ACES Space: PlayLab Bus

An ACES Malaysia Case Study

Introduction

The PlayLab Bus is a product of the STEMBucket © programme, which converted a dilapidated school bus into a Playful-STEM lab for youngsters to investigate STEM-related subjects and transform STEM knowledge into practice. The bus acts as a platform for innovation, allowing innovators from different disciplines to introduce practical innovations from their perspectives in achieving self-sustainability, particularly in the rural application contexts. It is a platform to embrace the concept of frugality, to repurpose used items for new uses and to embrace sustainability awareness among communities.

Co-creators involved will push their creative and problem-solving skills to new heights as they can apply their classroom knowledge and tactics in a novel situation. By being able to experiment with a wide range of ways and approaches, new ideas will spark in various situations which give them the necessary exposure and confidence through practice. It can also act as a research incubator and training to ignite innovative strategic thinking using gamification approaches for future researchers and to bridge the gap between schools and universities.

Scope

Art and creativity.

Artists in residence - with their involvement in PlayLab, the undergraduate artists were able to explore a new working environment with a new set of challenges and create conceptual artwork through the mural-making project. The unique requirements of PlayLab have also triggered professional presentation of their ideas, critically solving design and technical challenges through co-creation among lecturers and students.

Self-sustained Electricity.

The Modular solar power system uses flexible solar panels and a small system footprint allowing seamless integration without occupying much physical space of the PlayLab. The pure DC power supply architecture enables a greater power cultivation/usage efficiency from the limited number of solar panels for usage within PlayLab. PlayLab's appliances such as laptops, smart devices, projectors, network / WiFi equipment, lighting and even an application server can be powered with solar panels. This enables a self-sustained electricity supply to allow the PlayLab to continue functioning even when it moves to off-grid areas.

Self-sustained Water Supply.

A micro-scale rainwater harvesting system that collects rainwater directly from the bus's roof can be stored within the bus for the consumption of the PlayLab. The system design is tailor-made for the PlayLab to enable a self-sustaining clean water supply whenever the PlayLab

moves to rural areas. A two-stage water tank design allows the conservation/storage of water for critical usage and tank cleaning. Water will go through a filter before being solar-pumped into the PlayLab during usage and drained out through the frugally designed sink.

Hotspot and Server on the Move.
Wherever the PlayLab sits, it will serve as an Internet gateway on the move to narrow the digital gap. A virtual space for interaction, learning, exploration and even co-working are made available through the PlayLab. Service hosting on the PlayLab is made available to enable digital services such as the Digital Library, Education Portal, Virtual Laboratory, and Training sessions through gamification for more interesting and flexible experiences to cultivate students' interest in STEM subjects. Additionally, the virtual spaces comprise the CreativeCulture website, social media usage (Facebook and Twitter), and YouTube video content (CreativeCulture TV).

Target Group

Teachers and students of STEM, artists in residence, research scientists in ICT, Civil, Mechanical, Electrical, Environmental, Interior Architecture, Creative Arts, and academics from the 8 faculties in UNIMAS, Academic Staff Association UNIMAS (PPAU).

Project Team

- Researchers from universities: Universiti Malaysia Sarawak.
- NGOs: Academic Staff Association UNIMAS (PPAU), IEEE Sarawak Subsection.

Aims

- To create a cutting-edge mobile platform, a unique, playful space/environment that embraces frugality, creativity and science to encourage strategic thinking towards developing innovative solutions.
- To promote transdisciplinary collaboration between the sciences and arts, with the goal of promoting and advancing STEM and sustainability.

Main Design and Delivery

1. **Concept**
   The design concept of the PlayLab bus is to create and provision a platform/space for further innovation that allows multi-disciplinary participation to promote the co-creation of solutions from different perspectives embracing frugal and playfulness elements.

1. **Playful and Frugal**
   Playful: PBL, Experiential learning through play, PBL, playful values, learning based on need.
   Frugal: Reuse, Repurpose items, Build, Modify, Innovation, connection with daily life, build a constructive attitude.

2. **Co-creation**
   Co-creation: Design Thinking, PAR, individual to collective; local to global, collaborative, building trust, inclusive process and exclusive process, sense of belonging/ownership.

Sustainable Development Goals Addressed

- GOAL 4: Quality Education
- GOAL 5: Gender Equality
- GOAL 6: Clean Water and Sanitation

Timeline

The project ran over a period of 2 months, from 13 August 2021 – 22 October 2021.

Locations

- **Universiti Malaysia Sarawak (UNIMAS)**, Kota Samarahan, Sarawak.

Key Lessons Learnt

- Solving real-life problems through co-creation and hands-on practices.
- Resilience enhancement through creative adaptation and frugal approaches.

Strategies

- Source funding to duplicate the prototype for a STEM bus that is outfitted with a 5G connection based on the prototype.
- To promote the mobile, off-grid, 5g connected bus for STEM education in collaboration with the state.

Detailed activities

Activity 1: Artists in residence

Scope

Phase 1: Cleaning and fixing, repurposing.
Phase 2: initiating, anatomy to share ownership and decision making, shared action and reflection (PAR).

Target group

Undergraduate students and lecturers of creative arts discipline, UNIMAS ACES, Academic Staff Association UNIMAS (PPAU).

Project team

- Researchers from universities: University Malaysia Sarawak.
- NGOs: Academic Staff Association UNIMAS (PPAU), IEEE Sarawak Subsection.

Aims

- To achieve art practices through real-life challenges.
- To embrace playful values in the process and outcome of artwork.
- To encourage community resilience enhancement through teamwork.

Concept

Using the open bus platform to Invoke art excellency and creativity.

Playful and Frugal

Playful: Fun, curiosity, experiential, social.

Frugal: Creativity, collaboration, openness, practicality, resilient, minimalism, sustainable.

Co-Creation

Building of trust (using top down and grassroots approach), collaboration towards belonging, sense-making, fluid learning by doing, ownership, reflecting inner learning.

Lesson learnt and strategy

- New ideas can be sparked through the change in the environment.
- New levels of creativity can be achieved through empirical experimentation.

Activity 2: Adaptive Technology Adoption

Scope

Preparing the PlayLab platform with basic amenities required for day-to-day operation.

Creative adoption and installation of solar power and water harvesting systems with minimal modification and cost.

Target group

Technologists and researchers of relevant disciplines from UNIMAS.

Project team

- Researchers from universities: Universiti Malaysia Sarawak.
- NGOs: Academic Staff Association UNIMAS (PPAU), IEEE Sarawak Subsection.

Aims

- To create physical and practical lab space within the bus.
- To equip PlayLab with basic amenities such as renewable energy and water supply.

Concept

- Innovative adaptation of technology to suit the structure and built of the bus.
- Embrace a design concept that requires minimal maintenance and support.

Playful and Frugal

The exploration of the requirements and the limitations of each technology adoption can be a fun learning process through curiosity and experience.

To introduce minimalism and greater sustainability, frugal comes into play to enable minimal modification to the existing platform while adopting/integrating new technology into the platform. A frugal practice that is practical, resilient, and open to new ideas allows seamless collaboration with others.

Co-Creation

Building of trust (using top down and grassroot approach), collaboration towards belonging, sense-making, fluid learning by doing, ownership, reflecting inner learning.

Lesson learnt and strategy

- Resilience in adapting existing technology according to different environments.

Activity 3: Frugal Innovations

Scope

Prepare the required multipurpose space for PlayLab through the salvation and repurposing of existing bus components. Introducing space-saving features to allow better use of space. Furniture shall occupy minimal space and be very flexible to allow the space to be used for multiple purposes.

Target group

Researchers and practitioners from any discipline from UNIMAS.

Project team

- Researchers from universities: Universiti Malaysia Sarawak.
- NGOs: Academic Staff Association UNIMAS (PPAU), IEEE Sarawak Subsection.

Aims

- To embrace the reuse of existing components of the bus to minimise the overall space creation costing.
- To encourage brainstorming of ideas to continuously improve and challenge the current ideas.

Concept

- Space saving design invokes the creative adoption of foldable furniture and frugal innovations.
- To source for exiting items and repurpose them for the purpose of space saving.

Playful and Frugal

Playful: Fun, curiosity, experiential, social.

Frugal: Creativity, collaboration, openness, practicality, resilient, minimalism, sustainable.

Co-Creation

It takes much brainstorming and experience sharing among members of the innovation team to co-create constructively and progressively come out with new frugal ideas and options for innovation.

Characteristics of co-creation include the building of trust among members, collaboration towards belonging, sense-making, fluid learning by doing, ownership, and reflecting inner learning.

Lesson learnt and strategy

- Not everything has to be redesigned, a lot of existing items in warehouses or malls can be repurposed or further innovated to meet the new objectives.

Activity 4: Virtual Connected Space and Social Media

Scope

A virtual space goes beyond what a physical space can offer. Virtual spaces are created through in-house ICT systems to offer more PlayLab features and functions. The portable hotspot and server-on-the-move shall unleash the potential of the PlayLab on a global scale.

Target group

Computer scientists, IT system developers, communication network experts etc.

Project team

- Researchers from universities: Universiti Malaysia Sarawak.
- NGOs: Academic Staff Association UNIMAS (PPAU), IEEE Sarawak Subsection.

Aims

- To enable the hosting of ICT services on-the-move.
- To bridge the challenges of hosting server architecture running on the limited renewable energy.
- To explore the various telecommunication options to adapt to various scenario while PlayLab moves from urban into the rural.

Concept

- Portable ICT services invoke minimal energy consumption operated on renewable energy sources.
- Green computing architecture for services on the move.

Playful and Frugal

Playful: Extending playfulness through virtual spaces. Explore and experiment with new technology option on-the-move.

Frugal: Exploring existing computing architecture options for practical and sustainable adoption on-the-move.

Co-Creation

Technologists from computing hardware, software and system development come together to co-create a seamless ICT integrated platform on-the-move. Such collaboration enables the building of trust, a sense of belonging, sense-making, ownership and reflecting on each other's ideas for more effective inner learning.

Lesson learnt and strategy

- ICT services provision can be resilient to go beyond its conventional implementation approaches to breach the limitations in terms of CPU and power requirements.
- Computing architecture and services can be made micro through frugal to achieve a smaller coverage and audience for practicality.