



# Imagine **Playponics**

**Hydroponic playground gardens for schools in India**

**Call to interested schools**

## Playponics a new concept in sustainability education

Playponics involves the integration of student learning across design, science, technology and engineering, these subjects relationship to sustainability education, and learning through physical play, or 'kinesthetic' learning.

We have designed playground equipment, capable of local production that enables children to play and learn about the importance of building environmental sustainability knowledge. Our focus is on early years of education and the relationship future generations have with our world, how we consume, and the balance between consumption and sustainability.

Playponics play parks enable learning about this balance through the integration of physical play and hydroponic crop growth, planned to engage learners. We achieve this through the provision of specially designed play 'ecosystems' that capture 'play energy'. This energy is stored and used to help facilitate hydroponic and horticultural crop growth. When playing on and with Playponics equipment the child can 'see' how these systems work and build their understandings of mechanisms, cause and effect, symbiosis and co-operative behaviors.

We believe that education is the key in helping to solve the environmental and over consumption issues that face the world today. Playponics is one important way we can help do that. The concept has been developed by Designers at Sheffield Hallam University in the UK working with, technologists, scientists and educators in the UK and India.



## Why?

The well-known adage that if the world's population consumed at the same rate as the so called 'developed' nations we will need the resources of three and a half earths to sustain us all is hard to substantiate. However, we can be sure that the industrial (and post-industrial) nations have made the biggest contribution to environmental degradation. Excessive consumption, pollution, natural resource depletion, and disconnect from nature have been the warning cries of environmentalist for many years.

With India's middle classes on the rise (data indicates the group is set to grow rapidly, from around 80 million today to 580 million people by 2025), is it sensible that these developing societies 'ape' the consumption patterns of the West?

We believe there are better ways to live more sustainably, but that the best way to begin this change is to start with knowledge, education and creative thinking that will help us to re-connect with natural systems. This proposal outlines the potential benefits to early learners of engagement in sustainable practices.

Playponics is a system that integrates two apparently disconnected topics, crop cultivation and what all children love, play. These principles show a good fit with both global and local sustainability challenges as defined by The Primary Education for Global Learning and Sustainability Research Report (1). Although embraced by some schools, educational syllabuses seldom have a specific focus on sustainability issues, and further, rarely through experiential 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.'*(1)

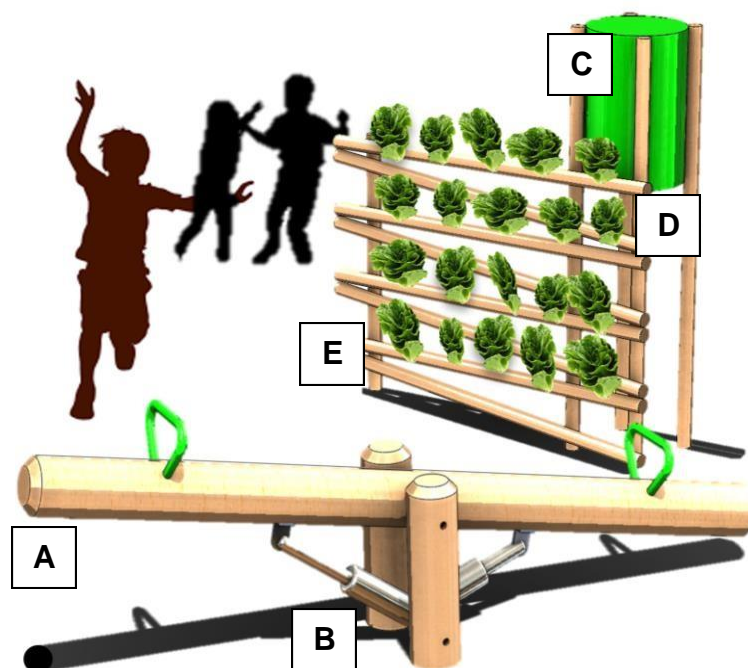
We aim to help address this 'passiveness' in sustainability education through direct interaction with sustainability play learn systems that enable deeper, richer and tacit understandings about our world to be developed. We use the term 'ecosystem' to define the Playponics concept. This is most usually used to define '*a biological community of interacting organisms and their physical environment.*' (2) It is used literally here as we explore the integration of child learning through play, with the building and embedding of early stage knowledge associated with horticulture and sustainable practices.

If we aim to tackle and hope to reverse the damage that is being done to our planet our next generations of school leavers will need to be equipped with broad and holistic understandings of our relationship with our world.

## How our ecosystems work

The Playponics concept is a simple one. Combine the benefits of physical play with systems that help facilitate sustainable crop production. We achieve this through the provision of specially designed playground equipment augmented with mechanisms that capture the child's 'play energy', store that energy, and use it to help irrigate and sustain a variety of hydroponically enabled crops. In this way we aim to instill in the participating children knowledge and understanding in fun, physically interactive ways.

For example, we can demonstrate that children riding a seesaw [A below] fitted with pumps [B], can effectively move water around the 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 utilization of the valuable resource of water. Participating children can see these processes in action as they play and learn about the rewards of fresh and healthy crops, as the product of the fun energy they put in.

A wide range of play equipment formats continue to be researched and developed. These include swing sets, roundabouts and 'barrel runs', to name a few. Each item of play equipment is connected to a water pump configuration appropriate to its mechanical function.

## Educational benefits

Although a simple, idea the benefits of this approach to play and sustainability technology education are multifaceted. We aim to create surroundings that promote exploration and build environmental learning that enable 'kinaesthetic learning'. *'Kinaesthetic learning or tactile learning is a learning style in which learning takes place by the students carrying out physical activities, rather than listening to a lecture or watching demonstrations.'* (4)

We consider these educational benefits in three primary ways.

1. Benefits derived as a result of taking part in physical play, both cognitive and in terms of a child's healthy, physical development. On a most basic level, Playponics installations facilitate physical activity which is fundamental to health.
2. 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, ecology and symbiosis).
3. The 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 utilization.

Added to these primary benefits for the child are wider social lessons, lessons about community (teacher, parent, student, school) engagement, co-operation, nutrition and the bigger topics of future sustainable living. In respect to learning about sustainability issues, education is the key to our (future) population's health, wealth and security.

The benefits of regular physical activity (PA) in promoting children's health are well known and understood. PA is also associated with improvements in children's intellectual development, *'PA has a positive influence on cognition as well as brain structure and function'* (3). However, for many schools, it can be hard to put programs into practice that bring about such holistic benefits.

Playponics installations require levels of maintenance that include mechanical, electromechanical and hydroponic systems (e.g. nutrient) management. Our ethos is that these processes include the child and school community. This maintenance is not deemed overly complex, and optionally aspects of learning can be integrated with the school curricula.

Broad mixes of topics are covered here in holistic and interwoven ways that go beyond traditional learning methods, or in other words, beyond 'chalk and talk' education, as *'Alongside any form of promotion of learning about issues such as climate change, ...there needs to be consideration of how children learn about them'* (1)

## The vision

Initially we aim to build and learn from a first Playponics scheme sited in a school in India. The installation will directly benefit the children and local community who will be involved in the Playponics playground design, layout and modes of engagement.

Our ultimate objective however is to further resolve these technologies so that they can filter across, up and importantly 'down', to a greater number of state run institutions throughout India.

Eventually we anticipate hundreds of Playponics play parks will be situated across the country in a variety of schools, colleges and community settings. For the participating children and local community, Playponics will help to instill tacit understandings of the need for sustainable relationships with our world, simultaneously with the fun and benefits of physical play.



A larger scale Playponics play park (indicative / artist's impression, shown above), includes a variety of play and exercise apparatus. A typical 200 meter square site (10 by 20 meters) will accommodate a substantial installation.

*Typically, such an installation would include*

- *A four seater swing set with integrated hydroponic growing frames*
- *Three seesaws and one hydroponic growing frame*
- *Ground level Roundabout with two growing areas*
- *One slide tower with four growing area frames to form a growing tunnel over a main path*
- *Three arm exercise stations connected to the slide tower tunnel growing frames*
- *Three single user 'barrel runs', and an associated single hydroponic growing frame*
- *Hand pump stations and a growing frames*
- *Each growing area frame incorporates a header tank tower (approx. 2.5m high) and is topped with a 250ltr water header tank.*
- *Each structure will be covered with a bamboo parasol for shade.*

## Local materials, manufacture and maintenance

The proposal we table here aims to augment schools sustainability learning programs through the provision of play equipment that will be, as far as is possible, produced, installed and maintained locally by students and staff of the participating schools. We further aim to engage staff and students in the process of designing the play equipment, the environment in which it is sited and the systems that enable it.

Locally sourced materials and fabrication will be utilized to minimize both materials and transport environmental impact. The SHU team has been investigating the use of sustainable materials in its Playponics research for the structural elements of the playgrounds and hydroponic growing frames.

An example of the growing area frames, constructed in locally sourced Bamboo (Delhi, March 2019), is shown in below.

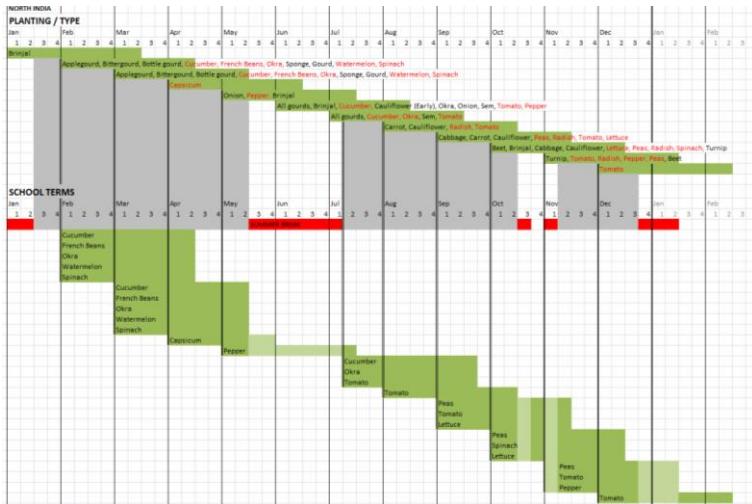


*Locally produced hydroponic growing frames*

Safety - All playground equipment and the immediate environment in which it is sited will be designed, produced and managed in accordance with The British Standards Institute (BSI) BS EN 1176-1:2017 'Playground equipment and surfacing'.

Crops - The Playponics team have researched and selected a number of crops suitable for growing with Playponics installations that fit with the teaching year. These are generally substantial crops (tomatoes, peppers, cucumber and lettuces) and we cite hydroponics as a principle mechanism by which crops are grown. *'Hydroponics is a method of growing plants without soil by instead using mineral nutrient solutions in water solvent..'* (2)

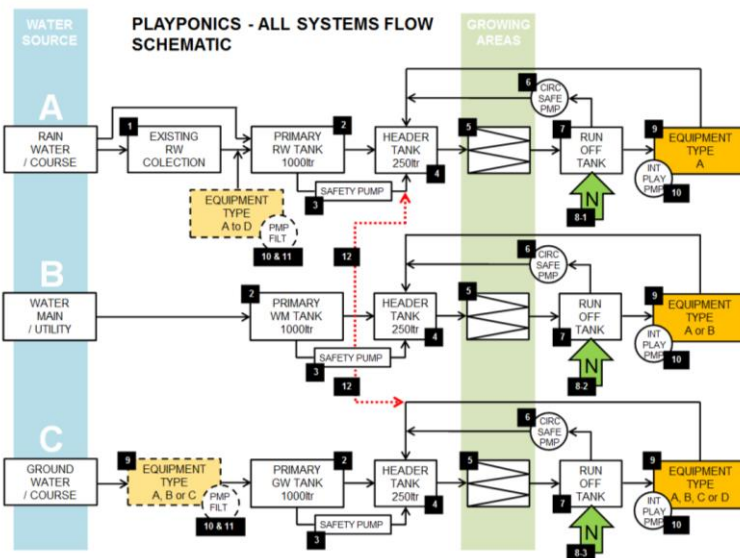
There are a number of nutrient options available and the Playponics team has been working to ensure that nutrient mixes are locally produced and managed. Depending on the local situation, climate and geography of the proposed Playponics site the system may additionally facilitate crop growth through more conventional means, i.e. as a way to filter, store water and irrigate ground / soil based crops to enable horticulture.



Crop and school year planting calendar

System backups - Playponics systems have incorporated a number of backup systems to ensure crops are maintained with water and nutrient during non-play times, at night, during weekends and holidays to ensure healthy crops at all times.

Water sources - Our research in India has highlighted the requirement to produce systems that are capable of a variety of local resource and environmental situations. We have developed flexible schemes that account for primary water source types and that are interchangeable. These are combined with larger and smaller scale playground equipment schemes appropriate to the schools needs and resources.



Water sources, system schematic and play equipment types



## Next steps

Our immediate objective is to fabricate, install and operate a Playponics demonstrator at a school in India. Finalizing the design and layout of the sample play park is targeted for completion by mid-November 2019. To install this set up we are seeking investment from a Corporate Social Responsibility (CSR) or like-minded financial supporter.

Our first Playponics installation will be a test bed to establish and refine a common set of principles and equipment designs which can be scaled up in support of similar educational programs throughout India.

Ground works for this installation can begin in November 2019 with play, learn and grow activity commencing during December 2019. We expect to learn much about how to deliver the Playponics concept in increasingly efficient ways and we estimate that future installations will cost in the region of £2000 to £4000 each, depending on local situations.

The Sheffield Hallam University Design Research team at the Lab4Living is already in receipt of design research funding that will augment the CSR funding we attract. This Global Challenge Research (GCRF) funding will continue to be used to facilitate project logistics and enable UK and Indian design research staff to continue this work.

You can read more about the work we are doing in India, funded by the GCRF [here](#) and [here](#). More information about the Lab4Living and Sheffield Hallam University's award winning projects can be found at <https://lab4living.org.uk/>.

**Your support - If this is a program you or your school is interested in please do not hesitate to contact us!**

We welcome your interest.

The **Playponics** team

Contact [h.reed@shu.ac.uk](mailto:h.reed@shu.ac.uk)

*Heath Reed, Principal Research Fellow, Lab4Living, Sheffield Hallam University*



## References

1. Research Report, Primary Education for Global Learning and Sustainability, Cambridge Primary Review Trust (CPRT Research Survey 5), 2016
2. <https://en.wikipedia.org/wiki/Hydroponics>
3. <https://www.ncbi.nlm.nih.gov/pubmed/27182986>
4. [https://en.wikipedia.org/wiki/Kinesthetic\\_learning](https://en.wikipedia.org/wiki/Kinesthetic_learning)

## Notes

Page 6. Details of the illustrated Playponics installation, what's included, how it works and associated costs are available on request.