

# Hydroponics Playground Garden, 'Playponics'; designing integrated sustainability and STEM education, through play.

## Demonstration (kind of...)



Avika and Devanshu Sood, Ativa Design, India

### Abstract summary

This play, **environmental sustainability and STEM education** applied research paper discusses and positions our thinking, rational, research themes and methods when 'designing for children'. From the **practicing designers perspective**, we consider what kinds of learning mechanisms can be capitalised upon when designing educational experiences and how these diverse headline topics might be holistically considered and integrated into potential new learning experiences. We explore the role of physical play in learning about science, technology, engineering with the **aim of increasing awareness in future populations of environmental sustainability issues**. We conclude that the evidence to date strongly indicates high levels of acceptance of the proposal.

The project has been initiated through collaboration between Designers at the Lab4Living (L4L) at Sheffield Hallam University (SHU), Ativa Design, and schools and businesses in the Delhi region and is supported with resources from the Global Challenge Research Fund (GCRF).



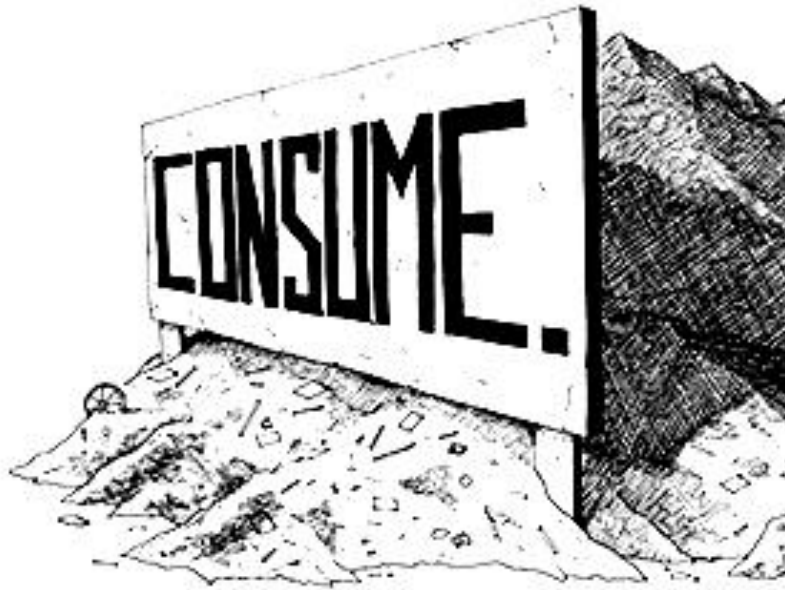
Mansi Chauhan,  
Tanya Chaudhary and  
Pradeep Kumar,  
Vahani Scholars



## Lab 4 Living

Heath Reed, Andrew Stanton, Tom Maisey, Lab4Living, UK

# Problem outline



A prime motivation for undertaking this work in these ways is supported and evidenced not only through current 'climate emergency' action, but also by a very pragmatic 'how' do we achieve this learning and potential behaviour change.

**'Alongside any form of promotion of learning about issues such as climate change, ...there needs to be consideration of how children learn about (it)'**  
(Bourn, Hunt, Blum, Lawson, 'Primary Education for Global Learning and Sustainability', 2016.

Our focus in this study is **Environmental Education** and the relationship future generations will have with our world, how we consume, and the balance between consumption and living in more sustainable ways.

This project specifically explores **ways children might engage** in learning about those issues, how we may instil knowledge about how to live more sustainably, and in the context that the best way to affect this change may be through education.

**'...today's global imperatives - to eradicate poverty and improve wellbeing, while restoring the Earth's balance - form a single agenda, and that the most effective means of achieving it is education.'** (Bokova, Figueres, World Economic Forum, 2015)

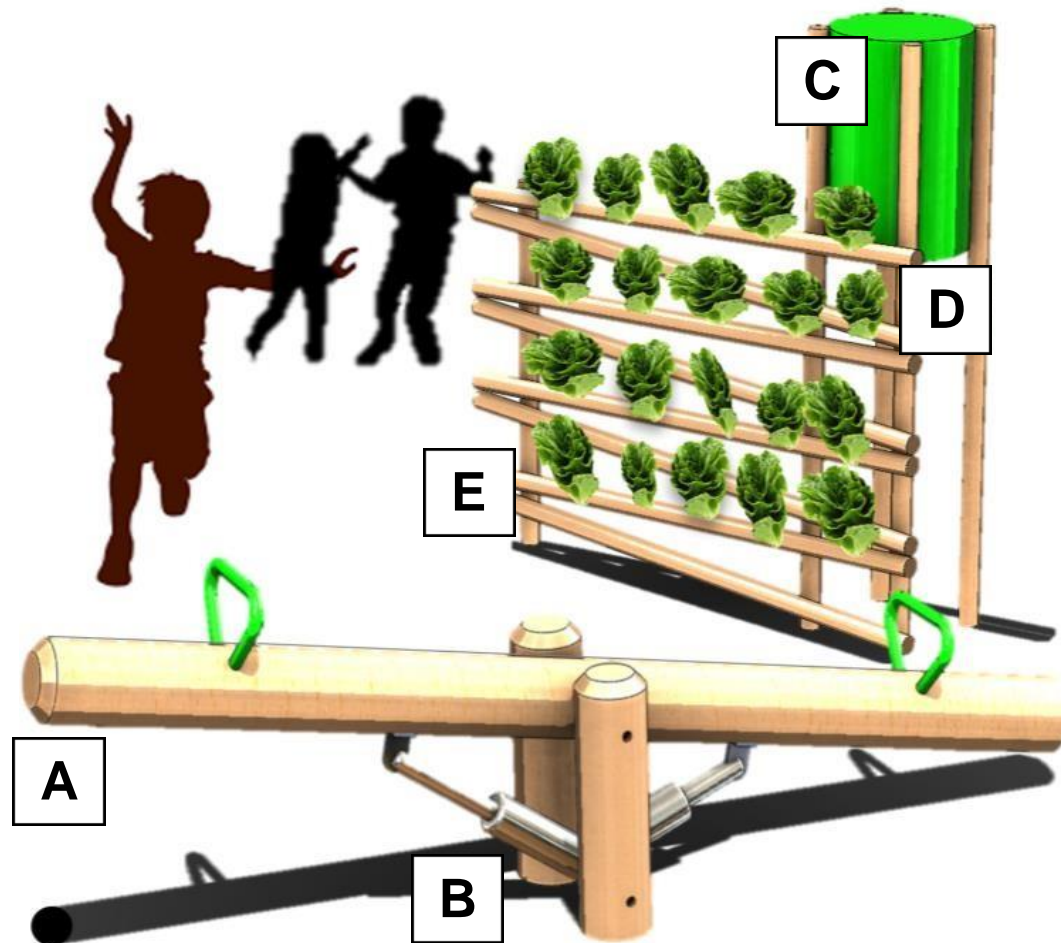
The project aims to support **India Government legislation** and policy regarding STEM and EE infusion, alongside meeting targets set by the UN Sustainable Development Goals (SDG). While this project crosscuts several **SGD's**, and where UN fundamental values include **'leaving no one behind'**. However, Playponics is been specifically developed to address SDG 4; '...quality education...' and 12; Responsible consumption and production.

This applied research has been planned in **two distinct phases**. **Firstly**, we identify known elements that impact upon the design of proposed educational play learn systems. **Secondly**, we planned to install and monitor a number of learning ecosystems arising from the first stage research. In our first level research the design practitioners investigated numerous core topics, namely;

- **Communities** - what are the local teaching, and the wider social and economic contexts?
- **Learning** - what pedagogical methods might be integrated? (challenging rote alone practices)
- **Technical** - how might these play systems be physically configured and enabled?
- **Technical** - what are horticultural and hydroponic requirements?
- **Health** - what are the health benefits of physical activity / play?
- **Implementation** - how might these proposed systems be implemented?

The **paper** (same title) outlines some key aspects of our enquiry to date.

## Research - artefact as probe



Artist impression of one of the 'Playponics' play learn installations

At the emerging concept's heart was **learning through physical play** enabled by custom-made designed playground equipment (swings, seesaws, and the like).

We have developed **a concept called Playponics** and, because of its highly 'likeable' format, use it to explore a position that engagement such play 'ecosystems' may show benefits in developing STEM (and STEAM), knowledge associated with horticultural practices, and broader lessons about cause, effect, co-operation, and benefits associated with physical activity.

This play equipment is augmented with systems that in turn **enable crop production**. In this scheme physical play energy expended by the child would be made tangible, harnessed, stored and used to help facilitate crop growth. In this way, from an educational method perspective, we aimed to help address shortfalls in current 'information transfer only' (or 'chalk-and-talk') type (rote) teaching and learning such that;

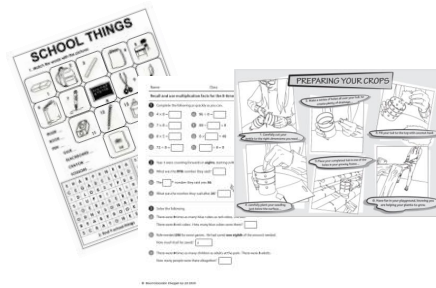
**'Rather than just being informed about the environment and the wider world, children will be supported in both understanding and experiencing (it)'** (Rickinson et al, 2004; RSPB, 2006)

Technically, we demonstrated that children riding a seesaw [A] fitted with pumps [B], can effectively move water around a Playponics system. As water is pumped it is retained by a 'header tank' [C] that in turn gravity feeds [D] nutrient rich water through a hydroponic crop growing frame [E]. In this way we can describe that play energy has been 'captured' and used to facilitate transmission, storage and utilisation of the valuable resource of water.



## The vision

A selection of play equipment concept designs have been developed, tabled and discussed with schools and educators. In this respect we consider that we have engaged, all be it at a 'high level' in a process of **participatory design**. However, in terms of research methods we expect it is the implementation of these pilot studies that will yield richer insight as to value.



# The reality



The design and local fabrication (Delhi, March 2019) of hydroponic crop growing frame.

Through these engagements the team further recognised that, in the **spirit of sustainability**, proposed systems needed to be designed respecting local materials, fabrication, manufacture, installation and maintenance. Being trained and experienced product designers (and capable makers), a phase of activity focused on local resourcing and experimental fabrication, undertaken to ensure proposals could be locally made

We therefore consider that these **local, frugal, 'design' related lessons** can form a part of the educational experience, alongside health, nutrition, PA and technical/STEM lessons.



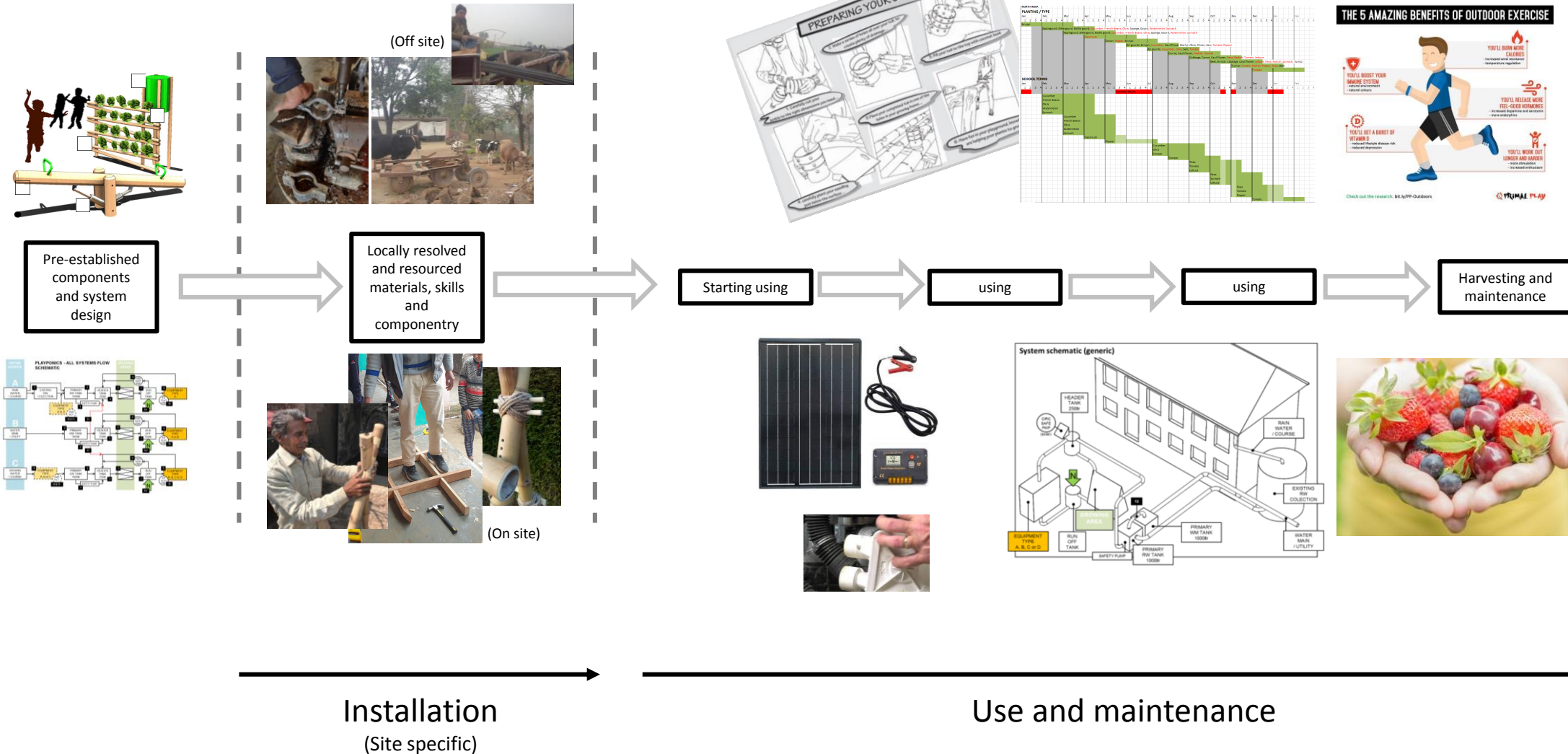
Life size demonstrator at the 11<sup>th</sup> Sustainability Summit GRIHA, Delhi in December 2019.

As such, constructed from local materials and using local fabrication services the first prototype playground was exhibited and demonstrated at the 11<sup>th</sup> Sustainability Summit GRIHA, Delhi in December 2019.

The setup attracted many **supporters and potential future stakeholders**.

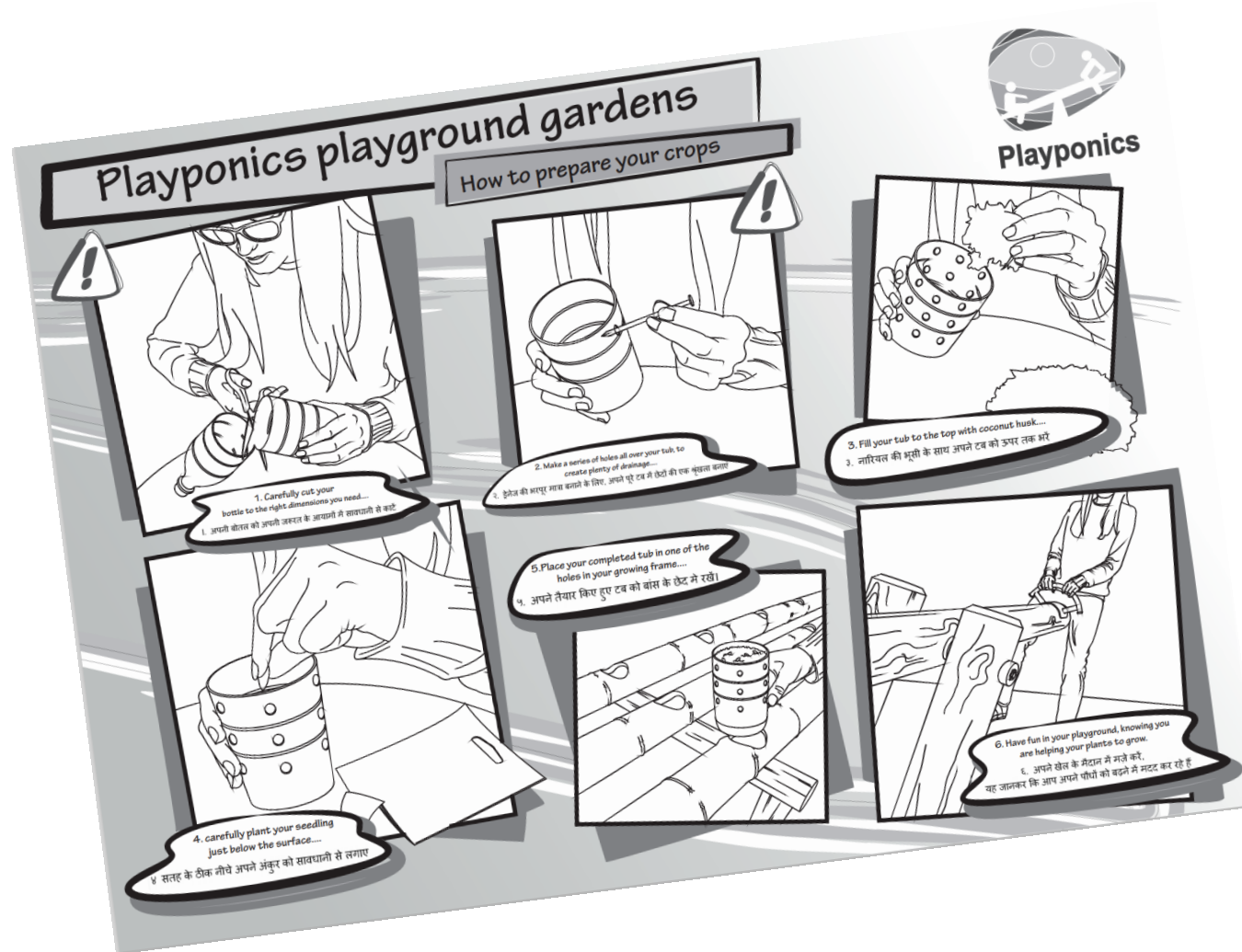
# Opportunities for learning

We anticipate a **range of learning opportunities** and holistic experiences. Learning modules can include mechanical and technical principles, nutrient solutions, lessons on physical activity, cause and effect, from system design to co-operation, horticulture practices and local, natural environmental levels (to name a few!).





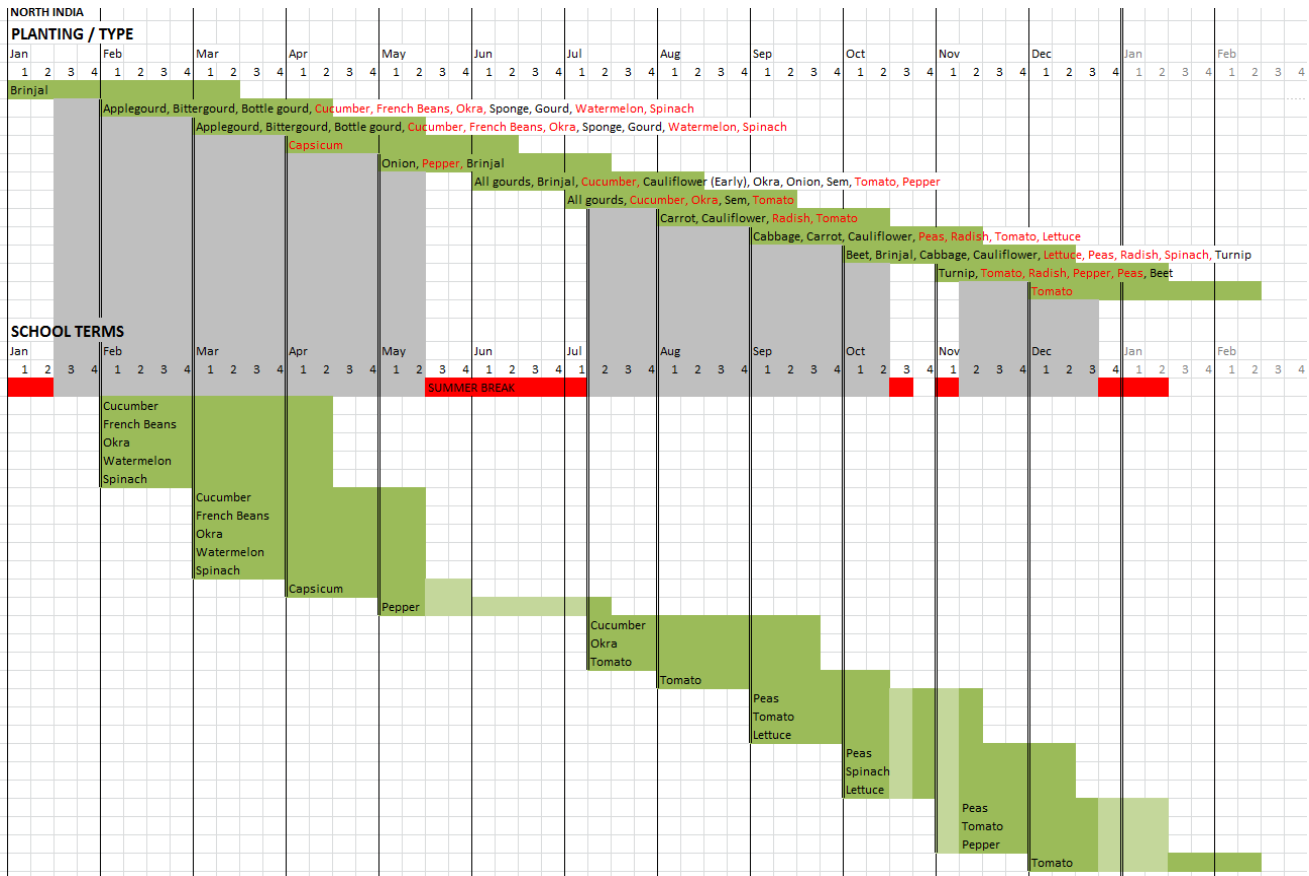
## Opportunities for STEM/EE infused learning



'...awareness of environmental issues comes not from direct engagement with the environment itself but from a more passive and indirect understanding of these issues. Direct interaction with the natural environment appears to be increasingly absent in children's lives and this new phenomena gives rise to concern because such experiences are essential in developing children's knowledge and understanding of the world.'

(Bokova, et al, World Economic Forum, 2015)

# Opportunities for STEM/EE infused learning



Technical – What are horticultural requirements, crop types, planting calendar and match with school teaching year.



## Update!



The 'real world' Playponics playground being installed in Khanpur, Uttar Pradesh, week commencing January 25<sup>th</sup>, 2021



## Community and co-operation



The 'real world' Playponics playground being installed in Khanpur, Uttar Pradesh, week commencing January 25<sup>th</sup>, 2021



## Skills sharing





## Understanding structures





## Role model exemplars











## Conclusions (some!)

Schools in India have stated that the proposal **fits well with their ethos** and ambitions for their pedagogy

In respect to learning about sustainability issues, education is key to our populations health, wealth and security. However, for many schools, it can be **hard to put programmes** into practice that bring about these benefits. Although a simple idea the benefits of this approach to play and sustainability technology education are multifaceted. As a result of our research to date we now consider the benefits of this approach in three primary ways.

- Benefits derived as a result of **taking part in physical play**, both cognitive and in terms of a child's healthy, physical development.
- In the child's developing mind, the **building of understanding** about the relationships between physical effort made and a crop's subsistence, knowledge building around biological systems, cause and effect, **sustainability** and symbiosis.
- **Design, science, technology and engineering educational benefits** derived from very real and **tangible, physical interactions** with the mechanisms and systems that enable energy capture, storage, transmission and utilisation, through the kinaesthetic and experiential learning modalities.

Added to these primary benefits for the child are potential wider social lessons, lessons about **community** (teacher, parent, student, school) engagement, **co-operation**, nutrition and the bigger topics of future **sustainable living**.

## ...thank you!

**If you'd like a Playponics system, or are interested in being part of the research group please let us know**

visit  
[www.playponics.in](http://www.playponics.in)

