

Building Resilience in Community with the ACES STEMBucket Programme

An ACES Malaysia Case Study

Introduction

The Sustainable Development Goals (SDGs) are used as a guiding principle in this case study to empower youth, women, and communities by giving them access to information, training, and a change in mindset toward sustainability. Communities throughout the world are navigating a landscape with constantly changing requirements and priorities, and innovation and creativity are being focused on finding solutions to these quickly moving needs. The issue of creating more resilient communities is one that is regularly debated, following the multiple disruptions experienced by public institutions, governmental organisations, and communities.

During the COVID-19 pandemic, Sarawak's rural and coastal communities were affected because they lost their tourist and fishing industries, as well as their children and youth's desire and drive for education, especially when they had to transition to online learning. It is evident that few young people and youth in Sarawak are enrolling and embarking in STEM-related courses. This opposes the aspiration for developing the country and the demand for achieving IR 5.0. The COVID-19 pandemic posed an uphill challenge for online lessons, pushing people to adapt to new norms, not just regarding lifestyle but also the learning environment.

The ACES STEMBucket © programme stems from the idea and desire to make STEM subjects more fun and enjoyable for students, youths, parents and teachers by transforming everyday household objects into fascinating and exciting STEM-based projects that students can work on with teachers and peers.

The STEMBucket © programme has demonstrated that science can still be fun and engaging across all modes of execution. The most important takeaway for all participants was that science could be explored using household materials. The community members showed a high degree of enthusiasm and active participation in the activities, emphasising the values of scientific knowledge in everyday life.

Scope / Define

The STEMBucket programme utilises fun, collaborative, and cost-effective techniques to enhance learning competencies such as reskilling and upskilling, as well as other critical learning abilities like motivation, efficacy, inner values, and empathy. The activities in the programme are designed to foster inclusive learning. Through playful and co-creative approaches, participants acquire and develop skills and values necessary to thrive in the

world today. This lead to sustainability and resilience to one another and the environment. Activities address challenges that are directly related to the UN SDGs in terms of well-being, gender equality, poverty, and quality education.

Targeted groups/Beneficiaries/Stakeholders

The general public including youths, students, educators, trainers, researchers, and communities, as well as groups of stakeholders with NGOs, government officers and industries.

The project involved over 3,300 participants;

- over 300 youths/students aged 8 to 17 years.
- over 500 graduates aged 22 to 30 years.
- over 2,500 attendees and viewers through activities, seminars and online workshops.
- over 150 residents and village communities.
- 20 community leaders and state administrative officers, directors.

Project team:

- Researchers from universities: Universiti Malaysia Sarawak, Swinburne University Technology Sarawak Campus (SUTS).
- NGOs: The Kalsom Movements, Malaysian Students Global Alliance.
- Industries: Chumbaka, Exploria.
- Communities: Pasir Pandak, Pasir Panjang, Telok Melano.

Aims

Promoting empowerment and agentic practice through inclusive learning using the STEMBucket program's utilisation of playful, economical (frugal), and reflective methods.

Main Design and Delivery

1. Concept

Knowledge: Pre- and post-knowledge surveys on the specific topic/content, capability, motivation, efficacy, theory of change.

Skills: Practical hands-on capability skills and empathic, values and efficacy.

Abilities: Decision-making, critical thinking, problem-solving, innovation and reflection.

2. Playful and Frugal

Playful: Experiential learning through play, Project-based Learning (PBL), Fun, Curiosity, Agency, Autonomy, Social.

Frugal: Creativity, Keeping it simple, Localise, Practical, Resourceful, Collaboration, Resilience, Adaptability to sustainability.

3. Co-creation

Co-creation: Design Thinking, Participatory Action Research (PAR), Open dialogue with collective reflection and participation, Ownership, Sustainable solutions and innovation..

Sustainable Development Goals Addressed

- [GOAL 4: Quality Education](#)
- [GOAL 5: Gender Equality](#)
- [GOAL 6: Clean Water and Sanitation](#)

Timeline

The activity was carried out over a period of 3 months and was divided into three phases: pre-execution, execution, and post execution.

Locations

- **Country-wide:** Students from across the nation took part in this project.

Key lessons learnt

Strategies

- Getting policymakers and politicians to participate in local community activities is essential for building their involvement and awareness of adaptation policy processes, as they are key players in these processes.
- Developing training sessions or modules that are flexible enough to be tailored to local contexts.
- Ensuring young people are motivated to understand the effects of climate change, and their own well-being through inclusive learning.
- Ensuring that teachers and facilitators are similarly engaged and trained.
- Developing and providing materials with NGOs and industries to be stored and shared in the ACES space.
- Extending training programmes to the whole community regardless of age and gender.
- Developing linkages with local training institutions, NGOs and industries for the benefit of the communities.
- Engaging students, researchers or trainers to deliver community training.

Policy / Practical Recommendations

- Upgrading skill sets for industries with minor adjustments.
- Gearing up educational institutions (universities) to provide new skills for new occupations and sectors that will emerge in the future (e.g. green economy).
- Realigning and retraining transversal skills (HOTS, high demand 21st skills) through play and frugal, STEM+ education.
- Investigating partnerships with universities to encourage university students and graduates to undertake community placements.
- Developing partnerships with labs/centres in the communities to deliver HOTS skills curricula using a playful and co-creative approach.

Impact

- Memorandum of Understanding was signed with #DemiLaut (in 2021), Exploria (in 2022).

Detailed activities

Activity 1: Environmental and Climate Change Awareness & Green skills

Scope

The focus of the sessions was to increase awareness about environmental concerns and climate change, with an emphasis on the concept of "green skills." These skills involve technical abilities, knowledge, values, and attitudes required to modify products, services, and processes to promote sustainable outcomes for society, the economy, and the environment.

The aim of these skills is to facilitate adaptation and development towards sustainable practices in various sectors, including business, industry, and the wider community. By imparting these skills, the sessions aimed to encourage the adoption of sustainable practices for the long-term benefit of all. The materials used are interactive, immersive, and filled with fun activities that are centred on climate change and climate adaptation. This increases community resilience.

Target groups

- The general public, youths, educators, young children and parents.
- Other groups of stakeholders include NGOs, community leaders, and politicians.
- NGOs: Early Career Ocean Professionals (ECOPs), JF Production KK.
- Stakeholders & Partners: UNIMAS, Centre for Marine and Coastal Studies (CEMACS), Universiti Sains Malaysia, Swinburne University Technology Sarawak

Campus (SUTS), Kuching North City Council (DBKU), Time to Rice, Learning Sciences students, Centre for Applied Learning and Multimedia.

- Communities: Telok Melano, Pasir Panjang, Pasir Pandak, Chairman of Majlis Pengurusan Komuniti Kampung (MPKK), Teluk Bahang, YB Datuk Dr Haji Abdul Rahman Junaidi (MP Pantai Damai).
- Schools: SK Pasir Pandak, Tunku Putra Schools, SK Telok Melano, SK Ong Tiang Swee, SMK Sri Matang.

Project team

- Researchers from universities: Universiti Malaysia Sarawak, Swinburne University Technology Sarawak Campus (SUTS), Centre for Marine and Coastal Studies (CEMACS).
- NGOs: The Kalsom Movements, Malaysian Students Global Alliance, Time to Rice, #DemiLaut, Academic Staff Association UNIMAS (PPAU).
- Industries: Chumbaka.

Aims

- To raise awareness and knowledge about the environment and the impact of climate change.
- To engage participants in the co-creation and co-ownership of the climate change educational process while promoting empowerment and agentic practice through the use of playful, cost-effective (frugal), and reflective strategies in the program.

Concept

- Building and strengthening partnerships with relevant communities.
- Sharing information about environmental issues and the effects of climate change and emphasising alternative solutions.
- Conducting activities and workshops using an experiential learning approach (hands-on, project-based) and gamification (escape rooms, role-play, short films).

Playful and Frugal

Playful: Creative use tools of collaborative online whiteboards (Miro and Mural) to allow interaction during activities and gameplay. Experimental learning in cooperative group games, escape rooms and role plays, incorporating frugal items with the aim to create autonomy in learning, ignite curiosity while experimenting with creating an agency, and collaborate to identify and solve problems together.

Frugal: Frugal education that is practical in the design leveraging on existing resources available, the use or remix of images, sound, and films in the design of the gameplay to build empathy, creativity, and resilience. This enables openness, resiliency, collaboration, and practicality.

Co-Creation

Community-centered, trustworthy by the building trust, collaborative towards belonging, sense-making (analysis), co-ownership of nature and their community.

Lessons learnt and strategies

These are community-specific insights for the project team.

1. Communities are quite proactive and take ownership of their own and learnt skill sets back to the community, home, and natural environment.
 - Building composting plants to convert waste into natural fertilisers.
 - Small-scale generation solar power grids based on renewable energy technologies.
2. Interested in preserving their own community through ecotourism.

Strategies:

1. To further strengthen partnerships and collaborate with potential NGOs, IEEE
2. To keep fostering trust with communities by including them in additional environmental awareness initiatives and activities that are appropriate for their needs.
3. Yearly beach clean-ups as a means of engaging and interacting with the people and NGOs.
4. Should continue coordinating and cooperating with the community's proactive leaders and champions, the local champion within the community.
5. Integrating the STEMBucket programme with Pasir Pandak primary school and Sejinjang Lab Pasir Pandak involved organising training sessions, talks, and an outdoor lab for experiments, which helped break down the barrier between indoor and outdoor learning, promoted flexible learning, and encouraged continuous learning.

Outcomes:

1. Since 2020–2022, more than 20 activities, talks, and events have been organised.
2. The success of DemiLaut Citizen Science Programme (2021-2022), 2022 Climate Change Maker Challenge and Malaysia-France Ocean Hackathon 2022.
3. Panel speaker at an International Ocean Plastic Workshop (<https://www.oceanplasticworkshop.com/panelist-bios>).

4. Invited speaker at IIT university, India.

Activity 2: Women Empowerment and Well-being

Scope

The sessions focused on:

- giving awareness about the importance of supporting and empowering women to attain gender equality and healthy well-being in sustainable development and learning opportunities and their abilities in STEM education.
- a playful approach is used to encourage girls and women in STEM education.
- giving awareness of a welcoming environment (platform and spaces) including inclusive training, mentorship, networking, collaborative opportunities, and a voice for sharing.
- raising awareness in communities by engaging and supporting females to be the task force members and local champions for health services, leadership, and entrepreneurship.

The contents used are hands-on, and immersive with fun, engaging activities. These focus on health, well-being, leadership, upskilling, financial literacy, and entrepreneurship, towards female empowerment leading to the sustainability and resilience of the community.

Target groups

Women, mothers, girls in STEM, youths, and students.

- Stakeholders & Partners: Malaria Research Centre, Universiti Malaysia Sarawak, Kapit Resident office, Kapit Health Department, Academic Staff Association UNIMAS (PPAU), Yoga Region by Alvin Heng, Sarawak General Hospital.
- Communities: People from Pasir Pandak, Pasir Panjang and Telok Melano, Sarawak Government Hospital, Kapit longhouse.

Project team

- Researchers from universities: Universiti Malaysia Sarawak, Malaria Research Centre.
- NGOs: The Kalsom Movements, Malaysian Students Global Alliance, Time to Rice, Academic Staff Association UNIMAS (PPAU).

Aims

- Utilising a playful experiential learning method in activities and seminars to nudge collaborative efforts towards gender equality, health equity, and the empowerment of women and girls in inclusive learning and Science, Technology, Engineering, and Mathematics (STEM) education.

Concept

- Conducting activities and workshops using playful experiential learning approaches to develop partnerships among the respective communities and women, NGOs, and student societies.

Playful and Frugal

Playful: Role-play, well-being themed snakes and ladders game, monopoly game for financial literacy, interactive and simple facilitator toolkit, photos, and images to engage participants for pre- and post-studies. These encourage girls to experiment and explore STEM through STEMBucket activity and create a platform to encourage agency among female students and women.

Frugal: Keeping the programme simple to follow and imitate and promote collaboration through themes based on localised content to facilitate social acceptance by the community.

Co-creation

Community-centered, building of trust, collaborative towards belonging, sense-making (analysis), co-ownership of nature and their community.

Lesson learnt and strategy

Lessons:

1. Need to identify a follow-up mechanism with communities/participants via or using technology (e.g. WhatsApp messages, emails).
2. More women should be involved because they are more likely to speak up about issues affecting their family and community, such as financial literacy, health and well-being, and education.

Outcomes:

1. A number of education and awareness games and content were developed. Sample games and content: Kira-Kira for financial literacy, Before 2050 - Climate Hero Net Zero, Malaria snake and ladder, Dengue snake and ladder, Handbook for Malaria educational booklet, water filter activity booklet.

2. Talks: International Women in Engineering/STEM Day: Dream. Experiment. Inspire, Breast Cancer by Dr Adibah Ali, Malaria Mindful society by Dr Paul Divis and Dr Angela Siner, Mindful lifestyle by Alvin Heng, Women and Entrepreneurship by ACES team led by Dr Florianna and Dr Fitri Suraya.

Partnership:

1. Develop more initiatives with industries by collaborating with researchers from other institutions.

Impacts:

1. CREAMMS_22: Creating a Malaria-Mindful Society (Research ID: USC/CP/PW/0018) for 2022.
2. 4 months of lunchtime yoga with Alvin Heng (Yoga Region).

Activity 3: Empowering youths (aged 8-17 years) through STEM

Scope

The focus of the sessions was on using a transdisciplinary approach to address real-world issues and to develop innovative, sustainable solutions while inspiring young people's excitement and energy to become action-takers. Young people can upgrade their skills by developing their scientific literacy and sustainable mindsets through the session platforms.

Target group

- Students, youths, teachers, mothers, industries, NGOs and university.
- Stakeholders: SK Chung Hua No 5, Tunku Putra Primary and Secondary Schools, Swinburne University of Technology, Sarawak, Universiti Malaysia Sarawak, communities (mothers, youth, students) from Telok Melano, Pasir Pandak, Pasir Panjang, schools in Penang (marine science camp).

Project team

- Researchers from universities: Universiti Malaysia Sarawak, Swinburne University Technology Sarawak Campus (SUTS).
- NGOs: Academic Staff Association UNIMAS (PPAU).

Aims

To use STEMBucket materials in education as extracurricular activities to spark students' curiosity for playful experiential learning and help them conceptualise the foundations of STEM topics. Partially guided activities include providing the tools they need to make changes in their communities to facilitate their learning and knowledge acquisition, identify problems, solve problems in the real world, and relate evidence to support their justifications.

Concept

- Facilitate inclusive experiential learning using playful approaches.
- Encourage and empower collaborative STEM learning experience.
- Connecting knowledge and experiments in STEM activities.
- Online escape room game design.

Playful and Frugal

Playful: Fun, using 'What if?' approach to ignite interest and curiosity in learning, giving controls to students in their learning, Reflection model and gamified content.

Frugal: Using local and existing resources, keeping it simple, and relate it to the local context and culture.

Co-creation

Collaborative towards belonging, sense making, fluid learning by doing, ownership, reflecting inner learning.

Lessons learnt and strategy

Lessons:

- It is necessary to provide the activities' missing pre- and post-evaluations to assess the effectiveness of the materials and activities.
- Getting younger students to co-create STEM activities with older students and adults.

Strategies:

- Included in the evaluation will be the effectiveness, knowledge, and skills of the students' responses to the materials.
- The requirement to provide a business plan for schools' STEMBucket programme.

Outcomes:

- Over 10 activities were conducted on recycling, waste management, clean water, engineering bridge construction.

- More than 100 younger students from Malaysia participating in STEM activity co-creation with their friends and adults/family members.

Impact:

- Teachers were keen on introducing the STEMBucket programme in their classrooms.
- Younger students' engagement, problem-solving abilities, creativity, sense of ownership, and social skills are seen to be improved when involving them in co-creating STEM activities with their peers and adults.
- Co-organise Kembara Anak Rimba event at the What About Kuching 2022, Sarawak state event.

Activity 4: Upskilling youths (17 – 40 years old) and students through Hackathons and Competitions

Scope

A number of challenges and hackathons aimed at the profound educational transformation in a setting that links what students learn in the classroom to real-world situations. The sessions expose students through a thinking process to recognise problems in the real world, deal with them, and develop creative, sustainable solutions utilising a transdisciplinary approach. In certain ways, it satisfies the needs of society, students, and capstone projects (e.g., encouraging teamwork and hard and soft skills acquisition) (e.g., solving real problems). Young people can also benefit from these possibilities for skill upgrading.

Target group

- Youths, university students, teachers, students.
- Stakeholders/Partners: Universiti Malaysia Sarawak, Pasir Pandak and Pasir Panjang communities, #DemiLaut, French-Malaysia Embassy, ACES UK, Sarawak State Education Department (JPNS), UNIMAS Learning Sciences postgraduate students, undergraduates from all the eight faculties in UNIMAS, other local universities in Malaysia.

Project team:

- Researchers from universities: Universiti Malaysia Sarawak.
- NGOs: The Kalsom Movements, #DemiLaut.
- Industries: Chumbaka.

Aims

- Encourage playful and gameful learning for teachers and students in Sarawak.
- Produce creative educators and highlight abilities to make learning more fun and engaging.
- Provide a platform to create meaningful and playful learning experiences.
- Develop competencies in documenting the impacts of playful intervention in teaching.
- Provide a platform for youths to showcase creativity and innovation in problem-solving using innovative methods.

Concept

- Allowing participants to explore creativity and problem-solving skills for real-life problems concerning issues such as climate change.
- Promote using frugal methods to solve issues in communities, using easily available everyday items to make innovative solutions.
- Allowing participants to investigate issues faced by the community through interviews and on-site investigation.

Playful and Frugal

Playful: Fun, using ‘What if?’ approach to ignite interest and curiosity in learning, giving controls to students in their learning, reflection model and gamified content, allowing students to collaborate (relatedness), exercise their creative freedom in solving problems unrestrictedly (autonomy).

Frugal: Using local and existing resources, keeping it simple, and relating it to the local context and culture, develop their abilities and skills while doing so in the process (competence).

Co-creation

- Increase intrinsic and extrinsic individual motivations - satisfaction while engaging in the activities (outside their comfort zones), and tangible rewards (social connection, prize, reputation).
- Collaborative towards belonging, sense-making, fluid learning by doing, ownership, reflecting inner learning.

Lesson learnt and strategy

Lessons:

- We applied what we learnt by running our own competitions after learning from our partners (#Demilaut and Time to Rice) by organising a number of hackathons and competitions.
 - Creative use tools of collaborative online whiteboards (Miro and Mural) to allow interaction during activities and gameplay during the hackathon.
 - The methods and results are captured in images and videos.
 - Hackers were sent to the location (community villages) to engage with the community and determine problems and needs prior to the creation of innovation in order to increase teamwork experience and skills.
 - To challenge the hackers to incorporate creative thinking and frugal practices into their social innovation.

Strategies for the team:

- Enhance and improve the processes in collaborating with partners by linking the proposed projects with the initiative of ACES.
- ‘What if?’ method to be used for the next series of hackathons for Playlab Bus innovation.

Outcomes

- Several hackathons were (co-) and organised by the ACES project team with #DemiLaut (national level), ACES Climate Change hackathon (national level), CreativeCulture GameChangerMY (in collaboration with Sarawak State Education Department (JPNS)), ACES STEMBucket hackathon (international level), and Malaysian-French Embassy Ocean Hackathon (International level in collaboration with the Malaysian-French Embassy Singapore).
- A number of social innovations were developed from the ACES Climate Change and the Ocean Hackathon. Sample innovation: Climate change educational games - Before 2050 - Climate Hero Net Zero, Mobile app to detect marine benthos coverage in rock pools, Social innovation IoT-based to repel infestation in dried fish, Fish intestine compost blocks (FICOB).
- There were 38 video submissions under the #DemiLaut Citizen Science Programme and 20 video submissions from the CreativeCulture GameChangerMY Challenge.