving processes. In addition to that, students' work on exercises involving conditional probability problems was analysed to further understand their abilities and thought processes. By examining students' perceptions and problem-solving abilities, this study aimed to provide a comprehensive understanding of the challenges students faced in conditional probability. The findings of this study shed light on the specific areas where students struggled in solving problems related to conditional probability. These insights can inform the development of targeted learning environments, instructional strategies and interventions to improve students' learning of conditional probability. The study contributes to the broader field of mathematics education by enhancing both practitioners' and academics' understanding of students' perception and abilities in the context of conditional probability problem-solving. The findings of this study have implications for instructional practices and curriculum development, aiming to enhance students' understanding and proficiency in conditional probability problem-solving. By addressing the identified needs, challenges and suggestions, educators can provide more effective support and interventions to improve students' learning outcomes in this area of mathematics.

Keywords: Perceptions, abilities, conditional probability, problem-solving

OPM004: Preliminary Investigation: Teachers' Perception on Computational Thinking Skills for Mathematics Classroom

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This paper aimed to investigate primary school mathematics teachers' perception on CT for mathematics classroom. Two series of virtual webinars were conducted to cover the teaching and learning mathematics activities. At the end of the webinars, a questionnaire to acquire teachers' perception on CT was disseminated to participants. The questionnaire consists of teachers' comprehension of the CT concept, teachers' interest in problem-solving abilities related to CT, perceptions of the integration of CT in teaching and learning practise, and perception of a teacher's competencies in teaching and learning using CT. The survey forms were distributed using the Google Form and were emailed to the respondents. SPSS and Nvivo software were used to analyse the data collected. There were 84 teachers attended the webinars, only 41 primary school mathematics teachers responded in this study. The studies demonstrate that teachers comprehend the concept of cognitive theory and that they value cognitive skills in their classroom activities as a component of the thinking process. However, it is important to take into account teachers' concerns about time constraints when utilising these skills to improve students' learning. The study will provide that the CT skills can be used for problem solving in mathematics classrooms, which is essential to prepare future teachers and students on CT skills, and the participants also stated that CT skills are necessary for students in the future because the students can apply CT skills for solving problem in daily life as well.

Keywords: Computational thinking, Mathematics classroom, Problem solving

OPM008: Impact of Digital Teaching Aids on the Academic Performance of Year 4 Pupils in Coordinates

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This quasi-experimental study aimed to assess the impact of digital teaching aids on the academic performance of Year 4 pupils in coordinates. The participants involved in this study were two classes comprising 52 pupils from a primary school in Penang selected using cluster sampling. The research instrument was built based on the Mathematics Standard-Based Curriculum for Primary School (DSKP). Pre-test and post-test evaluations were carried out for both the experimental and control groups to gather data. According to the literature review, common misconceptions faced by pupils in learning coordinates included ordered pair misconceptions and visualization problems. In order to address these issues, the experimental group received an intervention involving the use of digital teaching aids, while traditional teaching method was applied for the control group. Descriptive and inferential statistics with a quantitative approach, such as mean, standard deviation, paired samples t-test, and independent samples t-test, were utilised for this research. Based on data analysis, the results indicated that the use of digital teaching aids significantly improved pupils' achievement in coordinates, as demonstrated by a significant difference between the mean marks of pre-test and post-test within the experimental group. Moreover, the outcomes also revealed that a significant difference existed in the mean marks between experimental group and control group. The findings of this study bear notable implications for various education stakeholders.

Keywords: Digital teaching aids, Academic performance, Coordinates, Primary mathematics, Pre-test and Post-test

OPI009: What We Have Learned about Teachers' Questioning from 100 Mathematics Lessons Visiting?

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Since the New Math Curriculum Guideline (MCG) which emphasized on mathematical literacy has been published in 2014 in Taiwan, researchers would like to know how the MCG impacts teachers' mathematics teaching in the classroom. Due to the fact that mathematical tasks are the core of mathematics teaching and learning, and will be implemented by teachers' posing and questioning, this study would like to understand what kinds of types of mathematical tasks were used by teachers in their teaching? How did teachers guide students to learn and solve mathematical tasks by their questioning? Which learning focus was emphasized when teachers implemented mathematical tasks? The teachers' teaching practice in classroom could give us an insight into evaluate the influence and effectiveness of national MCG on teachers' teaching and students' learning. Case study was adopted as method in this study. There were 31 elementary teachers who came from 11 schools that located in urban, suburban and rural areas, and with different academic backgrounds and teaching experiences participated in this study. Three lessons with different mathematics topics that included Number and Quantity, Geometry and Algebra were video tapped for each teacher. Ninety-three mathematics teaching videos were collected and analyzed. For achieving the purposes of this study, researcher developed two instruments which focus teacher's follow-up questioning, types and focus of mathematics task for analysing teachers' teaching practice. The analytic reliability of two instruments is .89 and 1, respectively, for teachers' questioning and tasks types through two experienced analysts working on the same teaching video comparison and analysis. After got the qualified reliability, we started to analyze all of teaching videos. The results of this study indicated that most of questioning the teachers used was the closed-end questioning with short and immediate responses from students which focus on helping students to classify and understand the meaning of math concepts and problems. Only 5 % of questioning the teachers used were asking students to do mathematics reasoning and explanations about their problem solving. Eighty-five percent of tasks the teachers implement in teaching were low-cognition tasks which emphasized on memorizing mathematics facts or mastering arithmetic skills. During the teaching implementation, 18% of teaching focus were on mathematics reasoning and application. The results of this study showed that teachers' teaching performance in math lessons was not satisfied the requirements and expectations with our NCG, which emphasize on mathematics inquiry and reasoning. The findings of this study could make us understand what's going on in math classroom after our NCG published, and to evaluate the effectiveness of our NCG implementation. According to our finding, we should find a way to shorten the gap between practice and NCG, which include improving pre- and in-service teachers' program, understanding the challenges the teachers face and providing supports for them.

Keywords: Mathematics teaching, Teacher's questioning, Types of problems

OPI010: Enhancing Mathematics Teachers' Diagnostic Competence through the SMART Test Professional Learning: Challenges and Opportunities

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Some studies reported that Indonesian teachers faced difficulties conducting the diagnostic assessment. An online diagnostic test, SMART Test, was introduced to Indonesian teachers through a Professional Learning (PL) session to assist Indonesian teachers with this issue. This study aims to evaluate the impact of the PL in enhancing teachers' diagnostic competence. Guskey's five-level evaluation framework was used to assess the impact of the PL on teachers' attitudes and knowledge, school support, changes in classroom practices, and student learning outcomes. The participants of this study are ten Indonesian mathematics teachers, which consisted of five primary school teachers and five junior secondary mathematics teachers. Data were obtained using the teacher's journal diary, survey, and semi-structured interviews. The results indicated that the SMART-Test PL positively influenced teacher attitudes and content knowledge about diagnostic assessments. Furthermore, the teachers also used the analysis results and the suggestion from the SMART Test to change their teaching practices, which positively influenced students' learning outcomes. Teachers experienced challenges during the implementation due to the language barrier and the lack of technology tools. The SMART Test PL shows potential for enhancing teachers' diagnostic competence. However, further research is needed to examine the change in teachers' practice and how it affects students' mathematical thinking.

Keywords: SMART-Test, Online Diagnostic Test, Teacher Professional Learning, Teacher's Diagnostic Competence

OPI012: On the Nullity of Some Families of R - Partite Graphs

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A graph is denoted by $G = (V, E)$ where $V = \{v_1, v_2, \dots, v_n\}$ is a finite set of vertices and E is a finite set of edges. The order of graph G is the number of its vertices denoted by n while the size of graph G is the number of its edges denoted by m . A square matrix that is used to represent a graph G is called its adjacency matrix $A(G)$. The adjacency matrix of G of order n is the $n \times n$ symmetric matrix $[a_{ij}]$ such that $a_{ij} = 1$ if v_i and v_j are connected and 0 otherwise, for any pair $v_i, v_j \in V$. Eigenvalues are the special set of scalar values that is associated with the set of linear equations most probably in the matrix equations. The main focus of this paper, is the nullity of a graph G , denoted by $\eta(G)$ and defined to be the total number of the eigenvalue zero in the spectrum of a graph. The spectrum of a graph G is a two-row matrix, the first row elements are the distinct eigenvalues of its adjacency matrix $A(G)$ and the second row elements are its corresponding totals. Furthermore, the rank of G , denoted by $rank(G)$ is also the rank of $A(G)$, that is $rank(G) = rank(A(G))$. The rank of $A(G)$ is defined as the maximum number of linearly independent row/column vectors in adjacency matrix $A(G)$. In addition, given that G is of order n , it is known that $\eta(G) = n - rank(G)$. Thus, any result about rank can be stated in terms of nullity and vice versa. Now, the r -partite graphs is a well known graph. It is a graph G in which vertex set V is partitioned into r nonempty subsets P_1, P_2, \dots, P_r in such a way that no edge joins two vertices in the same partite sets. In this paper, a special class of families of r -partite graphs was examined and represented by its adjacency matrix, identified the rank of graph G then the nullity of G was determined.

Keywords: Adjacency matrix, nullity of a graph, r -partite

OPS055: Anakku Bitara (Proakbi) Programme: Indicators for Literacy and Numeracy Mastery of Year 5 and Year 6 Pupils

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The Literacy and Numeracy Programme (LINUS) and the Literacy and Numeracy for Primary School (PLaN) were implemented by the Ministry of Education Malaysia (MOE) to ensure the mastery of 3R (Reading, Writing and Arithmetic) among pupils in Stage One primary education. The main purpose of *Anakku BITARA* Programme (ProAKBI) for Stage Two pupils (Year 5 and Year 6) was to identify those who failed to master 3R based on the prescribed constructs by utilizing Literacy and Numeracy Mastery Identification (2Plan). A total of 3958 Performance Level 1 (TP1) and Performance Level 2 (TP2) pupils from Year 5 and Year 6 were involved in this study. To avoid intervention issues such as unfocused teachers and teacher transfer problems, the Melaka State Education Department created Progress Indicator Card (PIC), an innovation to record scores for each pupil's construct in order for teachers to implement an intervention based on constructs which have not been mastered. Mastery of each construct will be recorded through an indicator graph that reflects progress of the pupils. It is hoped that this innovation will assist teachers and parents to overcome the 3R issues with focused interventions before primary school pupils step into secondary school.

Keywords: Literacy and numeracy, 3R, intervention, mastery

OPM084: The Implementation of Integrated STEM Project-Based Learning (PBL) e-Module

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In an effort to empower Science, Technology, Engineering and Mathematics (STEM) in education, the Curriculum Development Division has taken the initiative to develop and implement an Integrated STEM Project Based Learning (PBL) e-module as a guide for teachers to conduct teaching and learning through project-based learning. This study was conducted to see the effect of the implementation of Integrated STEM PBL e-module at school. 64 selected schools have implemented various Integrated STEM PBL projects involving a combination of several STEM and non-STEM subjects. A survey was conducted on all schools involved. The collection of data is carried out in the form of questionnaires and interviews with teachers and students. The findings show positive impact in several aspects such as STEM-based teaching planning, the implementation of Integrated STEM PBL activities and the assessment based on the STEM approach. The results of the interview found that 88.9% of the students had an interest in STEM subjects and were interested in continuing their studies at a higher level in the STEM field. Integrated STEM PBL is expected to attract more students to venture into STEM fields at the school and higher education levels as well as be able to deal with challenges and be competitive at the global level.

Keywords: STEM Education, Project Based Learning, e-module, integrated learning

Parallel Session 1

Day 1: 31st October 2023 (Tuesday) | 1500 - 1700 | Thailand Room 1 | Moderator: Dr. Nur Jahan Ahmad

OPM006: Towards a Framework for Understanding the Meaning of Fractions

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The importance of learning fractions has been recognized by researchers and teachers in schools worldwide due to its function in our daily life and various challenges faced by students in understanding the concept of fractions. Efforts need to be made to define fractions for helping teachers and students develop knowledge and competence in fractions as well as mathematics in the VUCA world. Therefore, this study aims to propose a framework to develop students' understanding of the meaning of fractions. The framework for understanding the meaning of fractions based on four main dimensions namely fraction is partitioning, fraction is iterating, fraction is a number, and fraction has size, was proposed and needs to be emphasized among students. The proposed framework is significant for designing the teaching of fractions, which focuses on building a comprehensive and in-depth knowledge of fractions, rather than separating one dimension from another.

Keywords: Fractions, Mathematics teaching, Framework of fractions, Meaning of fractions, Fractions understanding

OPS039: Use of Artificial Intelligence "Checkmath": Helps Improve Mastery of Numbers and Operations through a Student-Centered Approach

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This research was conducted to improve the students' abilities in number training and operations with the help of Artificial Intelligence "CheckMath". Early observations of the researchers found that the students could not solve the problem of numbers and operations without the help of researchers. Pupils lack confidence in solving training problems in this area. Therefore, the researchers have implemented a learning intervention in a more interactive direction by using "CheckMath". This learning is applied based on the researcher's concern for the problems faced by students to master this field. This intervention is a digital intervention concept that applies the concept of 21st Century Learning (PAK-21), which is student-centered learning. In the learning standards outlined in the assessment curriculum standards document (DSKP), students are able to solve mathematical sentences involving whole numbers, fractions of millions and decimals of millions for basic operations and combined operations. Using the action study method, the researchers conducted pre-test, post-test, interview and observation on 10 excellent year 6 students to test the effectiveness of the use of "CheckMath" to help students improve mastery in the field of numbers and operations. The researchers also want to suggest that mathematics teachers can take advantage of this digital alternative approach in using it both inside and outside the classroom. This research is also expected to be a driver for efforts to foster students towards an interest in Mathematics in general.

Keywords: Artificial Intelligence "CheckMath", 21st Century Learning (PAK-21), student-centered learning

OPM002: Educators' Perception of Programming Module on Mathematics Instruction for Primary School

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This paper aimed to assess the educators' perceptions on the implementation of programming modules in mathematics instruction at primary schools to enhance pupils computational thinking skills and motivation. The study employed a qualitative approach. Specifically, the instrument is composed of semi-structured interviews via a purposive sampling method. A total of eight respondents among the mathematics educators from different institutions were involved. This study reveals that most respondents have a favourable view of programming modules integrated into mathematics education in primary school. In fact, most of the respondents concur that such a module can boost student learning motivation. However, they have limited or no programming application skills. Hence, the findings suggest that the mathematics curriculum for primary school needs a structured module in programming. Consequently, this study recommends the development of a module that integrates programming in mathematical learning with the intention to assist the primary school mathematics educators in enhancing pupils' computational thinking and boosting their learning motivation in mathematics.

Keywords: Mathematics, programming, computational thinking, motivation, instructional module

OPM007: A Study of Pre-Service Teachers' Interest in Fundamentals of Programming toward Achievement in Decision Mathematics Courses

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Basic programming refers to the basic knowledge and concepts required in software development or writing code using a programming language. Programming basics is an important first step for anyone who wants to learn and master programming skills. The purpose of this study is to investigate whether there is an impact between interest in the basics of programming and achievement in the subject when attending the Decision Mathematics course at the Institut Pendidikan Guru Kampus Pulau Pinang (IPGKPP). The sample consisted of 66 IPGKPP students from Mathematics courses. The instrument used is a questionnaire with a choice of five likert scales. The statistical test is independent samples t-test and analysis of variance (ANOVA) with the data analysed using SPSS (Statistical Package for the Social Sciences). There is a positive impact between interest in the basics of programming, gender and achievement in the subject of Decision Mathematics. The results showed that there was no significant difference between male and female students but there was a significant difference among different achievements in interest toward programming. The results also found that low-achievement students' interest toward programming were the lowest of all types of respondents compared with high-achievement students. In conclusion, the basics of programming and the subject of mathematics is something that is considered relevant because the structure of both which is logical is useful in understanding and solving problems. However, interest is not the only factor that affects achievement in mathematics.

Keywords: Programming, achievement, decision mathematics, pre-service teachers'

OPM009: Mnemonics Strategy in Enhancing Graph Sketching Skills

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This paper aimed to present the impact of using the mnemonics strategy (acrostics) to improve students' graph sketching skills and enhance students' confidence in sketching graphs. This research involved 7 students who enrolled in the course Mathematics SM015 at Kolej Matrikulasi Pulau Pinang during the academic session 2022/23. The cognitive load theory serves as the theoretical framework adopted to achieve the aim of this study. The Kemmis and McTaggart model is applied in this study. Pre-test and post-test were carried out to investigate students' performance after implementing the mnemonic strategy in graph sketching. The mnemonic strategy is effective to improve students' graph sketching skills and to enhance their confidence in graph sketching. From the paired-sample t-test, the p-value <0.5 implies that there is a significant difference in the means of the pre-test and post-test. Furthermore, the higher mean of the post-test indicates that students have significant improvement in sketching graphs after the mnemonics strategy was introduced. The students are found more confident when sketching graphs after the implementation of the mnemonic strategy.

Keywords: Graph sketching, mnemonic strategy, cognitive load theory

OPS042: Teacher Sharing Classroom (TSC) Basics Computer Science Teacher Towards the Digitalization of Teacher Education in Perak State (Pilot Study)

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Nowadays, teachers need knowledge and skills to strengthen the quality of teaching and learning for students' achievement. However, there are teachers who are less skilled (mentee teachers) due to non-teaching options or lack of experience in teaching Basics Computer Science subjects. In addition, constraints in terms of location and time cause mentee teachers to lack exposure and knowledge sharing from expert and experienced teachers (mentor teachers). Therefore, this study aims to improve the skills of mentee teachers in teaching and learning in the subject of Basics Computer Science through a co-teaching approach. The Teacher Sharing Classroom (TSC) programme is a teaching and learning sharing program of Mentor Teachers from other schools to mentee teachers from other schools that is implemented online using a co-teaching approach. This study was carried out quantitatively to 30 schools of mentee teachers who taught in Form 1, Form 2 and Form 3 and there are three mentor teachers. The findings showed that through the co-teaching method, it provide new knowledge to the mentee teacher. The worksheets and materials that have been used by the mentor teacher gave the mentee teachers a new ideas to plan teaching and learning lesson for topics and understand difficult topics. In addition, the mentor teacher's questioning technique can stimulate students to actively engage in teaching and learning session in the classroom. In conclusion, this study provides a platform for mentee teachers and mentor teachers to exchange opinions and share teaching and learning techniques and strategies with each other. The study also supports the digital education policy where this study uses new methods for future education.

Keywords: Co-teaching, Fundamentals of Computer Science, National Digitization Policy, Mentor Teacher, Mentee Teacher, Technology

OPS053: Engagement of Jahai Indigenous Students in Integrated STEM Learning through the Kombucha Tea Fermentation

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Engineering is one of the important elements of STEM education. The Engineering Design Process (EDP) is a new trend within science education reform. EDP is able to encourage students' engagement in science learning in the traditional sense (i.e. sustaining students' cognitive, behavioral, and emotional interest in learning), referred to as active engagement. However, most science teachers still lack information regarding the application of EDP in teaching and learning science. Fermentation of sweetened black or green tea by symbiotic culture of bacteria and yeasts, known as Kombucha tea, is emerging as an appealing STEM learning environment that can provide primary educators with solutions to address the complex nature of students' engagement in contemporary practice. This study aims to explore how the integrated STEM learning with Kombucha tea fermentation lends itself to the pedagogical approach of EDP (STEM-Kombucha) to enhance students' engagement in the context of Indigenous education. Characterizing the relationship between pedagogy, integrated STEM learning, Kombucha tea fermentation and students' engagement as a complex problem, the study followed an action research design to develop an integrated STEM learning experience for the Jahai tribe Indigenous students. This study was conducted by a teacher-researcher with 16 students in a rural area of Royal Belum Rainforest, Gerik, Perak, Malaysia. Data were gathered through the post-experience survey, teacher observations, and student work. The findings illustrate that STEM-Kombucha promotes a highly immersive environment where students were able to actively engage in the learning process to construct an experience and understanding of life processes, factors affecting the growth and the usage of microorganisms. While this study focused on how integrated STEM learning through EDP with Kombucha tea fermentation might enhance students' engagement, it also illustrates an innovative instructional approach not commonly found in contemporary Malaysia primary educational environments.

Keywords: teacher action research, Kombucha tea fermentation, engineering design process, engagement, Indigenous students

OPS071: Virtual Reality Trainers for Students with Disability: Analysis of Students' Motivation and Motor Performance

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Despite the growing policy, educational, and political concern surrounding the progressive trend towards enrolling students with disabilities in regular public schools, there have been few studies examining the effective inclusion of Students with Learning Disabilities (SLD) in teaching and learning. Inclusive education, as a fundamental human right, necessitates that educators explore more ways to include SLD students. Virtual Reality (VR) offers a highly motivating learning environment, combining 3D virtual settings with technologically advanced modes of interaction. VR provides an interactive experience in which individuals can become immersed in computer-generated environments. Nevertheless, there is limited research on the use of VR for Students with Learning Disabilities (SLD). Physical Education (PE) is a compulsory subject in Malaysia, aimed at developing skills, knowledge, values, and attitudes for maintaining a healthy lifestyle. Numerous studies have explored the use of VR to enhance PE learning. Therefore, this study examines the effectiveness of VR trainers in teaching PE to students with learning disabilities. As part of this study, a VR application is being developed, and users will be asked to provide their opinions. The study evaluates the motor performance and motivation of the experimental group to measure the effectiveness of VR trainers in facilitating SLD learning. The results demonstrate that combining immersive technology with motor learning theory successfully motivates SLD students and improves their motor performance scores in PE learning.

Keywords: Disability, inclusive education, computer-generated environments

Parallel Session 2

Day 2: 1st November 2023 (Wednesday) | 1000 - 1215 | Penang Room 1 | Dr. Warabhorn Preechaporn

OPS063: Evaluation of STEMEC Program Implementation in Malaysian Primary Schools: A Pilot Test of Input, Process, and Product Assessment

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The Ministry of Education (KPM) initiated the STEM Executive Consultation (STEMEC) program in 2019 in an effort to develop exemplary schools that implement integrated STEM education holistically using project-based learning methods. To ensure the feasibility of this program in primary schools, an evaluation study needs to be conducted. Considering that this program is still in the educational program phase under the Malaysian Education Development Plan 2013-2025 initiative, it is necessary to gather data to determine whether the program needs improvement, should be maintained, or replaced with a more effective alternative. The assessment of this program utilizes the CIPP Model by Stufflebeam (1971), which focuses on evaluating the dimensions of input, process, and product. This pilot research employed a survey approach with a quantitative methodology. The survey questions were developed by adapting previous studies and then distributed to 30 respondents, who were teachers involved in the STEMEC program. The data collection was facilitated through the Google Forms platform. The study's findings revealed that the respondents' perception of the STEMEC program implementation from the input, process and product evaluation in CIPP Evaluation Model was at a high level. The results of this study suggest that this program should be maintained. Adequate teachers training, sufficient facilities and materials, support, guidance, and monitoring are essential elements for the successful implementation of this program.

Keywords: Program STEMEC, CIPP model, programme evaluation

OPM016: Survey on Computational Thinking Skills with Internet of Things (IoT) Activities: Assessing Educators' Perspectives

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In the age of rapid technology growth, computational thinking abilities are being seen as necessary qualities. It is critical to grasp educators' viewpoints on the importance of computational thinking skills in Internet of Things (IoT) activities as IoT technology integration becomes more common in educational settings. In the context of IoT activities, this study intends to investigate educators' understanding, views, and practices linked to computational thinking skills. The purpose of this study was to introduce the basics of electronics using Arduino microcontrollers as well as create circuits with the breadboard. The data collection method was mostly through survey method and a Guttman scale questionnaire consisting of dichotomous and open-ended questions. Preliminary findings from the survey highlight the importance of educators' awareness and understanding of computational thinking skills in the context of IoT activities. The survey's findings will shed important light on how computational thinking skills are currently embedded into IoT activities as well as the assistance and materials needed by educators. This knowledge can help design curricular standards, policy suggestions, and targeted professional development programmes that will improve educators' ability to encourage computational thinking skills through IoT activities. This poll intends to add to the larger discussion on the successful integration of IoT technology and computational thinking in educational contexts by gaining an understanding of educators' perspectives.

Keywords: Computational thinking skills, Internet of Things, IoT, educators, survey, professional development, curriculum integration.

OPS059: My Lovely Pet

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Science Process Skills are basic thinking skills that are needed by a student to understand a science concept. This study aims to enhance science process skills through the application of a project-based learning method entitled 'My Lovely Pet'. Reflection on past teaching and learning sessions showed that students faced difficulties in the skill of classification, especially in the topic of animals, where they were unable to identify similarities and differences based on the characteristics of the particular animal. The target of this study consists of 5 Year 2 students from the Special Education class, who have not yet mastered the 3M skills, namely Reading, Writing, and Arithmetic, well. This project involves initial observation of the animal they commonly see around the school, which is a cat. Students are asked to narrate their observations of the cat using their own understanding and words. The teacher will guide them in finding information about their favorite animal based on verbal guidance and instructions during the teaching and learning session, as the students are still weak in reading skills. The result of their project is in the form of an attractive scrapbook that will be displayed in the classroom and can be used as a teaching aid. Based on observations and interviews conducted, the teacher found that the students showed positive confidence in answering all questions related to the project they produced. The students also felt happy because they can learn while playing with their favorite animal.

Keywords: Project-based learning, science process skills, special education students.

OPS064: Higher-Order Thinking Skills in Teaching and Learning of Substance Movements across the Plasma Membrane

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The purpose of this study is to identify the level of higher-order thinking skills by integrating project-based learning, *Model Kreatif Terarah*, constructivism theory, visual charts, mind maps, and concept maps for teaching the Movements of Substances Across the Plasma Membrane using a well-developed BIO Three Module. A quantitative approach with quasi experimental research design was chosen to answer two research questions and hypotheses. A Critical Thinking Appraisal Watson Glacier Questionnaire was used in this study. 60 students were randomly selected as respondents. The descriptive analysis revealed that the level of higher-order thinking was 46.9 percent for the posttest and 39.00 percent for the pretest. The t-test was then used to compare the treatment and control groups' levels of higher-order thinking skills. Initially, the groups' higher-order thinking skills are equal ($p > 0.05$, 0.983). There is a significant difference between the groups after implementing the module ($p < 0.05$, 0.000). This study hopes to improve students' high level thinking skills by employing the BIO Three Module as teaching aids. The theories and models used in the conceptual framework can be applied to develop modules for other topics in Biology.

Keywords: Module development, mastery concept, higher order thinking skills, project-based learning, constructivism.

OPS076: The Integration of Blended Learning with the Digital Platform Wakelet in Organic Chemistry Learning For Matriculation Science Students in Semester 2

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Readiness and preparation of students before entering the classroom are crucial for learning organic chemistry. However, some students lack the necessary resources and platforms to adequately prepare themselves before entering the classroom. This study aims to explore students' perceptions of the integration of Wakelet as an interactive digital platform in blended learning on the topic of organic chemistry. A total of 10 students were selected as respondents for this study. Data was collected using semi-structured interview and document analysis and later analyzed using thematic approach. Three themes emerged from this finding: i. Systematic; ii. Effectiveness; and iii. Ease and flexibility. The findings of the research indicate that this integration makes the students' learning process in organic chemistry more systematic, faster, and easier, and enhances students' self-directed learning, engagement, and motivation in learning organic chemistry. Students state that the use of the digital platform Wakelet makes them easier to search for their notes or their work. They also agree that Wakelet can help them manage their learning in Chemistry with ease. However, support and training are needed to help students master the skills and become familiar with the use of this new application. The implications of this study suggest that Wakelet is a suitable digital platform for the purposes of instructional planning, managing learning materials, and tracking students' activities in blended learning.

Keywords: Wakelet, organic chemistry, blended learning, matriculation and chemistry learning

OPI028: Assessing General Biology Self-Learning Modules through a Science-as-Practice Lens

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Curricular materials designed by teachers are pedagogical tools and artifacts of their participation in the planned curriculum and their teaching context. Teacher-designed Self-Learning Modules (SLM) were distributed in response to students' needs for distance learning during the COVID-19 pandemic. These SLMs reflect the current science curriculum but were revised for individualized instruction for fewer learning competencies. Even so, they concretize science instructional practices that could be assessed relative to certain visions of science curriculum reform. In the United States, the Next Generation Science Standards (NGSS) represents a K to 12 curricular reform that emphasizes teaching science as practice. In this study, the General Biology SLMs of a local school were assessed through the science-as-practice lens using the Educators Evaluating the Quality of Instructional Products (EQuIP) rubric. This rubric checks the quality of evidence in the instruction based on the following criteria: NGSS 3D Design, NGSS Instructional Supports, and NGSS Monitoring Students Progress. Our analysis revealed that the General Biology SLMs that certain aspects of the NGSS 3D Design were applied, but their execution could still be improved. In addition, there is adequate evidence of instructional support for student's learning. However, due to the SLM's self-learning design, there is little to no evidence that it monitors student progress. The implications for designing science curricular materials and science education reform will be discussed.

Keywords: NGSS, science as a practice, self-learning modules, EQuIP Rubric

OPS075: The Effect of Predicting, Observing and Explaining Learning Strategies Integrated Visualization on Students' Conceptual Understanding in Chemical Bonding

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In chemistry subject, Chemical bonding is one of the key and basic concepts. It is a topic that students commonly find to be problematic, developing a wide range of alternative conceptions. Meanwhile, integrating 3MV module could enhance students' understanding and reduce misconceptions of the topic chemical bonding. This research investigates the effects of 3MV module on enhancing conceptual understanding and reducing misconceptions in the topic of chemical bonding. A teaching and learning module based on the 3MV learning strategy (known as 3MV module) was built as a guide for teachers to implement this strategy. Learning video that disseminated through TikTok platform was developed and integrated into the module. A quasi-experimental study was designed with a sample of 93 students divided into control and experimental groups. The control group used a teaching and learning module integrated with 3M learning strategy meanwhile experimental group used teaching and learning module designed with 3MV learning strategy (with learning video through TikTok application). Pre-test and Post test by using three tier diagnostic test of chemical bonding and structure questions were used in this study and analysis shows that the data were normally distributed. Furthermore, there was no significant difference between experiment and control group for student achievement in pretest ($t(93) = .289, P > 0.05$). Students' achievement in posttest score analysis revealed a significant different between experimental and control group ($t(93) .000, P < 0.05$). Analysis of student's level of understanding the concept using the Certainty of Responses Index (CRI) technique which is descriptive analysis to categorize student into two main categories which are understand the concept and confident or misconception. The result showed that understanding concept of chemical bond was very low at 25.6% and misconception at 67.80% in the high category for the control group. Meanwhile the data for the experimental group showed that understanding concept is high at 70.80 % and misconception is at 25.90% is at low category. This study supports using 3MV module significantly improve the conceptual understanding and reduce misconception in the topic of chemical bonding.

Keywords: Chemical bonding, 3MV module, conceptual understanding

OPS025: Implementation of 4C Elements in Online Project-Based Learning to Assist Students' Communication Skills and Problem Solving Skills for Biology Subjects

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This study was carried out qualitatively of Project Based Learning through the application of 4C' elements which are communication, collaboration, creativity and critical online can help students' communication skills and problem-solving skills for the subject of Biology among upper secondary students in secondary schools in Kota Kinabalu, Sabah. The first objective of this study is to identify the problems faced by upper secondary students when implementing Project Based Learning. An analytical study to identify problems through observation, document analysis and interviews was conducted on 7 students involved in Project Based Learning. The second objective of the study is to test the initial theory by using the 3P model through observation, interview and document analysis. The third objective of the study is to refine findings or theories implemented through interviews, observations and document analysis. This study is a Qualitative Case Study to gain a deeper understanding of online Project Based Learning. All data obtained through interviews, observations and document analysis were analyzed using triangulation techniques. This finding concludes that there is a need to apply 4C' elements in online Project-Based Learning for Biology Subjects. The first objective findings show that students face problems from the aspects of cooperation, teacher guidance, question and answer sessions when implementing project-based learning, use of different languages, opportunities to speak and time constraints. The second objective findings show that students need to be given the opportunity to speak, the implementation of PBL is done in groups through a systematic task distribution system, the teacher acts as a facilitator, the teacher needs a set of meaningful questions to encourage students to learn by inquiry, students are given time to implement PBL and the need for argumentation or dialogue techniques through presentation techniques and a systematic scoring system. Overall, it shows that students are satisfied with implementing Project-Based Learning online through the application of 4C' elements to help students' communication skills and problem-solving skills for the subject of Biology.

Keywords: Communication, problem solving, biology, project based learning

OPS083: Involving Students in Developing Atom Model to Enhance their Understanding of the Atomic Structure: An Action Research Project

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In science class, models are tool used routinely to help students visualise the concept, object or even a process or a system that cannot be experienced directly. The purpose of this action research was to enhance the level of students' understanding of atomic structure by their participation in making the model of atom. The participants were 30 students of Form One in a secondary school in Penang, Malaysia. Quantitative data have been collected using a pre- and post-test and the questionnaires. Qualitative data were gathered through observations and student's feed back writing. The findings revealed that students improve their score in the post-test and more engage in the atom model making activity. As one form of active learning, student's hands-on activity encourage them to collaborate in task given actively, and this improve their understanding in learning.. This action research is significant for teachers and students that the application of hands-on activity could contributes to the improvement of students engagement in learning activity.

Keywords: Science learning, developing models, atom structure model, hands-on activity

Parallel Session 2

Day 2: 1st November 2023 (Wednesday) | 1000 - 1215 | Penang Room 2 | Dr. Jeyaletchumi Muthiah

OPS062: Kit Subadd Vismat Application Innovation: A Simple and Fun Way to Learn Addition and Subtraction

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This study sought to introduce the KIT SubAdd VisMat innovation, which is designed to help students learn the concept of addition and subtraction correctly. The key objective of this innovation is to assist pupils comprehend the concept of addition and subtraction, notably regrouping, as well as to foster a passion and enthusiasm for Mathematics via engaging learning. The innovation that applies this KIT SubAdd VisMat uses learning aids, sample images and digital materials. The study involved 90 seven years old students in three selected elementary schools in northern region Malaysia. The pupils were categorized into 3 groups: the control group, the module group and the applications group. The control group was taught in the conventional method, whereas the module and applications group were taught utilizing KIT SubAdd VisMat. The findings revealed a statistically significant difference in score mean between the module and control group, as well as the applications and control groups. Module group and apps group students had better understand of addition and subtraction concept especially when it involved regrouping. The finding of this innovative research have provided a simple and entertaining explanation of Mathematics concept.

Keywords: KIT SubAdd VisMat, addition, subtraction, mathematics, regrouping, digital materials

OPS036: Mastering Differentiation: A Hands-On Approach

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Secondary school students often encounter difficulties when solving problems involving differentiation, and they struggle to relate this topic to real-life situations. Differentiation is one of the essential but challenging concepts in calculus. To address this issue, a hands-on approach with a STEM module has been developed and implemented among Form Five (Grade 11) students from SMJK Chung Hwa Confucian in Penang. Pre- and post-test questions were administered to assess the students' understanding of the concept of maximum and minimum points. During the hands-on approach, students solved a real-life problem by determining the minimum area using a heuristic method and constructed a model. They then justified the volume of their model. Geogebra software was employed to aid in comprehending the turning points of the equation. Students eagerly presented their constructed models in groups, explaining their work and making conjectures. The results of the post-test indicate that 16 out of 30 students were able to answer a Higher Order Thinking Skills (HOTS) question related to the concept of maximum and minimum values without the guidance of a teacher. Furthermore, the hands-on approach actively engages students in the teaching and learning process, bridging the gap between calculus concepts and real-life situations. By relating and solving problems involving maximum and minimum values within real-life contexts, students gain a deeper understanding of the concept, which can ultimately lead to improved performance in both school and national examinations.

Keywords: Differentiation, Hands-on-Approach, Geogebra, Calculus,

OPI017: A Phenomenological Study of Teachers' Professional Learning and Their Understanding of Making Meaning in Mathematics

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Meaningful teaching and learning of mathematical concepts project provided professional development for three years to grade 8 mathematics teachers in a district in the Eastern Cape province of South Africa. By the end of this programme teachers were interviewed with the purpose of understanding their perception of what they learned in terms of making meaning in mathematics. This article describes the professional development programme and preliminary findings from the analysis of the interviews with three teachers who participated in the project for the consecutive three years. By understanding teachers' perceptions in this case, this article informs the future professional development programmes aimed at improving teachers' knowledge making meaning in mathematics. Findings indicated that teachers learnt how to improvise in the contexts using available artifacts as resources that promote understanding of mathematical concepts, lesson study practice and inquiry-based teaching.

Keywords: Mathematics, Meaning, Professional learning, Artifacts, Lesson study

OPI018: Ethnomathematical Practices in Tahiti (*Thysanolaena Latifolia*) Farming: Integration for a Localized and Authentic Mathematics Curriculum

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The study centers on the indigenous tahiti farming practices of the Obo Manobo community of barangay Manobisa, Magpet, North Cotabato. Using an ethnomathematical lens, I attempted to understand the community's knowledge and its connections to the basic education mathematics curriculum. Ethnographic participant observation and community immersion were employed, and gathering data was done through interviews and field notes. Narrative research analysis through secondgeneration didactical engineering was utilized in making sense of the data gathered. Findings revealed that the small-scale farmers of tahiti use the following ethnomathematical practices: (a) using dupa in measuring the distance between planted tahiti clumps, (b) abre puno, (c) abre kalsada, (d) proportioning of harvested tahiti stalks (inupat, linima, tersya, and tunga), (e) measurement that uses body parts, (f) soft broom production, and (g) accounting of finished soft brooms. These practices were connected with ten learning competencies of the K to 12 junior high school mathematics curricula. Across these competencies are the concepts of measurement, estimation, perimeter, circumference, ratio and proportion, inverse proportion, and counting principle. These ethnomathematical practices will be a great resource in contextualizing and localizing mathematics curricula, further making mathematics teaching more relevant. Mathematical tasks or problems were designed and their integration into the curriculum was discussed with math teachers from a nearby school. The research findings provide insights into the perceived benefits of integrating ethnomathematics into mathematics education and shed light on the ways these practices might enhance students' mathematical understanding and application. The implications of this study concerning representing indigenous knowledge in the curriculum will be discussed.

Keywords: Ethnomathematics, indigenous knowledge, contextualized mathematics curriculum

OPI019: Mathematical Investigation in HyFlex Setup: Affordances and Constraints for Engineering Students' Participation

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This paper aims to investigate the value of incorporating mathematical investigation (MI) in a Mathematics course for engineering students and to identify the affordances and constraints in a Hybrid-Flexible (HyFlex) setup, with a specific focus on structuring students' participation in MI activities. This qualitative study involved 27 purposively chosen engineering students who were exposed to MI within a HyFlex learning modality. Data was collected through students' written outputs, oral presentations, and video reflections. Thematic analysis was employed to analyze the gathered data. The findings revealed several key aspects of the value and challenges related to MI in the HyFlex setup. Firstly, MI in HyFlex allowed students to have a more engaging and immersive learning experience. Secondly, the HyFlex environment offered students the flexibility to choose their participation mode, allowing students who are sick or away from school to still perform activities remotely. Thirdly, technological constraints affected students' ability to fully participate and collaborate with their classmates in certain aspects of the MI. Lastly, while the HyFlex model provided flexibility, students needed to manage their time effectively to optimize in-person and remote engagement in MI tasks. The value of MI in a HyFlex setup can help mathematics educators design more effective and inclusive learning experiences. The insights into affordances and constraints provide valuable guidance for structuring and optimizing participation in MI activities. Addressing technological challenges and emphasizing time management strategies can further amplify the educational impact of HyFlex environments for engineering students.

Keywords: Mathematical Investigation, Mathematics teaching, Hybrid-Flexible Learning, Thematic analysis

OPS056: Numberless Word Problem Strategy in Sentence Based Mathematics Problem Solving Skills among Year 5 Pupils

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This action research was conducted to determine the type of mistakes done by year five pupil in solving mathematics word problems and to determine student performance before and after the Numberless Word Problem Strategy implemented in their classroom. This is a qualitative study using Somekh (1989) action research design. Research sample was chosen using purposive sampling techniques involving three year five pupils from rural area in Semporna, Sabah. The data collection was done in two weeks period involving three sessions of interventions. Research instrument used was document analysis, pre and post written test and interviews. Data analysis was done qualitatively; the mistakes done by the pupil was categorize based on Newman Error Analysis Model. Change on pupil performance was measure by the number of mistakes done in pre and post written test and their comprehension was triangulate by interviews findings. Research finding indicates that pupil at band three level (TP3) in mathematics often making mistakes at comprehension level. While pupil at band four level (TP4) often making mistakes at transformation level. Results also indicate Numberless Word Problem Strategy had effectively reduce number of mistakes done at comprehension level during post written test. This research hopefully will offer an alternatives teaching strategy for teacher specially lesson involving mathematics word problems and as a stepping stone to conduct experimental research on a wider scale in the future.

Keywords: Mathematics word problems, student performance, Newman Error Analysis Model

OPM068: The Relationship Between Level of Metacognitive Skills Towards Achievement of Mathematical Problem-solving in Primary School

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Mathematics requires complex problem-solving skills. Since real-world issues are frequently non-routine, it is important to introduce children to mathematical thinking exercises that entail problem-solving techniques. Level of metacognitive skills are closely related to students' level of achievement in mathematical problem-solving. This study explores the relationship between level of metacognitive skills and achievement towards mathematical problem-solving of primary school students. This study uses a quantitative survey approach on year 5 students at SJKC primary schools in Kuala Lumpur. A total of 366 respondents were randomly selected to participate and complete the questionnaire in this survey. The questionnaire consists of 20 questions which are under four aspects namely awareness, cognitive strategy, planning and self-checking. Data analysis used in this study was descriptive analysis such as the mean, standard deviation, frequency and percentage while Pearson's r correlation was used for the inferential analysis by using the Statistical Package for Social Science (SPSS) version 27. The interpretations of the mean score showed results of $m=2.90$ for awareness aspect, $m=2.78$ for cognitive strategy aspect, $m=2.93$ for planning aspect, and $m=2.90$ for self-checking aspect. These results indicated that the Year 5 students have a moderate level of metacognitive skills. Furthermore, the results also showed a strong positive relationship between students' level of metacognitive skills and level of achievement in mathematical problem-solving. This study proves that students who exhibited higher levels of metacognitive skills demonstrated superior problem-solving abilities which lead to better performance in academic. We hope that education stakeholders can empower students to become more proficient and confident problem solvers in the primary school context.

Keywords: Metacognitive skills, achievement, mathematical problem-solving, education

OPM047: Mastering Division with MD'Teknik: Fueling Year Three Students' Math Enthusiasm and Academic Triumph

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Division, which is considered the most difficult basic operation for primary school students has contributed in placing Malaysia in the lower quartile in international mathematics assessments in terms of achievement, as proven after reviewing past studies. *Lembaga Peperiksaan* has suggested that students should learn various techniques in solving mathematical problems. Therefore, this paper aims to present a new developed technique in mathematic problem solving, namely MD'Teknik on the impacts of Year Three students in mathematic problem solving. This study uses a quasi-experimental design with a quantitative approach involving 60 students in a primary school in Seremban district, Negeri Sembilan. They were divided into two groups, 30 students in the control group and 30 students in the treatment group. Analysis of Pre-Post Test scores was conducted through independent t-tests and Pearson's Correlation by using the Statistical Package for Social Science (SPSS) in order to answer research questions and hypotheses. The independent t-test shows the results of [$t_{58} = -2.323, p = .024$] while the results of Pearson's correlation show that [$r = .449, p = .013$]. These results indicated that MD'Teknik has significantly improved the Year Three students' achievement in mathematic problem solving when compared to the conventional method. Besides, results also show that MD'Teknik brings a moderate positive relationship towards students' interest in mathematics. This study proved MD'Teknik is beneficial to education stakeholders and should serve as an alternative in mathematic problem solving. In further studies, we hope that this technique may be effective with other types of respondents' especially inclusive or indigenous students.

Keywords: Division, MD'Teknik, achievement, interest, education stakeholders

OPS067: Science and Maths in the VUCA World: A Comparative Insight into the UK Professional Standards Framework (UKPSF) and the Kerangka Kompetensi Guru Bidang STEM (KKGB STEM)

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This research aimed to comprehend the role of the UK Professional Standards Framework (UKPSF) and the Kerangka Kompetensi Guru Bidang STEM (KKGB STEM) in bolstering educators to navigate the challenges posed by a world characterised by Volatility, Uncertainty, Complexity, and Ambiguity (VUCA). A comparative analysis was employed to assess how these frameworks support educators. The study specifically looked into the qualitative facets of higher education teaching promoted by the UKPSF and the emphasis of the KKGB STEM on digital literacy, real-life inquiry, and interdisciplinary integration in STEM pedagogy. The UKPSF encourages a culture of continuous reflective practice, fostering adaptability among educators. This is further evidenced by the HEA Fellowship, which recognises educators' professional development and urges them to remain updated. In contrast, the KKGB STEM primarily addresses the imperatives of science and maths education for the 21st century. Key aspects include digital literacy in an evolving digital era and an emphasis on real-world inquiries, resonating with the VUCA nature. Furthermore, the interdisciplinary approach of the STEM pedagogy aims to foster versatile thinking among students. Both frameworks are paramount for the contemporary educational landscape. While the UKPSF cultivates adaptability and continuous professional growth in educators, the KKGD STEM equips them with specific tools and strategies to meet the demands of modern science and maths education. Collectively, both frameworks can complement each other in providing a holistic approach to nurturing educators proficient in leading students through the challenges of the VUCA world.

Keywords: UK Professional Standards Framework (UKPSF), Kerangka Kompetensi Guru Bidang STEM (KKGB STEM), digital literacy, continuous reflective practice, comparative analysis

Parallel Session 2

Day 2: 1st November 2023 (Wednesday) | 1000 - 1215 | Thailand Room 1 | Moderator: Dr. Bala Murali Tanimale

OPM014: Monitoring/Evaluating Tool(s) Development for Lifelong Skills-Enhancement e-Programmes as Exemplars to Sustain Quality of Science and Mathematics Education in VUCA World

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Implementing lifelong education to develop 'Future Ready' learners in preparation of Industrial Revolution (IR) eras is the global governmental aspiration in collaboration with the industrial sectors. In response to call for quality technology-enhance Science and Mathematics education in VUCA world, SEAMEO RECSAM initiated the 'Learning Science and Mathematics Together' [LeSMaT (Borderless)] project-based programme under the Golden SEAMEO Basic Education and Student Networking involving blended-mode lifelong education. This article reports SEAMEO Inter-Centre Collaboration (ICC) Education 4.0 project initiative as an offshoot programme of LeSMaT involving a mixed-research design study in 'Science, Technology, Reading, Engineering, Arts and Mathematics' (STREAM) demonstrating various models of skills under LeSMaT's sub-themes. These sub-themes are guiding focus for project teams to develop technology-enhanced learning (TEL) output that could showcase their enhanced knowledge/skills required for their potential career employability. Literature research was made on existing e-programmes fulfilling SEAMEO's priorities including discussions on developing e-survey for tracking RECSAM's e-programmes in line with Sustainable Development Goals (SDGs). Qualitative and quantitative data collection and analysis methods were implemented involving case study and validation of e-survey entitled 'Motivation towards STREAM education' (MoToS). The qualitative analysis integrating 'type 4' multiple-case design includes analysing output illustrating curriculum innovation through transdisciplinary studies reflecting Education 4.0 and SDGs whereas quantitative method involved Rasch model to validate MoToS to monitor/evaluate participants' engagement in 1st Regional Workshop on SEAMEO-ICC Education 4.0. The findings using Rasch analysis revealed MoToS is reliable with measure of CA 0.98 internal consistency and 'feeling stressed on STREAM' is the most difficult item. After the e-course series 2020-2022, participants' output was examined using 'Cross-Case Analysis' (CCA), 'Within/Exemplary-Case Analysis' (WCA/ECA). The e-course series produced SDG-related outputs with exemplars integrating SEAMEO Priority Areas No.7 and No.5. Future studies for Education 4.0 discussed includes developing creative programmes to improve transdisciplinary quality education.

Keywords: Lifelong quality science and mathematics education, VUCA world, transdisciplinary studies

OPS077: Augmented Reality as a Learning Media on Climate Change in Malaysia

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This study exemplifies the use of new technology with the potential to significantly enhance the quality of education in Malaysia. Additionally, it investigates the impact of implementing augmented reality as a learning tool on students' knowledge and technology usage in the learning process. The study focuses on the use of augmented reality as an educational tool for teaching the subject of climate change. The teaching instrument framework was designed using Fusion 360, SketchUp, Reality Composer, Virtual, and Eon-XR software. The study involved 25 second-grade students in the Kuala Selangor area. The results demonstrate that implementing augmented reality to identify environmental issues affecting climate change has yielded positive outcomes. Students have displayed proficiency in using technology and a deeper understanding of climate change. Moreover, students have shown increased interest in learning and an enhanced ability to comprehend the subject matter. In conclusion, the development of augmented reality as a learning medium can raise awareness and alter students' attitudes toward climate change.

Keywords: Augmented reality, learning media, climate change, EON-XR.

OPI008: Lesson Study: The Tale of A Fair Game

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This paper reports the results of implementing an exploratory probability task. The study aimed to recognize the knowledge of students in applying probability principles and properties in creating fair games and to draw the difficulties the students encountered in creating fair games out of a pair of dice. By engaging Lesson study, the researchers carefully planned a task for a probability lesson, noted observations appertaining to the presentation and implementation of the task, and conducted a post conference to reflect on these observations. Some results and recommendations are as follows: 1) Provide students with a task that will make them create and clarify misconceptions about probability, develop strong sense of the properties of probability, and establish clear communication as the teacher elicits and scaffolds students' ideas about probability; and 2) Engage students in a game which provides a free environment for students in order to negotiate their issues and understanding of the concepts being introduced to them. In conclusion, setting up and implementing an exploratory task require careful planning, and provide opportunities for teachers to reflect on their teaching practices.

Keywords: Probability, fair game, lesson study, scaffold

OPS072: Digital Teaching in Enhancing Effectiveness of Students Learning

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Digital teaching revolutionizes the conventional classroom model by transcending geographical limitations, granting students access to a global network of educators and peers. It encompasses numerous avenues for elevating student engagement, including interactive multimedia, online discourse, and adaptive learning platforms, enabling educators to craft vibrant virtual classrooms that accommodate diverse learning styles. Real-time feedback, gamified elements, and virtual simulations elevate interactivity and enthusiasm, promoting active involvement. This paper underscores digital teaching's potential for fostering international collaboration, uniting students worldwide for collaborative projects and discussions, enriching cultural appreciation, and equipping them with essential skills for a globally connected society. The study conducted at Politeknik Seberang Perai investigates students' perceptions of digital learning, identifies factors influencing their engagement, and explores potential correlations between teaching strategies and student engagement. The results, based on a random sample of 150 participants, empower educators to tailor their methods to individual student needs and inform the development of adaptive learning algorithms that accommodate diverse learning paces and preferences. In summary, digital teaching is a transformative educational force, offering innovative means to enhance the effectiveness of student learning.

Keywords: Digital teaching, interacting learning, student engagement, teaching strategies

OPS065: Affective Factors on Malaysian Pre-service Science Teachers Readiness Towards the Delivering of STEM Education

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Pre-service science teachers play a major role in the development of human resources especially in the science field according to Malaysian Education Blueprint 2013-2025. Malaysia had targeted to have more scientists and engineers from the beginning of 2020 and need to fill more than 236,000 manpower deficits in the STEM field. This is to place Malaysia as a high-income country. This manpower needs to be prepared since their time in school. So, this paper aims to investigate factors that influence pre-service science teachers' readiness towards delivering the STEM education approaches. Pre-service science teacher affectiveness in this study is defined as their professional beliefs and self-regulation. Their affective characteristics includes STEM teaching efficacy beliefs, STEM teaching expectancy outcome and 21st century attitude. The study was participated by 248 pre-service science teachers from teacher training institutes and public universities in Malaysia. A questionnaire set was given out and the data obtained were analysed using SEM-PLS approaches. Analysis has shown that pre-service science teachers' STEM teaching efficacy beliefs and STEM teaching expectancy outcome were the main factors affecting their readiness towards delivering STEM education by 0.1 significant level on 90% confidence level. This study suggests that pre-service teachers need to have a high efficacy and high outcome expectation when delivering their teaching in the classroom by giving them a proper workshop or guidance during their study in their respective institutions.

Keywords: Pre-service science teachers, readiness, STEM teaching

OPS078: Developing Water Level System Encouraging STEM Skills among Students

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The generalization of vocations across wide subjects exacerbates the challenges involved in identifying the lack of STEM skills in the labor force. Since there are several branches of science and engineering, and because these fields differ from one another throughout space and time, science and engineering are not professions in the traditional sense (Teitelbaum 2014). For this study STEM Skills defined as problem solving skills, mathematics, leadership, critical thinking, creativity, attention to details and collaboration. However, we only discussed on problem solving skills and creativity for this paper. Learning will be meaningful as a result of the STEM education's goal of helping students relate science, technology, engineering, and mathematics to one another, to other subjects, and to real-world situations. In this project students have been exposed to water shortage problem in their school. To prevent the toilet from becoming dirty and smelly due to shortage of water the toilet should be closed automatically. Students need to develop the water level system that can overcome the problem, they used engineering design process model. They were guided for eight weeks in developing their prototypes. Manova analysis showed that developing water level system can encourage STEM Skills among students. In addition to integrating science, technology, engineering, and mathematics subjects in STEM education, the development of STEM skills is also of great importance.

Keywords: STEM skills, problem solving skills, creativity skills and engineering designing process

OPS019: From Virtual to Tangible: Enhancing STEM Teaching and Learning with 3D Printed Models

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Object-based learning involves using tangible models to facilitate hands-on experiences and deeper comprehension of abstract concepts. This study seeks to enhance STEM education by leveraging 3D printing technology to develop teaching materials promoting object-based STEM learning. The project's objectives are to design and develop a comprehensive library of 3D printable models aligned with primary science and mathematics curricula and to investigate the impact of object-based learning on student engagement, conceptual understanding, and academic achievement. The initial phase will involve mapping the existing curricula and learning objectives with relevant 3D print designs that represent complex concepts and accommodate different learning styles. A mixed-methods research approach will be used to evaluate the teaching materials' efficacy. Pre- and post-assessments, surveys, and interviews will be conducted to collect data on student learning outcomes, attitudes, and perceptions. The findings will be analysed to assess the impact of object-based learning on student achievement and motivation. The project will address scalability, cost-effectiveness, and teacher professional development challenges. This study advocates developing 3D-printed teaching materials to enhance object-based learning in primary school science and mathematics. By combining hands-on experiences with abstract concepts, this approach is hoped to improve student engagement, deepen conceptual understanding, and foster a passion for learning. Recommendations and guidelines for integrating 3D printing into existing science and mathematics curricula will be developed, along with teacher training programs. As for the educators, it will equip them with effective tools and skills to inspire the next generation of STEM professionals.

Keywords: Object-based learning; 3D Printing; science education, STEM education, teaching resources

OPS043: Teacher Education Institute Students' Perspective on Adopting Mobile Learning in Science

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The aims of the study are to determine the mobile device usage of teacher education institute students and their opinions of adopting mobile learning in science. A cross-sectional survey design was adopted in this study, in which questionnaire was administered to the students in science department of a teacher education institute. A total of 54 students took part in this study. The quantitative data were descriptively analysed, whereas conventional content analysis was used to categorise and create emerging themes for the open-ended questions. The analysis showed that teacher education institute students used to conduct learning related activities using their mobile devices. It included accessing science learning materials, conducting science online learning activities, watching science videos, and communicating with their lecturers or peers. They strongly agreed that mobile technologies facilitate personalisation in learning science, as well as agreed to the authenticity and collaboration for learning. They suggested the integration of augmented and virtual reality applications to promote situatedness learning in science. The study imply that teacher education institute students are generally active mobile technology users. The outcomes of this study can be used by administrators and lecturers of teacher education institute to promote the adoption of mobile learning in science according to students' learning habits and preferences.

Keywords: Mobile devices, mobile learning, mobile technologies, science, usage

OPS001: Evaluation of STEM Makerspace Workshop using Kirkpatrick's Model

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Integrating the concept of makerspace offers one way for educators to implement meaningful STEM project-based learning. In view of that, a 3-day workshop entitled Introductory STEM Makerspace Workshop – Learning Through Making was conducted for lower secondary science teachers focusing on electric circuits. In this workshop, teachers were equipped with knowledge and skills to carry out maker-centred project-based learning in science. Besides, teachers were challenged to design and produce lessons incorporating maker-centred learning in the classroom or after-school activities. This study evaluated the effectiveness of this workshop for 18 teachers using three of the four levels of Kirkpatrick's Evaluation Model. For level one, the participants' reaction data was collected through the online evaluation form and observation during the workshop. The results indicated that participants were positive for the workshop. In level two, the participants' learning was evaluated through photos and reflections uploaded in the Google Docs after each session. They acquired the basic skills of soldering, 3D printing designs, and making a simple electrical product by applying the concept of parallel circuits. As for the third level involving the change of behaviour, the data was collected through voluntary feedback from the participants. Four participants had indicated the application of the knowledge and skill in school at the time of writing. Thus, this evaluation determines whether and to what extent the workshop's effectiveness is for the participants. Additionally, it aids in identifying strengths and shortcomings and serves as a decision-making tool for future improvements.

Keywords: STEM makerspace, teachers' training, evaluation, Kirkpatrick's Evaluation Model

Parallel Session 3

Day 2: 1st November 2023 (Wednesday) | 1500 – 1615 | Penang Room 1 | Moderator: Ms. Deva Nanthini Sinniah

OPS050: From Classroom to Clean Energy: The MinUS-C Module's Impact on Solar PV Education

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This educational module aims to provide students with a genuine insight into the real-world context of solar PV concepts and technology. Innovative techniques are employed to bridge the existing knowledge gap, enabling students to embrace renewable energy technologies, particularly solar PV, through digital game-based collaborative learning and inquiry approaches. The immersive environment of the Minecraft digital game illustrates simulations of fundamental scientific concepts such as solar energy introduction, energy transformation, photovoltaic effects, circuit types, PV system components, and more. This stimulates students to apply newfound knowledge in developing a scientifically literate community using solar PV technology in real-life scenarios. Comprehensive assessment processes focus not only on the artifacts produced during activities but also on the students' experiential learning journey in constructing meaningful knowledge. This approach aligns with the aspirations of the Malaysian Ministry of Education to transition from conventional teaching methods to those that encourage active student engagement in the learning process. Furthermore, this module also inspires students to explore potential career opportunities in the solar PV technology sector. With enhanced knowledge and readiness to adopt solar PV technology, students are poised to become change agents, aiding society in transitioning to renewable energy technologies, especially solar PV, ultimately achieving future energy sustainability goals.

Keywords: Solar PV Technology, digital game-based collaborative learning, inquiry approach, renewable energy technologies

OPM013: The Quality of Teaching and Learning of the Lecturers on the Satisfaction Level of the Institute of Teacher Education's Students

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Student satisfaction is used as one of the main elements to evaluate the effectiveness of courses related to computational thinking while teaching quality is considered as an indicator of learning. The purpose of this study is to study the relationship between the satisfaction of students towards the quality of teaching and learning (T & L) of the lecturers at the Penang Institute of Teacher Education. The study design is a survey and the study sample is a purposive sampling where 34 students at the Institute of Teacher Education, Penang Campus were selected as the study respondents. The research instrument used is a questionnaire adapted from Tang and Kong (2002) regarding quality T&L consisting of dimension teaching, assessment, course and guidance. The data is analysed using the Pearson Correlation. The study found that students' perception of T&L was at a high level and students' satisfaction was also at a high level. The inferential statistic showed a correlation relationship between students' perception of the quality of T&L had positive with their satisfaction. The learning process of using Scratch programming to instil computational thinking skills is seen as interesting, fun and satisfying to the students. The main implication of this study is that the process of teaching and involvement of students should be given importance to ensure fun learning and problem-solving.

Keywords: Quality teaching, students' satisfaction, computational thinking

OPM081: Goal Setting as a Metacognition Skill among Form Four Physics Students

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Goal setting is the ability to set specific and achievable objectives within a defined period, considering personal strengths and limitations, and clearly envisioning the desired result. To understand Physics concepts well, students need to have specific goals and be aware of their strengths and limitations. This study utilised the case study qualitative research design to investigate the goal setting skills of Form Four physics students. The sample was comprised of six teachers, 16 students, and a public document. Data from students' and teachers' interviews and the Curriculum Standard Document and Assessments of Form Four Physics were triangulated to capture the goal setting skills among the students comprehensively. The document and interviews were analysed using the six thematic analysis stages, as proposed by Braun and Clarke (2006). Based on the thematic analysis of the document, two categories were derived from the codes: 1) understanding the big picture, and 2) valuing the task. Four categories were derived from the students' and teachers' interviews: 1) understanding their learning strengths, weaknesses, and learning profiles, 2) understanding the big picture, 3) valuing the task, and 4) recognising the attainable goals. The findings indicated that goal setting skills were present among Form Four Physics students, and this skill can be further developed through additional studies.

Keywords: goal setting, metacognition, physics students, thematic analysis

OPI021: Impact of Brain-Based Teaching on the Conceptual Understanding of Newton's Law of Motion

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With the rise of several educational reforms, Brain-based teaching is deemed to be an effective teaching strategy as it focuses on how the brain could maximize learning. Following a mixed- method approach, this action research aims to examine the impact of Brain-based teaching on the conceptual understanding of grade 8 students of Newton's Laws of motion. Quantitative data were obtained using a concept test, and worksheets, while qualitative data were gathered using a students' perception questionnaire (SPIQ), students' journals, and classroom observation. Quantitative results revealed significant difference between the pretest and posttest scores with a learning gain of 9.35 being the mean of the posttest scores which implies that the learners have increased their understanding of the topic after the intervention. Daily worksheet scores also demonstrated "very good" to "excellent" rating. Further, the SPIQ showed that majority of the learners perceived BBT positively with the highest mean score of 3.6. Finally, the journal entries highlighted three themes manifesting the merits of BBT in the classroom including: enhanced learning through various activities, reflective learning, and insightful learning. These findings indicated that BBT was effective in improving the conceptual understanding of the learners.

Keywords: Brain-based teaching, relaxed alertness, orchestrated immersion, active processing, brain-based learning, Newton's Laws of motion

Parallel Session 3

Day 2: 1st November 2023 (Wednesday) | 1500 - 1600 | Penang Room 2 | Dr. Wan Noor Adzmin Mohd. Sabri

OPS032: The Effectiveness of APOS-ACE Teaching Approach in Improving the Performance of Understanding, and Application-Analysis in Differentiation Topic among Matriculation Students

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The purpose of this study is to investigate the effectiveness of APOS-ACE approach in improving the performance of Understanding, and Application-Analysis for the Differentiation topic among Matriculation students. Study participants included 96 students from two colleges, Labuan Matriculation College and Malacca Matriculation College. Quasi-experimental design which follows the non-equivalent Control Group Design was used in this study. Data that refers to score results was obtained from pre-test, post-test 1 and post-test 2. The data then was analysed performed descriptively and inferentially. The independent sample *t*-test reveal that there is a significant difference in mean score mark between the students being taught using APOS-ACE approach and conventional approach. Students under APOS-ACE approach are seen to have significantly better performance in Understanding and Application-Analysis. They also exhibit a better retention of knowledge compared to conventional teaching approach. It is recommended special activities involving APOS-ACE teaching and learning are carried out to ensure better performance of students in Differentiation topic.

Keywords: Teaching approach, effectiveness, performance

OPS034: Differentiated Learning: Utilization of Alternative Methods to Assist Year Four Students in Mastering Multiplication Skill

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Multiplication operation is one of the fundamental skills in mathematics. This skill is crucial for elementary school students. If students do not master it, it will affect their learning and mastery of higher-level mathematical skills. Therefore, an action research study was conducted to assess the effectiveness of several alternative methods compared to the traditional algorithmic method in the process of mastering multiplication skills. Initial assessments were carried out through student work reviews, pre-tests, surveys, interviews, and observations. The survey results indicated that students were not proficient in multiplication operations and did not grasp the concept of multiplication or the algorithm for solving multiplication problems. The alternative methods used in this study were Regrouping Multiplication (RM), Area Model Multiplication (AM), and Sticks Multiplication (SM). The study involved 26 fourth-grade students, consisting of 13 boys and 13 girls. Data were collected through Post-tests, student work reviews, surveys, and observations. The findings showed that 100% of the students in class 4M mastered multiplication skills using the alternative methods they chose, and a differentiated learning environment was successfully created among the students. The results of this study indicate that the introduced alternative methods are highly effective in helping students master multiplication skills and can assist teachers in establishing differentiated learning in the classroom.

Keywords: Multiplication operation, Regrouping Multiplication (RM), Area Model Multiplication (AM), Sticks Multiplication (SM), Differentiated Learning

OPM080: STEAMing Ahead: Leveraging Graphing Technology to Foster Mathematical Thinking of Graphs of Functions

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This study explores an innovative approach combining Science, Technology, Engineering, Arts, and Mathematics (STEAM) with the study of graphs of functions. It narrows on the integration of mathematical software tools to facilitate the teaching and learning of graphs of functions by exploring and understanding the behaviour of functions. However, traditional methods of teaching these important concepts often fall short in fostering creative and critical thinking skills among learners. Thus, the infusion of STEAM principles into the study of graphs of functions enabled the learners to create a learning environment that promotes mathematical proficiency and develops creative and critical thinking skills. Therefore, a preliminary study was conducted among a group of 24 secondary school educators attending a Regular Course on Mathematics education at SEAMEO RECSAM. A set of questionnaires were analysed for the quantitative results and semi-structured interview results were analysed for the qualitative data. The preliminary findings show that the integration of STEAM principles into the teaching and learning graphs of functions is deemed suitable for a deep understanding of functions. It also shows some positive feedback to empower learners with well-rounded skills and important knowledge to excel in STEM-related fields and beyond.

Keywords: STEAM, graphing technology, mathematical thinking

OPS044: Tessellation on Transformation Geometry in Mathematics Classroom

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This paper aimed to present the structure of a tessellation teaching module for secondary school mathematics. The module used scaffolding theory through Vygotsky's Zone of Proximal Development as theoretical framework. The researcher introduced tessellation through scaffolding process by using selected examples of regular polygons which involved transformation geometry such as reflection, rotation and translation through showing suitable videos to the students for their better understanding in the tasks given. Group work of pupils in developing 21st century skills such as communication, creativity, critical thinking and collaboration were carried out through cooperative learning to enhance knowledge sharing among the pupils. The module provided teachers a clear look into pupils' understanding of the transformation geometry. The group work helped the pupils consider and express what they know about the subject matter at hand. The teaching module will provide secondary school mathematics teachers who want to introduce pupils to tessellation as a creative process and improve their understanding in transformation geometry, the teaching module will offer plenty of support and helpful suggestions.

Keywords: Tessellation, transformation geometry, teaching module

OPM049: Ameliorating Lower Secondary Pupils' Mathematical Thinking and Ability through the Design and Development of a Mathematics Guidebook

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Lower secondary school pupils in Malaysia struggle to solve problems and make decisions using their mathematical knowledge and skills. In fact, the Trends in International Mathematics and Science Study (TIMSS) assessment since 2015 indicates that Malaysian secondary pupils' achievement was lower than the international average. As a result, the goal of this paper was to present a comprehensive design and development of a guidebook for teachers to supplement lower secondary mathematics lessons. The guidebook is based on the ADDIE instructional design model, namely using a model of analysing, designing, developing, implementing, and evaluating. This paper, however, is limited to two stages: design and development. There are ten learning activities that educators can use while teaching pupils in the classroom. The activities cover three major learning areas that are interconnected, namely "Number and Operations," "Measurement and Geometry," and "Relationship and Algebra." At the design stage, the guidebook involves the mapping of learning objectives, instructional strategies, and content structure. Meanwhile, the development stage involves creating the content, developing the learning activities, and integrating the technology based on design specifications. Teachers' feedback and comments indicate a positive and encouraging hope that the guidebook will enable them to guide pupils to have better, deeper, and more meaningful mathematics learning. The guidebook has the advantage of ameliorating pupils' mathematical thinking and ability through hands-on and mind-on activities.

Keywords: Mathematical thinking, teaching and learning, learning activities, mathematics

Parallel Session 3

Day 2: 1st November 2023 (Wednesday) | 1500 - 1615 | Thailand Room 1 | Moderator: Ms. Shazmin Kithur Mohamed

OPS021: Safeguarding Intangible Cultural Heritage Through Game-based Learning Using Minecraft Digital Tool

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Minecraft is one of the most popular computer games that has caught the attention of educators all around the globe with a huge following from enthusiasts and has also been recommended as a helpful learning resource for student development. The use of technology as an integral part of the teaching and student development process to increase students' interest in different subjects and disciplines. This study shares the output of using Minecraft as a digital tool in safeguarding intangible cultural heritage as promoted by UNESCO, aligned with Sustainable Development Goals 11.4 proposed by the United Nation. The study's findings are within the expectation of the initiators, where the outcomes are seen as a positive, value-added activity to help reinforce students' learning and increase awareness towards heritage. Deeper insights into the student's opinions of the benefit were successfully attained. The results and findings will benefit educators' in implementing game-based learning to promote fun learning in 21st century classrooms.

Keywords: Minecraft, Intangible Cultural Heritage, UNESCO

OPS022: Empowering Educators: An International AI, Python and Robotics Bootcamp

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SMJK Keat Hwa, Malaysia in collaboration with StemPedia from India have organized a 2-week online International bootcamp with the title of "Empowering Educators: An International AI, Python, and Robotics Bootcamp" for global educators from 23rd August to 2nd September 2023 to upgrade their knowledge and understanding of Artificial Intelligence, Machine Learning, Robotics, Python Programming, ChatGPT and Robotics with Python. There were around 2000 educators from 18 countries joined the training camp which was guided by Coding/STEM/Robotics Instructors or Trainers from all around the world. We aim to help the school teachers and educators to empower their classrooms with cutting-edge technology and innovative teaching methods. There were 10 sessions during the bootcamp such as Introduction to Python, Game Development, ChatGPT, Human Body Detection, Introduction to Machine Learning, Hand Pose Classification, Face Detection, Natural Language Processing, Object Detection and Robotics with Python. Digital platform, namely PictoBlox was being used. All the 10 sessions were conducted in real-time via YouTube live session with the technical support via youtube chat, WhatsApp and Telegram. We help the educators by empowering them on these digital and AI skills, providing recognition, prizes and certificates internationally for free of cost. The top 10 performers were awarded with Educational AI and Robotics Kits that help in learning and teaching 21st-century skills in a fun and engaging way. Pre-Survey and Post-Survey were conducted via google form. We wish to make extra efforts for bringing the change globally and increase the popularity of AI, programming, IoT and STEM.

Keywords: Artificial Intelligence (AI), Machine Learning (ML), robotics, python, ChatGPT

OPS023: Do Science Teachers Belief, Self-Efficacy and Attitude towards Exam-Oriented Practice Changed After the COVID-19 Pandemic: Challenges in Assessing Students in VUCA World

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COVID-19 pandemic has changed the education system scenarios leading into the ambiguity of the uncertainties of the future lock-down. Face-to-face high-stakes examinations were cancelled or postponed by most nations during the pandemic and Malaysia is no exception. This creates agitation among education communities especially to determine eligibility to enter higher education and how well the students had learned. This study is to investigate do teachers' belief, self-efficacy and attitudes towards exam-oriented practice in the post-pandemic. A cross-sectional survey designed was conducted with the sample of 425 secondary school science teachers from five states in Malaysia representing the north, south, east, west and Borneo zone. Multiple Regression Analysis using JAMOVI 2.3.28 version discovered that teachers' attitude and teachers' self-efficacy had a significant influence on teacher's exam-oriented practice by contributing 45.6% of variance in teachers' exam-oriented practice. However, teachers' belief is not significant. A cumulative means from each constructs show that science teachers' belief, self-efficacy and attitudes towards exam-oriented practice is still high. It can be concluded that exam-oriented practice is still relevant among secondary school science teachers. Therefore, stakeholders need to consider the aspects of belief, self-efficacy, and attitudes of teachers in drafting policies before transforming new assessment systems to ensure not to be exam-driven education but in building the students talents holistically.

Keywords: Pandemic, exam-oriented, science teachers' belief

OPS029: An Experiential Learning Approach to Develop Graduate Attributes

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The aim of this project was to evaluate the effectiveness of an experiential learning design approach in developing graduate attribute characteristics of student teachers in STEM subjects at a university in the northern state of Malaysia. This project involved a collaborative design tool with three other universities which are located in Scotland, southern state of Malaysia, and in Indonesia to assist university students in developing humanistic skills. This study was a quantitative research design with purposive sampling among third-year university students taking a science teaching method course. The graduate attributes used were communication, confidence, and critical thinking, and these skills were incorporated into lectures, tutorials, assignments and presentations. Paired-sample t-tests were conducted to assess the impact of the experiential learning approach on the three graduate attributes mentioned above. The results indicate that there were statistically significant differences in the graduate traits of communication, confidence, and critical thinking. This study has provided an assessment tool that can be used in teaching and learning to develop graduate attributes needed for employment after graduation. The implication of the study is that some of the HEBAT elements addressed by the university can be integrated into the academic environment and not just extracurricular activities as is usually done.

Keywords: Communication, confidence, critical thinking, graduate attributes

OPI024: Mathematics Teachers' Readiness in Information and Communication Technology (ICT) Implementation for Mathematics Teaching

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This paper aimed to examine how mathematics teachers' readiness in implementing ICT in the mathematics classroom. The method used is descriptive with quantitative and qualitative approaches. A questionnaire was given to six mathematics teachers, while interviews were conducted with three vice principal school leaders and two teachers. Both teachers and vice principals came from public high schools in the city of Bandung, Indonesia, including SMA Negeri 8 Bandung, SMA Negeri 14 Bandung, and SMA Negeri 27 Bandung from January to June 2023. Quantitative data analysis uses a percentage system followed by determining readiness category, while qualitative data analysis with the process of collection, reduction, appearance, and conclusion. The results of this study indicate that teachers have readiness at the 'ready' level which belongs to the second quartile from the top with a percentage of 73.3%. Meanwhile, the interview results showed that the vice principals assessed that mathematics teachers were well prepared when asked to implement ICT-based learning. According to interviews, the teachers are already proficient in using ICT tools like PowerPoint or mathematical software like GeoGebra, Desmos, and Photo Math. This study gives information about teachers' readiness to utilize ICT learning is a resource for researchers who want to create ICT-based teaching materials. So that we are able to judge whether schools have teachers who are and are not prepared.

Keywords: Mathematics teachers' readiness, ICT readiness, mathematics Teaching

Parallel Session 4

Day 3: 2nd November 2023 (Thursday) | 0830 - 1030 | Penang Room 1 | Moderator: Dr. Loh Su Ling

OPS060: Titration Experimental Assessment using Digital Science Comic Book

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This study was conducted to identify the effectiveness of digital science comic book as a platform to explain how to conduct "Titration" experiments for Chemistry subjects at the matriculation level of the Four Semester System program. This study involves a action research approach. A total of 15 students were selected as a study sample in this action study. This study used a pre-test and a post-test to collect data. A pre-posttest was used to study the improvement of student achievement towards the use of digital science comic book. The results show that the use of digital science comic book has a positive impact on students. The objective of this study is to identify the difference in scores before and after using this digital science comic book. The development started by producing a module called "Module Critique" and continued with the production of digital science comic book. It involves tasks such as problem analysis, objectives, target users and content. This digital science comic book that was developed focuses on science-based content in the subject of Chemistry that has teaching and education for the target users, which are the student in Malaysia Matriculation system. This digital science comic book can be commercialized on various social media such as Instagram and Telegram. Apart from that, these digital comics can also be uploaded on websites such as blogs. Thus, the integration of multimedia technology in education promises many opportunities for success. The advantages of digital science comic book as one medium in the world of education has the potential to be studied and developed even though it is still new in Malaysia.

Keywords: Digital science comic book, titration, chemistry

OPS017: The Effectiveness of Implementing the Multiple Intelligences Approach Enhancing the Malaysian Primary Students' Science Process Skills

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This study was undertaken to determine the effectiveness of multiple intelligences approach in the process of science teaching and learning in order to improve the primary students' science process skills (SPS). The SPS consists of Basic Science Process Skills and Integrated Science Process Skills. The research design was non-equivalent control group design quasi-experimental involving One Group Pre Test-Post Test, Pre Experimental Design. The study was conducted on a group of 64 students at a primary school in Penang. The instrument used in this research is Science Process Skills (SPS) test. Descriptive quantitative analysis was employed on the findings followed by subsequent inferential analysis using MANCOVA with repeated measures. The test result shows that Multiple Intelligences Approach had significantly improved the Intelligence Orientation, Science Process Skills, and achievement among pupils. The study concludes that the teaching and learning by using multiple intelligences theory have a positive impact on the development of science process skills among students. The implication of the study suggested that the multiple intelligence approach should be incorporated into teaching and learning science specifically at the primary level. This is due to the reason children should be developed from the early stage to learn science naturally based on their intelligence preferences.

Keywords: Multiple Intelligences, science process skills, teaching and learning

OPS040: Demystifying Delusion and Unveiling the Crypt in Learning Science and Mathematics via the Dual Language Program

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The Dual-Language Program (DLP) is advocated as it assists language proficiency development, promotes enjoyment, possesses positivity, elevates students' outcomes as well as academic achievement and nurtures bilingualism. In the context of Malaysia, DLP serves as the avenue in the learning of Science and Mathematics in English. Hence, this paper investigates students' understanding of DLP, readiness, acceptance towards the program besides to unearth the challenges faced. A total of 2162 DLP students nationwide were involved using questionnaires, open-ended questions, and focus group discussions. Although they displayed a positive level in all dimensions measured, several prominent issues and crucial challenges were revealed by the respondents. These challenges are in dire need to be solidified. Otherwise, it may affect the progress of DLP. To recapitulate, DLP may succeed if the implementation is carried out well and its accountability is advocated by the interest group, particularly the students.

Keywords: Dual-Language Program (DLP); science and mathematics; bilingual education; English as a second language

OPS045: Development and Usability Testing For Augmented Reality Application, Carbon-ARY For Carbon Compound Topic in Chemistry Subject

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This research aimed to develop an Augmented Reality application, Carbon-ARY consist of secondary school Chemistry topic of Carbon Compound as a teaching aid that can be utilised during Chemistry teaching and learning session. This research employed developmental research design based on ADDIE model. The respondents selected for the Augmented Reality Application, Carbon-ARY's Usability Testing through purposive sampling that was administered upon five Chemistry teachers. The expert validation result obtained the coefficient value of 0.93 for Content Validity Index and acceptable. The usability finding shows high mean value in all six attributes that are evaluated; (i) compability between teacher and the application (M = 70.0, SD = 35.4), (ii) design and display of the application (M = 71.0, SD = 30.2), (iii) the application interface's effectiveness (M = 80.0, SD = 16.3), (iv) reliability and content validity of the application (M = 100.0, SD = 0), (v) the application's ability as a learning aid (M = 96.6, SD = 8.1), and (vi) operationability of the application (M = 86.6, SD = 20.6). In conclusion, this research successfully develop Augmented Reality application, Carbon-ARY that has good validity and usability. As implications of this research successfully develop an educational innovation namely Augmented Reality, Carbon- ARy for Carbon Compound in Chemistry subject.

Keywords: Augmented Reality application, chemistry, validity and usability

OPS073: Assessing the Validity and Reliability of a Research Instrument for Measuring Science Literacy, Higher-Order Thinking, and Student Achievement: A Comprehensive Analysis

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This study aimed to assess the quality and effectiveness of an achievement test designed to evaluate the science literacy and higher-order thinking skills of undergraduate mechanical engineering students, which focused on material science and sustainability. This study was conducted at a higher education institution in northern Malaysia. The test consisted of multiple cognitive levels to gauge student proficiency. A pilot study involved purposive sampling of second-year undergraduate students who had previously enrolled in the material science course. The validity of the assessment test was carried out by three subject matter experts, and reliability analysis was performed using data from eight students. The items in the achievement test were analysed and calculated to get the Content Validation Index (CVI), and the Kruder-Richardson coefficient (KR-20) was calculated via the Test Analysis Program (TAP). The results show that while the research instrument was generally satisfactory, some refinements, such as sentence structure and contents, were needed. This validation and reliability contributed to the development of improved achievement of the test questions for future data collection, emphasising the importance of reliable data in subsequent research endeavours.

Keywords: Science literacy, higher-order thinking, validation, reliability

OPI007: Advancing the Cultures of Science Teaching and Learning in South African Schools

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This paper reports on an outreach project to improve science teaching and learning in schools in South Africa. South African learners have consistently scored in the bottom part of all national and international benchmark testing in science and mathematics. The most recent TIMSS 2019 report again placed the quality of South Africa's mathematics and science education in an undesirable position. This situation does not bode well for the country's human resource needs in the Science, Technology, Engineering and Mathematics (STEM) sector within the ambit of a 4th Industrial Revolution (4IR). This outreach project served to address this dilemma through three developmental stages which incorporated (1) improving the culture of science teaching via inquiry-based pedagogy, (2) elevating the culture of science learning by cultivating learners' enthusiasm and interest in science, and (3) incubating the cultures of science teaching and learning in a creative space called a science teaching and learning centre. A multiple case study approach was used to carry out this qualitative research initiative, which sought to explore the impact of the outreach project on teachers and learners of participating schools. The study highlights a number of key successes achieved including (1) the application of an inquiry-based approach in science by the majority of teachers on the project, (2) learners' participation in science clubs and science competitions, and (3) the construction of 94 science laboratories at participating schools. The study identifies some key elements in its three-pronged development model that could prove important in the planning of future projects of this nature.

Keywords: Science education, Cultures of science teaching and learning, Inquiry-based science, Outreach project

OPS061: The Forward-Backward and Dual-Panel Translation Methods are Comparable in Producing Semantic Equivalent Versions of a Computational Thinking Skills Questionnaire

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This study aims to investigate semantic equivalence between two translated versions of the computational thinking skills (CTS) questionnaire produced by the forward-backward and dual-panel methods. The forward-backward and dual-panel versions of CTS were self-administered among 60 participants who met the inclusion criteria of being a native Bahasa Malaysia-speaking Malay, aged 14. The administration sequence of the two versions was randomized. Additionally, three sociolinguists, who were blinded to translation processes and survey findings, rated the translated versions against the source version on three aspects of semantic equivalence. The findings illustrate that textual content in both translated versions was considerably similar ($n = 21/29, \approx 72\%$). The overall results from weighted kappa, raw agreement, interclass correlations, and Wilcoxon signed-rank as well as experts' ratings were confirmative of semantic equivalence between the forward-backward and dual-panel versions of the CTS. However, some mixed findings were indicative of potential gaps in both translated versions against the source version. In conclusion, both the forward-backward and dual-panel methods produced semantically equivalent versions of CTS; but translation alone is insufficient to narrow the subtle gaps caused by differences in culture and linguistic style.

Keywords: Computational thinking skills, lower secondary school students-reported outcome measures, surveys and questionnaires, translation

OPS069: Validation of an Instrument for Measuring Malaysian Secondary School Students' Science Motivation and Self-Regulation towards Science Learning

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Several studies have examined the students' motivation and self-regulation towards science learning among secondary school students. Students' motivation and self-regulation have been identified in influencing the engagement of students in the science learning activity. Thus, there is a need for an instrument to measure secondary school students' science motivation and self-regulation towards science learning in Malaysian context. This study aimed to validate an instrument for assessing Form Four students' science motivation and self-regulation towards science learning. A total of three (3) experts had validated the instrument which was adapted from the previous studies in measuring the students' motivation and self-regulation in science learning. Few changes were made to the instrument for the adaptation process based on Malaysian context. The content validity index (CVI) was utilized to investigate the structure of the items in the instrument after collecting the responses from the experts. The instrument composed of four (4) constructs which included Learning Goal Orientation, Task Value, Self-Regulation and Self-Efficacy corresponding to 31 items was shown to be valid based on validity analysis with S-CVI/Ave of 0.96. Later, the newly validated instrument will undergo the reliability process after the pilot study for the instruments' reliability purpose before it can be used in the real experiment in the educational field.

Keywords: Science motivation, self-regulation, science learning, content validity index (CVI)

Parallel Session 4

Day 3: 2nd November 2023 (Thursday) | 0830 - 1015 | Penang Room 2 | Moderator: Ms. Tiana Mohamad

OPI014: Exploring Project CREATE Mathematics and Peer-Assessed Gallery Walk in Teaching Mathematics

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The purpose of the study was to evaluate the effectiveness of Project CREATE Mathematics combined with Peer-Assessed Gallery Walk in teaching Mathematics. The research followed a pretest-posttest control group experimental design. Two groups of thirty-eight and thirty-four grade 11 students purposively selected, considering that sectioning in the grade 11 is grouped heterogeneously. Prior to the lesson, both the experimental and control groups were given a pretest. The experimental group was taught using the Project CREATE Mathematics and Peer-Assessed Gallery Walk, while the control group received instruction through the traditional chalkboard-discussion method. After five weeks of exposure to the respective teaching methods, both groups were assessed with a posttest. The posttest results were compared to their pretests, and conclusions were drawn from the findings. The study showed that the performance of students in both the control and experimental groups had improved, indicating the effectiveness of both teaching methods. Both groups demonstrated higher mean scores in the posttest compared to the pretest, and their gain scores increased. However, the experimental group exhibited greater gains compared to the control group. As a result, it can be concluded that the Project CREATE Mathematics and Peer-Assessed Gallery Walk as a teaching strategy was more effective than the Traditional Method. The findings of the study indicated that both the control and experimental groups demonstrated improvement in the students' performance, suggesting the effectiveness of both teaching methods. Moreover, the use of Project CREATE Mathematics and Peer-Assessed Gallery Walk as a teaching strategy for mathematics, indicating its potential to enhance student performance. These findings can be valuable for educators, curriculum developers, and policymakers seeking evidence-based approaches to improve mathematics education.

Keywords: Project CREATE, peer-assessed gallery walk, mathematics teaching, students' performance, teaching strategy

OPS058: Improving the Skills of Adding and Subtracting Length Measurements of Year 5 Arif Using Jo Double321 Method

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The innovation produced is JO Double321 for Mathematics subjects that focuses on the addition and subtraction of long measures that use column representation. This innovation is carried out to help students answer questions quickly without having to memorize a lot of Mathematical formulas in addition to creating an interesting and fun learning atmosphere. In addition, students can understand and solve the problem of addition and subtraction of length measurements through the Modular Approach used which combines two skills which are conversion and addition of length measurements involving decimals with unit conversion. A total of eight students were involved in this study. JO Double321 can stimulate creative, critical and innovative thinking through elements of creativity that carried out. This innovation also uses the visual space theory approach, which is that colorful number cards can attract the interest of weak students to learn with fun. The research design is quantitative where the data is analyzed descriptively using mean. Based on the mean analysis carried out in 4.7 it is said that this JO Double321 is very easy to use. The cost required is very reasonable as it requires materials that are easily available and can work every time for a long period of time. Analysis of face-to-face teaching found that some students were able to reach Mastery Level 3 with repeated repetition and reinforcement. But the findings obtained by using JO Double321 show that students can reach Mastery Level 3 with only one learning session. The implementation of this innovation also has a very positive impact on increasing the effectiveness of student-centered teaching and learning thus being able to improve teachers' pedagogic practices.

Keywords: Addition skills, subtraction skills, numbers

OPS016: Analyzing Mathematics Anxiety and Its Related Factors Using DEMATEL Method

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This research aims to investigate math anxiety among Negeri Sembilan Matriculation College students and analyze the interdependencies and causal relationships among various factors contributing to this phenomenon using the Decision-Making Trial and Evaluation Laboratory (DEMATEL) method. Math anxiety is a phenomenon that affects numerous students, leading to negative emotional reactions and hindered performance in math-related tasks. A mixed-methods approach was employed where the data were collected through a guided survey interview. A list of significant factors on maths anxiety were presented from a thorough review of scholarly literature and expert opinions. Evaluation from a sample of six mathematics lecturers with extensive teaching experience where three of them are the subject matter experts (SME) and six college students grappling with math anxiety were then analyzed using DEMATEL method to construct a cause-and-effect relationship matrix, quantifying the strength and direction of interrelation among these factors. The findings of this research have important implications for educational institutions, educators, and students alike. Firstly, the analysis highlighted specific factors that have a substantial impact on math anxiety, such as previous math performance, teaching methods, and self-confidence. Furthermore, it uncovers the complex web of interdependencies among these factors, shedding light on how they mutually influence one another. Additionally, students will benefit from a more supportive and conducive learning environment that fosters self-confidence and effective study habits. These significant findings will contribute to the evidence-based interventions and strategies to support students in overcoming math anxiety and achieving optimal math performance. It also contributed to the existing literature on math anxiety by offering a structured approach to assess and understand the relationships among contributing factors. This finding can inform educators, counselors, and policymakers about the critical areas to target when addressing math anxiety.

Keywords: DEMATEL method, mathematics anxiety, mathematics performance, matriculation students, teaching methods

OPS057: Application of Engineering Design Process (EDP) in Implementing Integrated PBL for Secondary School Students

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The implementation of student-centered teaching is considered to provide more opportunities for students to learn actively. There are several active learning methods that are being practiced today and one of them is Integrated ProjectBased Learning (Integrated PBL). The implementation of Integrated PBL in Malaysia is at the early stage but its implementation has been increasingly widespread. This study was conducted with the aim to see how the implementation of integrated PBL can be implemented by applying the Engineering Design Process (EDP). The steps in EDP such as identifying the problem, exploring, designing, creating, testing, and improving are seen to provide clear guidance to the students on how to solve the problems given in integrated PBL. The implementation of Integrated PBL also considers the post-pandemic era and it is carried out by applying the use of technology. The study was conducted as an Action Study towards 161 Form 3 students from a secondary school in Melaka. The theme for the Integrated PBL in this study is Green Technology. The implementation has involved 5 subjects such as Science (host), Mathematics, Engineering and Technology (RBT), Bahasa Melayu and English. This study has been carried out by following the Kemmis and McTaggart Action Study Model. Data for this study was collected qualitatively through observation, document analysis and open research questions to students. The findings of this study show that the implementation of Integrated PBL can be implemented well even though it involves a large group of students. The implementation of EDP has helped students collectively to solve problems and produce Green Technology Home Models in structured ways. Students can also apply knowledge regarding green technology house (Science), plans and elevations (Mathematics), mechatronic design (RBT) and writing and speaking in Bahasa Melayu and English in the same project. This study is expected to provide guidance to teachers who are keen to implement Integrated PBL in their schools and to researchers in this field.

Keywords: Integrated PBL, Engineering Design Process, Post-Pandemic

OPS018: STEAM Education: Understanding and Readiness Among Malaysian Teacher Trainers

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This study aims to investigate the levels of understanding and readiness for STEAM education among teacher trainers. This quantitative research involved 83 teacher trainers from Institut Pendidikan Guru Kampus Pendidikan Teknik (IPGKPT) who were selected using a random sampling technique. Data for the study were collected through the questionnaires. The data will be analysed in e. The findings indicate that the level of understanding among teacher trainers is moderate (mean=3.00, sd=0.58). Similarly, the level of readiness is also at a moderate level (mean=2.31, sd=0.85). The level of understanding in STEAM shows that the female teacher trainers higher than the male. But, for the level of readiness, it shows the males are more ready than the females. The results of this study highlight the need for teacher trainers to acquire additional knowledge, training, and a stronger intention to embrace and effectively implement STEAM education. These findings have significant theoretical and educational implications, which can inform the development of future instructional strategies and practices.

Keywords: STEAM education, teacher trainers

OPI029: Project Based Learning Strategies to Increase Student Creativity Skills in "Kurikulum Merdeka"

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Education and learning are student-centred by using effective learning approach and optimizing the use of technology, therefore the role of prospective teachers really determines the potential of the students they teach. This type of research is research into the development of learning media in the form of electronic student activity sheets. In principle, development uses the R&D (Research and Development) development model. This research refers to the current development of the curriculum which is an optional curriculum used by educational units, namely the independent curriculum with the achievement of pancasila student character through project profiles using active and creative learning models. The learning media in the form of electronic student activity sheets used is a category that is worthy of being assessed based on validity, effectiveness and practicality scores. The indicators of creative thinking ability achieved, namely sensitivity, fluency, flexibility, elaboration and originality, in the control class achieved higher indicators of creative thinking ability than in the non-student activity sheet and non-PjBL control classes. Using learning media in the form of student activity sheets developed and taught using the PjBL learning model can improve the creative thinking abilities of student teachers in developing learning media for students.

Keywords: PjBL, kurikulum merdeka , student activity sheets, creative thinking skills

OPS074: Authentic Learning in Urban Farming Fertigation Project to Enhance Students' Entrepreneur mind

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Entrepreneurial thinking is very important in this VUCA world. Cultivating those thoughts needs to be done from junior high school in preparing them to be independant. The urban farming fertigation project gives students the opportunity to identify environmental problems and how to overcome them to create a conducive and economic environment that utilizes existing resources to the maximum. This study is a pre-experimental design involving two phases of vegetable cultivation intervention over one and half year and supported by qualitative data. This study uses a purposive sample that involves 40 junior high school students and 10 teachers at a normal day school in the suburban. The intervention given involved the cultivation of two vegetables using a transdisciplinary STEM approach in fertigation technology. The research instrument consists of an entrepreneurial mindset questionnaire and an interview protocol. Repeated one way ANOVA analysis shows that this fertigation project is able to enhance and sustain entrepreneurial thinking among students. Qualitative data analysis from student and teacher interviews supports the findings of quantitative analysis that strengthen students' entrepreneurial thinking. The implications of this project and study suggest that urban farming activities are intensified as a co-curricular activity to support learning in the classroom.

Keywords: Urban farming, authentic learning, STEM approach, entrepreneurial thinking

Parallel Session 4

Day 3: 2nd November 2023 (Thursday) | 0830 - 1015 | Thailand Room 1 | Moderator: Ms. Sanura Jaya

OPS030: Aye Aye, Captain! Let's Embark on an Engaging Virtual Math Learning Journey!

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Amidst the period of pandemic-induced confinement, there was a collective recognition of the pivotal function played by internet platforms in affording pupils with educational prospects. The primary focus of our research pertained to the challenges experienced in the instruction of mathematics, primarily in the domain of Graph Motions. More specifically, the researcher examined the issue of being unable to directly witness and monitor students' discussions during the teaching process. The main aim was to successfully include group learning within Google Meet sessions, prompting the teacher to devise innovative approaches for actively involving students on the platform. In order to enhance collaborative learning, the researcher implemented the use of the Jamboard software and breakout rooms, taking inspiration from a professional conference. The Jamboard programme facilitates synchronous collaboration on a communal digital whiteboard, promoting engaged involvement and an instructional strategy centred around the learner. Students have the capacity to offer valuable insights, diverse viewpoints, and effective problem-solving approaches, thereby fostering a culture of collaboration, effective communication, and the capacity to expand upon each other's ideas. The research encompassed a sample of 31 students from Form 5D at St. Cecilia Convent Secondary School, located in Sandakan, Sabah, Malaysia. By using the functionalities offered by the Google Meet platform, the researcher has successfully established an interactive and learner-focused educational atmosphere, departing from the limitations of conventional classrooms and facilitating active participation and cooperation within a digital context.

Keywords: Online platforms, Google Meet, Collaborative learning, Student-centred, Jamboard

OPS035: Relationship between Constructive Feedback Practices by Appraisal Officers and Performance Appraisal Effectiveness

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The objective of this study is to examine the relationship between the practice of giving constructive feedback by the appraising officer and the effectiveness of performance appraisal. The respondents of the study are mathematics teachers who serve in secondary schools in Sibu, Sarawak. Constructive feedback operationally refers to the act of giving praise or appreciation to enable teachers to clearly know the level of achievement of goals and targets that have been achieved, thus providing a stimulus to maintain good workperformance. This cross-sectional survey study uses a questionnaire technique to collect research data and the sampling technique used is a simple random sampling technique. The data obtained from 319 respondents show that there is a positive and significant relationship between the practice of giving constructive feedback by performance evaluators and the effectiveness of performance evaluation in schools. Theoretically, this study contributes to the development of the knowledge framework related to the studied variable, which is the practice of providing constructive feedback and the effectiveness of performance evaluation. From an empirical point of view, the findings of the study provide evidence that explains the importance of the aspect of readiness to provide feedback on work performance in the field of performance evaluation management, especially in relation to the field of education. From a practical aspect, the findings of the study provide important information to various parties to formulate and improve policies related to human resource management.

Keywords: Constructive feedback, performance appraisal, cross-sectional survey study, evaluation management

OPS037: From Blocks to Code: An Insight into Students Transitioning from Scratch to Java

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This research examines the transition from Scratch to Java programming, highlighting high achievement among participants. The study includes 21 students and utilizes mixed methods, combining quantitative analysis and qualitative narratives. Findings demonstrate the effectiveness of Scratch Visual Teaching Aids (VTA) in developing educational games, understanding algorithm concepts, and improving programming projects. Students' attitudes towards Scratch VTA show increased interest, concentration, and enjoyment in learning. Qualitative narratives reveal varying perceptions of the transition, with prior programming knowledge influencing the shift. Challenges include adapting to the learning session and mastering Java's syntax and concepts. This study enhances programming education practices, providing recommendations for educators during the Scratch-to-Java transition.

Keywords: Programming, algorithm, Scratch, Java, visual teaching aid

OPS038: Teachers' Self-Efficacy and Acceptance of Technology STEM Against Pedagogy Based on ICT in Schools with Less Students

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This study was conducted to examine the level of self-efficacy and teacher acceptance of technology in information and communication technology (ICT) based pedagogy for STEM subjects in underserved schools in Perak. The study design is guided by a quantitative approach in the form of a survey study. The selection of the study sample was done through a simple random sampling technique, where a total of 65 teachers in Schools with Few Students, Perak covering teachers of STEM subjects have provided feedback. The teachers involved in this study responded through three research instruments namely the Teacher Sense of Efficacy Scale (TSES) instrument, the Initial Scale Items for Perceived Usefulness and Perceived Ease of Use instrument and the instrument adapted from the Mailizar and Fan (2020) study. The data obtained were analyzed through two methods namely descriptive analysis and inferential analysis. Descriptive analysis found that all study constructs were at a high level, with the most dominant value shown on the teacher self - efficacy construct (Mean = 3.58, SP = 0.22). Descriptive analysis also showed that teachers' acceptance of technology among the study sample was at a high level, where the mean and standard deviation were (Mean = 3.55, SP = 0.17). While inferential analysis through correlation test showed a significant relationship between the variables of teacher self-efficacy and teacher acceptance of technology with ICT-based pedagogy, respectively at a value of ($r = 0.623$, $p = 0.00$ at a significant value of $p < 0.01$) and ($r = 0.677$, $p = 0.031$ at a significant value of $p < 0.05$). This study concludes that teachers' self-efficacy and teachers' acceptance of technology are significant predictors for determining information and communication technology (ICT) -based pedagogy.

Keywords: Self-efficacy, teacher acceptance of technology

OPM082: Advancing Technology Integration in Southeast Asian Education: Empowering Educators with Policy Insights

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The advent of the digital age has brought about a profound transformation in the landscape of education, requiring educators in Southeast Asian nations to adeptly integrate technology into their teaching methodologies to adequately prepare students for the future. This research delves into the present status of technology integration among educators in this region and puts forth actionable recommendations to enhance their competencies. Based on an extensive e-survey conducted with 58,690 responses, this study establishes a solid foundation for its findings. The recommendations encompass augmenting accessibility to professional development initiatives, resources, and training aimed at optimising technology integration. It also emphasises the creation of technology-rich learning environments and the cultivation of partnerships with technology organizations. This paper underscores the urgency of investing in the professional development of educators in Southeast Asia, with these recommendations targeting the provision of essential skills to equip students for an ever-evolving digital world. It particularly highlights the pivotal role of consistent policy implementation in ensuring the effective adoption of these recommendations. In sum, this paper furnishes valuable insights into the significance of technology integration among educators in Southeast Asia and elucidates the essential measures needed to foster students' success in the digital era.

Keywords: Technology integration, educators, Southeast Asia, professional development, digital era, policy implementation.

OPM066: Rise of Metaverse Literature in Asia-Pacific Countries: Bibliometric Study

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The main aim of this research is to explore past, present, and forecasted trends in Metaverse Literatures within the Asia-Pacific region. The research leveraged a bibliometric method to extract a total of 571 academic publications related to Metaverse Literatures from the Web of Science database. The study then utilized co-citation and co-word analyses to ascertain the most impactful publications, to understand the knowledge framework, and to predict potential emerging trends in the field. Through co-citation analysis, four primary clusters of influential works were identified, while the co-word analysis revealed three distinct clusters. The findings highlight the growing significance of Metaverse Literatures research in the Asia-Pacific region. While the importance of Metaverse Literatures is evident in the Asia-Pacific region, there has been a lack of comprehensive examination of the research landscape. This study stands out as it shines light on the current research related to the metaverse and offers a unique perspective on the prospective future progression of the domain in the Asia-Pacific regions.

Keywords: Metaverse, Asia-Pacific, developing countries, bibliometric analysis, web of science

OPS051: Digital Storytelling Science Creative Module

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The Digital Storytelling Creative Science Module, a groundbreaking solution, is designed to enhance students' creative thinking skills and achievement in science, specifically focusing on the Acid and Alkali topic. This pioneering module addresses a critical challenge: the enhancement of the three pivotal sub-skills of thinking—namely, association, visualization, and divergent—among form two secondary students. Distinguished from traditional teaching methodologies, the PDSK Module employs an immersive storytelling approach, complemented by collaborative teamwork, to nurture these three essential creative thinking sub-skills. The classroom implementation of this module encompasses five progressive stages of digital storytelling, drawn from Cheng and Chuang (2019): Brainstorming, Dynamic Adaptation, Virtual Practice, Training, and Display. This innovative teaching methodology diverges from conventional approaches by adopting Merrill's first principles of instruction (2002), which spotlight the demonstrative facet to cultivate foundational student skills. The culmination of the five-tiered digital storytelling process within the PDSK module exhibits a remarkable augmentation in students' knowledge, application, and performance, translating into a tangible mastery escalation in the realm of science learning, particularly encompassing the intricate domain of Acid and Alkali.

Keywords: Digital storytelling, association, visualization and divergent, acid and alkali topic

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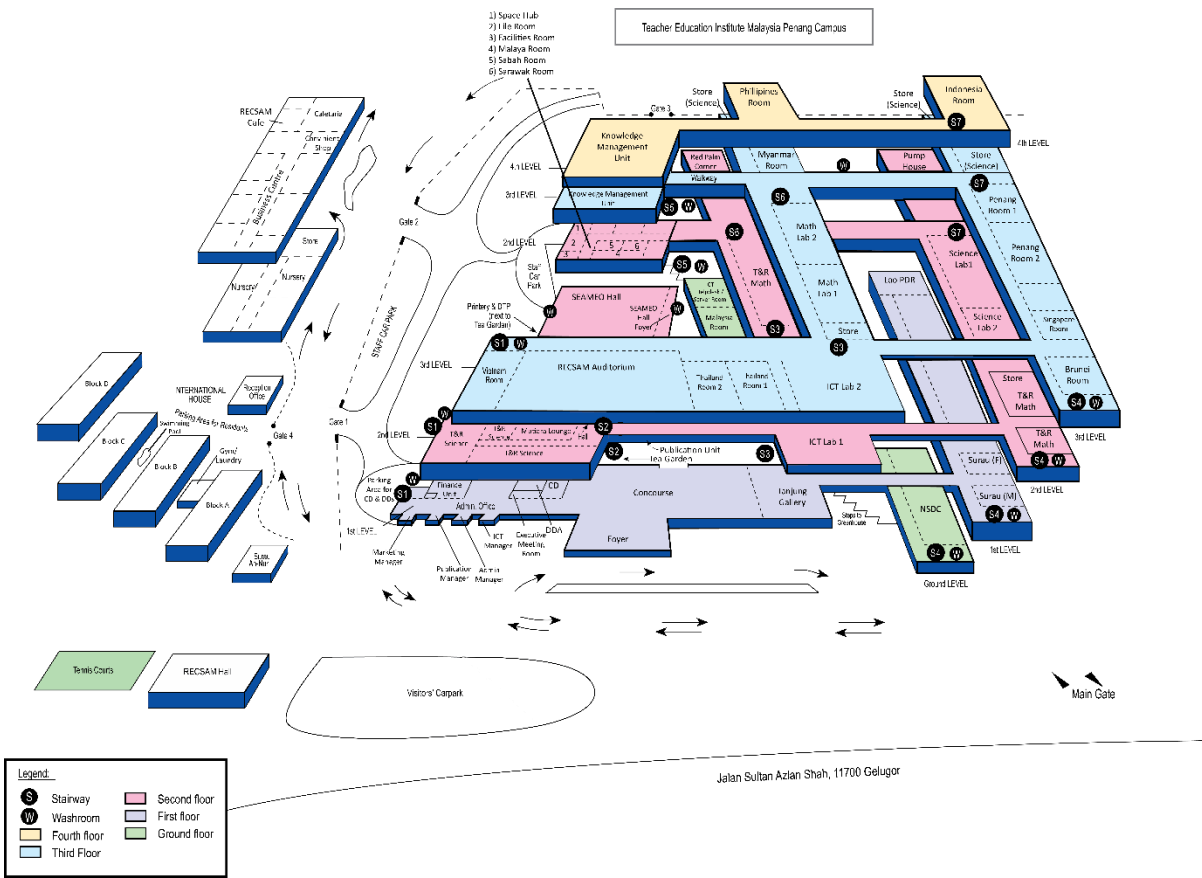
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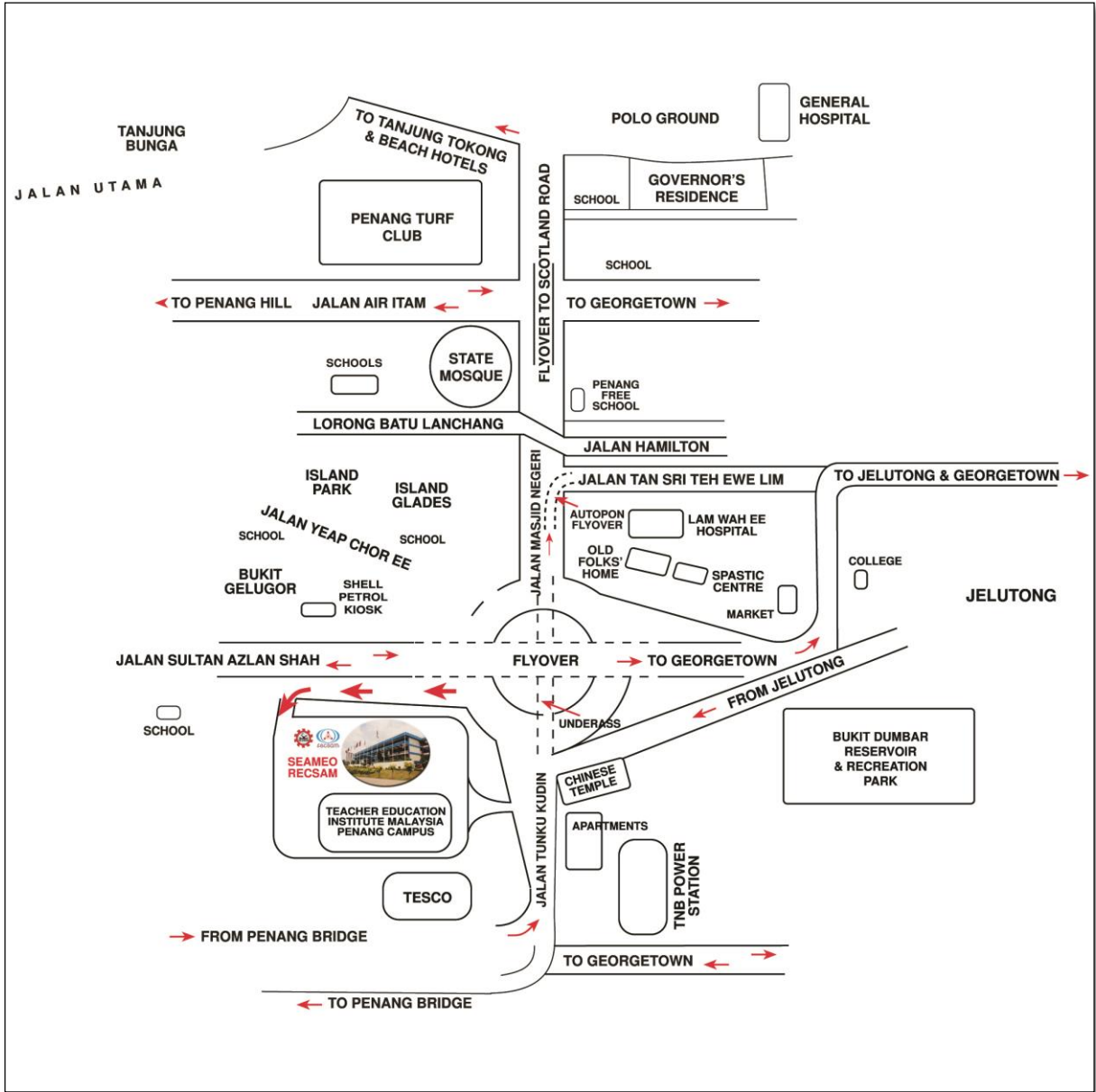
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