Embedding permaculture principles into education

Children in Permaculture (CiP) is an Erasmus+ project in which seven European organisations are working together to improve the education of children in formal, informal and non-formal settings through the development of resources such as case studies, curricula, session plans, films and other resources. These resources will enable kindergarten and school teachers, permaculture practitioners, parents and other educators to engage in holistic, sustainable education with children based on permaculture ethics and principles.

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Introduction

The permaculture principles were developed based on deep observation of how natural systems work. They can be applied in versatile ways to a wide variety of situations, in order to better harmonise with nature. Permaculture experts are often referred to as “designers” as permaculture encourages co-creating with nature to create abundance and efficiency. Designing is a process that evolves by constant reflection and evaluation using permaculture principles and other design tools. Here the principles have been adapted for use in learning environments with children. Keep in mind that a single session plan does not need to reflect all of the principles listed below. Rather, this is a checklist to facilitate reflection during the planning process.

Bill Mollison and David Holmgren, the co-founders of the permaculture concept have both written permaculture principles. In this chapter we look at both the 12 principles described in Holmgren's (2002) Permaculture Principles and Pathways and the 5 attitudinal principles described in Mollison's (2009) 'Permaculture: A Designer's Manual'. This rest of this chapter elaborates on each of the principles in turn. Each section starts with the principle in its original wording, then lists child-friendly questions, discusses practical applications in working with children, and lists some questions which help educators to plan sessions with children.

The Holmgren principles

1. Observe and interact:

- ***“What can you see, smell, hear, taste and/or feel?”***
- ***“What’s changed since last time we were here?”***
- ***“Let’s look more closely”***
- ***“What curious questions do you have about this?”***

There are many different things to observe and it takes time. Slowing down to observe using all the senses is an essential starting point for a permaculture education.

Include opportunities to develop observation skills to learn about: the environment (for example through collecting, spotting, silent sitting, mapping, playing and experimenting); people (for example through asking questions, listening to answers, watching how they react and noticing how you feel when they speak) and knowledge base (for example reading books, watching films and listening to elders). Learning to “read” the language and signs of nature is a skill that can be learned, and it begins with curiosity, for example “Why is the grass all swept in the same direction? What could have caused that?”

Lots of permaculture-related activities for children involve them in observing nature, so they can develop love and appreciation for nature, get to know and understand how it works and make use of this knowledge and experience now and in the future. Cultivating an ability to observe interesting details and express your enthusiasm for nature (whether it’s a frog or a leaf) is a key

part of this process.

This principle is also reflected in the approach of seeking inspiration for the sessions by observing the children's interests and your own before planning a session.

Reflection questions:

- *Can the children be supported to directly observe and interact with nature?*
- *Can the children be encouraged to use all of their senses?*
- *Can place-based learning be included?*
- *How can the educators observe the children and note their interests?*
- *How to keep track of the educator's interests and observations?*

2. Catch and store energy

- ***"How do people, plants and animals save food for different times of year?"***
- ***"How can we catch natural energies like rain, sun or wind?"***
- ***"Let's make a drawing about what we did today"***
- ***"Can we find anything that is leaking or wasting resources? (like water, effort or energy)? How can we fix it?"***

In nature most things capture energy and store some for later; for example, plants catch the energy of the sun and store it in their seeds or tubers, squirrels store nuts for the winter. Humans catch and store food energy in our larders and through saving seeds to be planted next year, making jams and preserves, capturing water high in the landscape (so it can trickle down when needed) and much more. These are all activities which we can teach children to do.

In addition, people also capture and store subtler forms of energy such as ideas, experiences and observations. Encourage children to document their experiences and to reflect on them later - through involving them in making photos, videos, drawings, paintings, etc.

Children can also learn to look at energy leaks and think about how to plug these leaks. For example, older children can think about changing the design of a garden to reduce the amount of time and energy spent watering plants.

Reflection questions:

- *How can you plan an activity which will save or store energy?*
- *Are you wasting energy anywhere? This could be in terms of your own personal energy (is there a behaviour or action which leaves you feeling drained?), potential energy (e.g. water in the landscape), electrical energy (e.g. turning off devices when not in use) or children's energy (e.g. a child with high energy whose energy can be channelled)?*
- *How can the children be encouraged to "save some for later"?*
- *How to involve the children in documenting and recording their experience?*

3. Obtain a yield

- ***"What can we harvest and how can we use it?"***
- ***"How can any surpluses be put to good use?"***

- ***"What did we get out of today's activities?"***

Appreciate all the things you receive from the work you do, and that nature gives abundantly. There are many different yields from any outdoor activity, such as having fun, learning maths or science, promoting health and wellbeing, exercising, being creative, as well as physical yields such as food from the garden. Yields are not only what we take but also things that are created or are given back to nature, eg. compost is an indirect yield of cooking that helps the garden.

Celebrating the yields together makes them more visible for everybody and can awaken gratitude for the gifts of every moment. Work on remembering that other species are just trying to obtain a yield too (so don't get too cross when something eats your crop!).

Reflection questions:
- *What is the yield of this activity for individuals, the group, the community, and/or nature?*
- *Are there other creative ways that outcomes from the activity can be shared (besides the outcomes that the children will directly enjoy) - perhaps with animals, plants, or other people in the community?*
- *Is there a chance to appreciate and be grateful for nature?*
- *Is there a way that you can have more yields from the same work?*

4. Apply self regulation and accept feedback

- ***"How can we do even better next time?"***
- ***"How can we listen carefully, with respect?"***

The planet is a self-regulating system for example, it has kept the temperature within the limits which are suitable for life despite the sun getting hotter, over millions of years. Humans can regulate our own behaviour by listening to feedback from natural and man-made systems as well as other people. For example, in the garden you can keep an eye on the temperature of the greenhouse to ensure that it doesn't get too hot or too cold for the plants inside, or you can see if there are too many slugs through careful observation and then taking some action to regulate the system.

Children can learn to watch out for this feedback, and come up with their own ideas on how to regulate it (e.g. opening the door of the greenhouse, bringing ducks in to eat the slugs and so on). Educators can watch children, and listen to their ongoing feedback, for example by the way that they are looking, their reaction to an announcement, seeing when they have had enough of an activity or when they want to keep going with it. Educators can also specifically seek feedback by asking children questions to check what they understood, learnt, or enjoyed. This can be used to formulate a plan for later in the same session or following sessions.

Listen to nature and other people - learning how to notice and care about how we affect other people, species and resources around us.

Reflection questions:
- *Can you plan an activity which gives an opportunity for children to receive feedback from each other or nature and reflect on how to improve?*
- *If a conflict arises how can everyone learn from the experience?*
- *How can the educator be sure to hear the feedback offered by the children?*

5. Use and value renewable resources and services

- ***"Let's thank everything that helped us do our activity today."***
- ***"How can we use things nature makes a lot of?"***

Renewable resources are those which can easily be replenished. Things made by nature go back into nature more easily than highly processed things, such as plastics (which are made from oil). For example, a basket made out of willow will gradually biodegrade (and you have the pleasure to make a new one) whereas a plastic basket will take thousands of years to decompose, long after it is broken and unusable. Therefore, in general, it is preferable to use resources which are made from natural materials rather than plastic whenever possible.

Coal and oil are resources which have taken millions of years to make, so anything which uses or is made from oil is not renewable. Oil is used to make petrol, diesel and aeroplane fuel, therefore minimizing transportation is an important role of a permaculture educator. Consider this when transporting children and educators (can they walk or cycle instead), as well as transporting foods and other goods. This is another reason for growing your own food and using it to replace food transported from afar. It is also useful to advocate for electricity to be generated from renewables sources.

The importance of valuing natural resources and services is key - and the educator's appreciation of nature and all the gifts (services) nature brings will positively affect children, in turn affecting the way they interact with natural resources.

Reflection questions:

- *How can you support children to walk/cycle to school/kindergarten/forest/garden?*
- *Are you able to find a site that you can walk, cycle, or take public transport to, rather than take the car or plane?*
- *How can you source natural, local materials for this activity?*
- *Have plastic and other non-renewable resources been thoughtfully avoided?*
- *If power is required, is it possible to generate it from renewable resources (pedal power, solar, wind etc)?*

6. Produce no waste

- ***"How can we throw less stuff away?"***
- ***"How can we use that again or how else could this be used?"***
- ***"Is there a better place for this than the bin?"***
- ***"How many things do we use that are made from recycled materials?"***

Get creative with ways you can use things that would otherwise get thrown away. "Waste" such as plastic bottles can be reused (or "upcycled") to make something such as a bird-feeder (rather than using new materials), or kitchen "waste" can be turned into compost. Use all resources wisely. Invite and integrate all people and their ideas in the process.

Encourage and support children to recycle. Install recycling bins, scrap paper trays (so paper is

always used on two sides), a compost bucket etc. Point out and use products that are made from recycled materials (toilet paper, paper, fleece, clothing). Organise creative ways for toys, clothes, books, sports equipment etc. to be exchanged (e.g. a second hand market day organised by the children, a raffle with second-hand items as prizes).

Reflection questions:

- *How can you plan activities that minimise and eliminate unnecessary waste?*
- *Are children involved in cleaning up and taking care of resources?*
- *Can "waste" be used again to create something new?*

7. Design from pattern to details

- **"How can we plan from the big picture to the detail?"**
- **"What patterns can you spot?"**
- **"First think big, then think small." (Shapla, 2016)**

Keep track of the bigger picture throughout your session. This permaculture principle suggests showing or experiencing the whole system first, and then looking at its constituent parts or details (rather than presenting information in isolated pieces and perhaps the whole at the end). An example of this is to first "see the forest" (e.g. by climbing a nearby hill to look at it) and then learn to identify the trees.

Repeated patterns all perform a function in nature, for example the branching pattern is great for collection and distribution and can be seen in leaves, rivers, lungs and pathways. Play games to spot patterns in nature with children, and to learn about their functions.

Human behaviour also follow patterns which help us to take complicated decision in split seconds, and some are more helpful than others. Think about your own behaviour patterns, especially in the way you react to children and their behaviour. Is there another pattern which could be more helpful? Learn to identify the bigger patterns in children's behavior (for example if a certain child always become disruptive at 11.30 am - could it indicate that they are hungry?).

Reflection questions:

- Is there a chance for children to look at the big picture before focusing on its parts?
- What patterns can you spot? Can you see the same pattern repeated in different places and times?
- Is there a different pattern which could get the desired results more effectively?
- When planning sessions, it is useful to look at the whole time you will spend with them - for example the whole term or year, what is the overall pattern which you would like to encourage?

8. Integrate Rather than Segregate

- **"How can we help everyone to work towards the same goal?"**
- **"How can we get things to work together rather than against each other?"**
- **"Are all of our friends able to join in?"**

An example for integrating different aspects into one activity can be children practicing counting (in 2s and 3s for older children) whilst playing hide and seek. Whereby they are learning maths,

and communication whilst getting fresh air, exercise and connection to nature.

When we remember that everything and everybody is important and has a special place we are stronger. If somebody or something is left out, and is all alone it makes all of us less safe and happy. Be conscious to find ways that children with special needs will be fully included.

Reflection questions:

- *Can we integrate different aspects of learning into one activity?*
- *It is important to include everybody, consider questions such as "What are the vegetarian options?" "Will our Muslim friends be able to participate equally?"*
- *How can you involve the children in making everybody feel safe, important and included?*

9. Use small and slow solutions

- ***"How can we slow down and really enjoy this?"***
- ***"How can we break this into smaller steps?"***

The saying "More haste, less speed" tells us that if we hurry, we can end up taking much more time because something is often forgotten or overlooked at the beginning, or something drops or is broken.

'Small changes can have a big effect'. Small manageable steps can be more effective and sustainable than dramatic ones. For example, when teaching children to light a fire we start with fire safety rules (no fire), then later invite children to make a very small fire (with a sparker and a little cotton wool), the next session a larger fire and once they demonstrate good fire safety skills they can start cooking on the fire, experimenting with different tinders and kindling etc. Similarly with tool use - start with using a potato peeler (for whittling) before introducing knives (once they demonstrate safe tool use).

Make sure that your session plan is moving forward one step at a time for where the children are at, without making too big a leap. Making small changes can help to keep everybody included and involved.

Reflection questions:

- *How can you plan activities which create opportunities to slow down and find solutions that require patience and time?*
- *Are you realistic about the time the activity needs? Have you allowed enough space for spontaneity and reflective time? Remember you do not need to fill every moment.*
- *Is the session plan appropriate for their age, developmental stage, background knowledge, culture, and experience?*
- *Is there enough feedback during the session to inform the educator whether the group can carry on, and go for the next step?*

10. Use and value diversity

- ***"How many different types of plants, animals, seeds, (etc) can we spot here?"***

- ***"Why is it useful for there to be lots of different types of plants/animals/people/interests/habits/etc?"***
- ***"How can different things work together to make the whole more than the sum of it's parts?"***

The more different things in your place or system, the healthier everything will be.
Think about ways to help children to realise what things have in common, as well appreciating individual differences - for example we all need to eat, but some of us like tomatoes whilst others don't. Encourage accepting attitudes, and understanding that just because a thing/habit/person/etc. is different, this doesn't mean that they are better or worse. Everything can contribute in its own way. For example, plants that some gardeners consider to be "weeds" can contribute important nutrients and improve soil for the other plants, such as dandelions which are supply nutrients and break up compacted soil with their long roots.

A system is more robust when diversity is encouraged and that includes people too! All sorts of plants, animals, bacteria, fungi and people are needed for a healthy system.

Reflection questions:
- *Can children with different abilities have ways to contribute and will everyone be valued?*
- *Are there ways to notice and appreciate diversity of people and nature?*
- *Can you plan ways to include lots of different types of people (e.g. older people), plants, teaching styles, activity types (playful, reflective, sitting, moving)?*

11. Use edges and value the marginal

- ***"Where do you see edges? What is happening there?"***
- ***"How do we notice whether anybody is feeling left out and what can we do to make them feel happy and valued?"***
- ***"Are there any people we aren't including?***

Sometimes the most interesting things are happening where two different things meet - that meeting place is called an edge. New things and more varieties happen in those edges. For example, the most diverse places in nature are in the edges between different habitats, such as an estuary (where salt water, fresh water, air, soil, and sand all meet). They are diverse because they will meet all the needs of a species which requires only one of these habitats, as well as the species which require more than one (e.g. a bird which needs a tree to nest, fresh water to drink, seas to fish, and air to fly).

There is also an edge in learning - the edge between the known and the unknown, the edge between different abilities. Difference in abilities or understanding between children can be utilised effectively by encouraging peer mentoring - so that children that need more time are not left behind or marginalised by faster peers. This encourages many important pro-social cooperative skills in children that have advanced more quickly in a particular activity or area.

The playground at a school is an interesting edge between the classroom (strict indoor rules) and the forest (wildness!). In the UK and other places, a teacher can take a whole class into the playground without requiring more staff, permissions etc. Therefore, creating diverse spaces and

gardens for outdoor learning on school grounds, is an accessible solution which allows children to experience child-led, practical learning, outdoors, every day.

In the 'margins of society', there are many children who have a different experience at home, school or elsewhere. For example children who: are home-educated, are living only with their father, have lost a parent, are refugees, speak a different language at home, are experience homelessness etc. It's important to value these minority experiences and to be sensitive to avoiding stereotypical assumptions.

Reflection questions:

- *What edges can be explored or discovered?*
- *Can nature be found in the town/city/school/home?*
- *Is it possible to include awareness of people who live on the edges of society or who are minorities?*
- *In a garden, can children reach everywhere without stepping off the path?*
- *What meeting places can be created for ideas that would otherwise not be valued or heard?*

12. Creatively use and respond to change

- ***"When new things come up, how we can adapt?"***
- ***"How can we be flexible when people have different opinions, desires, feelings and needs?"***

Modelling reacting well to things that arise in the moment is very helpful for children to learn from for example, if it rains when the forecast was dry (play in the puddles and make dams), if an animal appears (take the time to appreciate that gift from nature) or if a child wants to do something that wasn't scheduled (can you integrate that idea instead of following your own plan?).

Reflection questions:

- *Are there ways to integrate things which come up in the moment, to use, respond and appreciate a yield from them?*
- *Think about how to react when unexpected things come up. Is it possible to go with the flow?*
- *Is it possible to support children to be flexible in ways of meeting their needs?*

Mollison's Attitudinal Principles

These principles were taken from "Permaculture: A designer's manual" by Bill Mollison (2009) who was one of the co-founders of permaculture. These are the attitudes that underlie and define the permaculture approach to design, and thus are important to keep in mind when designing sessions.

1. The problem is the solution (everything works both ways)

- ***"How can we can turn this problem upside down?"***

Not all problems are disasters. For example, if there seem to be too many slugs in a garden, then

you could get ducks as they will eat them happily. Involving children in working out solutions encourages a positive 'can do' attitude, empowering them to take action to find solutions to problems in their life.
In consent decision-making, objections are seens as gifts because a 'reasoned paramount objection' can contain wisdom which may have otherwise been overlooked and caused problems later.

Often one can put together two problems to create one solution. For example there was a problem of people dumping rubbish (including roof tiles) in one location, and a problem of a mound of soil with stinging weeds in another, putting these together made a beautiful herb spiral!

Reflection questions:

- *How can you give children the opportunity to do creative problem solving, or look at a problem in a new way?*
- *Is it possible to turn something that originally seemed to be a problem into something great and useful?*
- *Are there ways to involve children in welcoming problems or difficulties?*

2. Minimum effort for maximum effect (make the least change for the maximum possible effect)

- ***"How can we let nature do the work here instead of us?"***
- ***"How can we do less and get more rewards?"***

Often we can think up big and complicated solutions, when something much simpler would actually suffice. The use of fossil fuels often makes things seem easier but burning these fuels is actually using huge quantities of energy. For example, "Do you really need to use a motorised vehicle to move children or equipment or can you just walk or cycle with it?" Or "Do you need a new multipurpose building, or will a tarpaulin and a spade (for toilets) be sufficient?". Or "Can you place things that need frequent care in a place that you pass every day anyway?"

Reflection questions:

- *Are there ways to use less energy to achieve the same effect?*
- *How can nature do the work instead of you or fossil fuels?*

3. The yield is theoretically unlimited (or "the yield is limited only by the imagination")

- ***"Let's imagine the many different things we can do with, or make out of this."***
- ***"Can you suggest a new use for this, that we hadn't thought of before?"***

In permaculture we think of yield as not just the physical weight of a product, but in terms of all the things that we can get out of it whether physical, educational or emotional etc. For example, some potential yields of sowing seeds with children include: learning about plant life-cycles, connecting to nature, practicing maths (addition, area), understanding weather patterns and their effects on plants, learning about the needs of plants (sun, water etc), joy, fun, laughter, team-working,

hand-eye coordination and fine motor skills development, literacy (following instructions, talking, reading or writing about the process), food (eventually), and compost (eventually). Thinking about all the potential yields can help you to appreciate what is happening more, and help you to plan harvesting more of these yields.

Reflection questions:
- *Is it possible to achieve more yields from this same activity (with minimal tweaks)?*
- *Are there ways to include the children in thinking about new ways of using resources?*

4. Work with nature (rather than against her)

- ***"How can we can cooperate with nature?"***
- ***"What's your own nature? (What do you like …?) How can we work with that and still be meeting everyone's needs?"***

If you don't work with nature, you will always be battling, better to work out what nature would do and then allow that. Water flows downhill (so catch the rainwater higher than the garden), soil needs to be covered (with crops or mulch or nature will cover the soil in new plants), water-loving plants grow in wet places (so plant wet-loving plants in wet places rather than drain the wet place to make space for dry-loving plants).

Each child is unique and individual with different needs, likes and dislikes, skills and abilities, can you consider them in your session, so you can work with them? For example, if a child needs to move they will be disruptive sitting down, so can you give them a task which involves movement, working with the nature of the child.

Reflection questions:
- *Is it possible to work with the nature of the child?*
- *Are there ways to support children to work with the nature of their friends?*
- *Are there ways to support children to work with the nature and properties of the site/species/tool which they are interacting with?*

5. Everything gardens (or has an effect on its environment)

When people garden they are changing their environment to get particular results. This principle refers to the way that everything is constantly influencing its environment (sometimes with an aim for particular results). For example, stones change their environment by absorbing the sun and radiating it back out later in the evening/night, by casting shadow on one side, and providing a habitat for minibeasts. If a child finds a worm, take a close look at it together, ask "How does it change its environment? (worms turn leaves into plant food).

Children are constantly affecting their environment, can children and educators work together to make sure that their influence is positive? For example, if children build a dam across a stream, what will be the consequences in the next heavy rain? Should the dam be left or dismantled? (Often it is good to slow streams in heavy rain, but sometimes the dam could divert the stream into an inappropriate place, like someone's house).

Reflection questions:

- *How can contributions from the children be included, as they also garden (and educate)?*
- *How can nature educate the children? Is it possible to make use of what appears spontaneously in nature?*