

Science in Cycles

'All taking requires giving back'

Project Report

The purpose of this report

The premise for this report is to give an outline of the Science in Cycles project, with particular emphasis on how the Real World Learning model was used as a basis for planning, delivering and evaluating a six month outdoor learning programme.

Project Overview

Science in Cycles was an exciting and leading edge project that offered an opportunity to bring science learning into the open air through outdoor learning sessions in a woodland setting. The planning and delivery of the six day-long sessions was designed specifically to support positive thinking and action for sustainability.

This project involved collaboration on a local, national and international scale through Dyfi Outdoor Learning Wales (OLW - www.outdoorlearningwales.org) partners led by Coetiroedd Dyfi Woodlands (CDW - www.dyfiwoodlands.org.uk) working together in the planning and delivery supported by the Field Studies Council (FSC - www.field-studies-council.org) in its role as the lead partner in the Real World Learning Network (RWL - www.rwlnetwork.org), a European network project.

This collaboration allowed the first full programme trial of the RWL Hand Model for delivering quality first-hand learning experiences in natural settings focused on developing positive action for sustainability through outdoor science.

The project used the key science concept of cycles to explore the interconnections between the learners, the natural world, the non-natural world, their communities and the global society - all core to developing the systemic thinking, intrinsic values and green competences that underpin sustainability.

The programme was run with the 'Outside Education' group, a well-established group of home educators from across Gwynedd, Powys and Ceredigion in Mid and North Wales. Each session was differentiated for three groups each facilitated by an outdoor learning practitioner. These groups fell nominally into Foundation Phase/Key Stage 1 (1-6 years), Key Stage 2 (7-11 years) and Key Stage 3 (12-14 years).

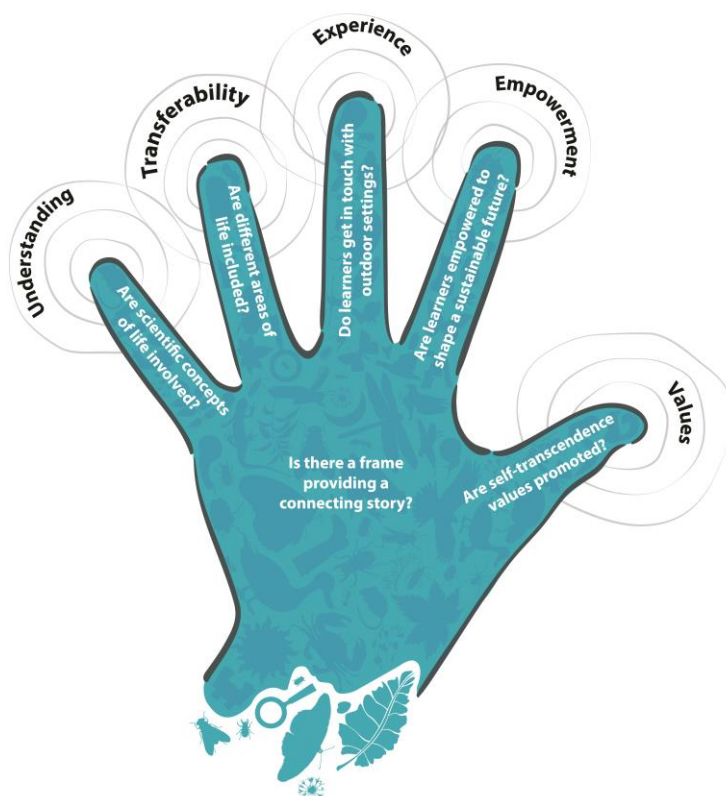
Each of the sessions concentrated on one of the following five themes: water, rocks, nutrients, seasons, life and interconnection. Through these themes, and the activities designed to explore them, the sessions aimed to bring forward and embody the six elements of the RWL model.



The project basis

The RWL model offered the structure and theoretical support for developing, delivering and evaluating the programme. The six key areas of learning outlined as questions in the model were explored in different ways throughout the whole process. These were:

- **Values:** Promoting and strengthening self-transcendence values; those values that lead to sustainable thinking and behaviour.
- **Understanding:** The development of a holistic understanding of basic scientific concepts that underpin all life on the planet, in this case with a strong focus on cycles.
- **Transferability:** Ensuring the delivery is relevant to different fields of learning, and thus linking the learning to the learners themselves, the natural and non-natural world, the learners' communities and global society.
- **Experience:** Ensure the learning experience connects the learners with the outdoor setting using a wide variety of outdoor teaching and learning approaches.
- **Empowerment:** Offering learners the chance to experience learning in a self-directed way, working collaboratively with their peers and envisioning a positive future in which they play an active part.
- **Frames:** Giving a narrative or deeper underpinning meaning to the whole learning experience, providing a way of thinking about the world that promotes sustainable ways of being.



The facilitators

Over the course of the six one day per month sessions five main facilitators worked together through the planning, delivery and evaluation, with an additional six volunteers supporting the delivery. One facilitator remained with the KS3 group throughout, while the other four interchanged between the KS1 and KS2 groups across the sessions. Four of the main facilitators came into the project with a wealth of outdoor learning facilitation between them, including Forest School, formal school based learning, adult education, community based learning, fieldwork, and Forest School Camps. The fifth facilitator came with less formal experience, being one of the home educating parents and a Forest School Level 1 helper. There was also significant input during the planning stage, and to some extent delivery and evaluation, by one of the oldest members of the KS3 group. This offered a highly valuable dimension to the whole process.

The learner group

The Outside Education group is a mixed age and gender group, ranging from 1 – 15 years old, and includes the hands-on involvement of many of the parents during the sessions. This group of home educators and their children have been working together on a fortnightly basis for over 8 years, with a number of Forest School projects taking place within that time. Through these projects and other one-off sessions the facilitators of the Science in Cycles project had all previously worked with the group in the outdoors.

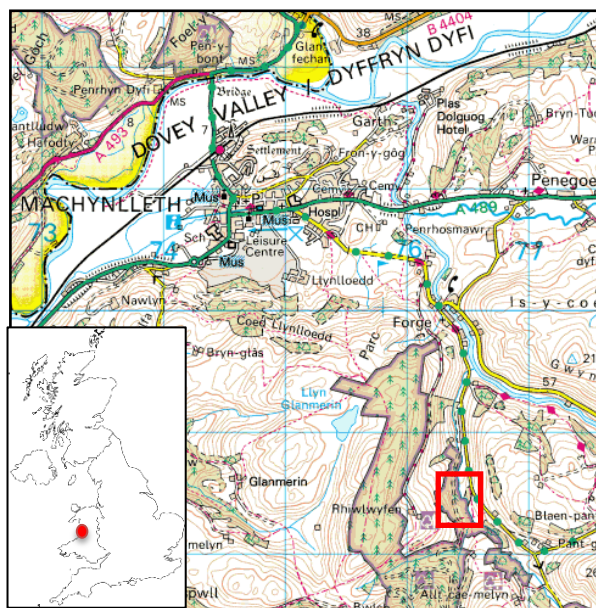
The project location

The outdoor learning sessions all took place within the Natural Resources Wales pubic woodland called Ty Gwyn, situated near the village of Forge 2 miles out of the Mid Wales town of Machynlleth. This woodland has been an established Forest School site for over 10 years, and has been used by the Outside Education group for a number of their previous projects. The majority of the learners were therefore very familiar with the setting, having been visiting it regularly for much of their lives.

The site has a mixture of woodland types and ages, including regeneration woodland, mature coniferous plantation, deciduous plantation, coppice and some ancient standards. The relief slopes steeply down to a stream in the valley floor, with a small flat area alongside the stream.

There is a promontory above the stream on which a 'Forest Home' has been established with log circle, fire pit, sink area, woodshed, compost toilet and facility to rig up tarpaulin shelters for bad weather. The site is accessed via a forestry track that runs along the top of the Forest School site, adjacent to which is a 'meeting area' with log circle and space for introductory activities.

All areas of the site were utilised for the Science in Cycles sessions, including the stream and adjoining areas of the larger woodland along the access track.



Using the Real World Learning Model

The remainder of this report will focus on the use of the Real World Learning model by the facilitators in their planning, delivery and evaluation of the sessions and the project as a whole. This was the first full project in the UK to trail using this model as the basis for an outdoor learning programme, and as such will offer feedback on how the model was used, its usefulness and recommendations for future users.

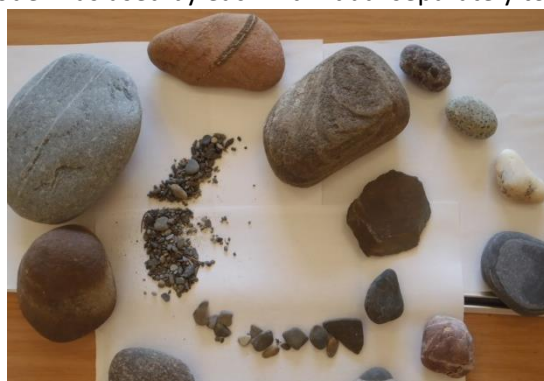
The Planning Process

The project commenced in May 2014, not long after the model had been developed by the Real World Learning partners. As such there was little guidance available to the Science in Cycles facilitators. One of the lead facilitators, who had involvement in RWL through the FSC, gave an overview to the other facilitators and gave them some of the background texts behind the elements of the model. There was a short amount of time for discussion, and a small amount of email communications over interpreting and understanding the model.

Recommendation: Factor in a carefully led day exploring the model as a group of teachers/facilitators – developing a shared understanding, and allowing space for discussion prior to programme development.

Each session was planned in a very open and discursive way. The model was used by each individual separately to help generate thinking about the upcoming session. Through this open process it was quickly found that this particular group of facilitators were most comfortable entering the model via the **understanding** element, focussing their thinking on the cycle chosen for each session respectively. From this point ideas for activities or focal areas within each of the broad cycles were shared via email in the lead up to a face to face planning meeting.

Recommendation: Explore different ways of planning using the model, allowing space for creative and lateral thinking and process. Explore the comfort areas of the different facilitators involved, finding out which elements of the model they feel most comfortable with. Use this as an initial way in before then exploring how the other elements sit alongside and find resonance.



Using natural materials and forms to inspire creative thinking during a planning meeting.

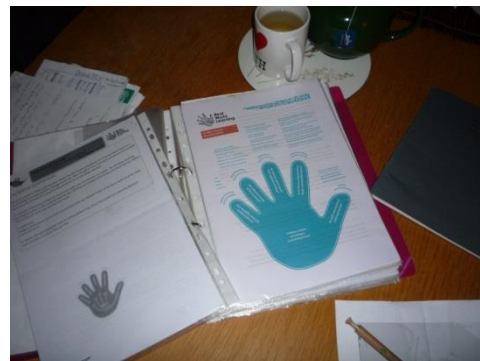
All six sessions used the **frame** 'All taking requires giving back' which had been agreed at a project planning meeting between the facilitators. This was one of the example frames developed with the RWL model, and chosen as it brought through the bigger thinking around the concept of cycles and the strong values of responsibility and sharing. This frame was used as a clear guide by the facilitators to channel their thinking during the planning process.



Using hedgerow fruit to embody the frame during 'Raising curiosity'.

Recommendation: Collectively discuss and agree frames that are to be used in any programme, agreeing their suitability and collectively exploring how you want them to guide the planning, delivery, learning and reflection. Agree that all involved are comfortable with the wording and direction of the thinking involved.

The planning meetings took place roughly half way between each session - allowing space for reflection, consolidation, thinking and development time. This proved a very fruitful way of working as it offered the space to fully reflect upon the process between each session, both looking back and forward. At each planning meeting the three lead facilitators for the forthcoming session would share their thoughts, and then bring these together aligning them as a coherent differentiated plan for the three age groups (see Session Plans - Appendix A-F). Throughout each planning meeting a large copy of the RWL hand model would be in the centre of the table for reference and discussion. The facilitators used this as a tool to check-in with and modify their plans in relation to the different elements of the model, in the process developing their shared thinking around the model and its application. **Recommendation:** When first using the model allow plenty of time for planning and discussion. Having the model in a visible place to stimulate and guide discussion and planning is very helpful.



Keeping the model visible as a central focus for discussion and thinking

During these meetings the three age group plans were drafted through group discussion, then finalised afterwards by the respective leaders and collated via email in the week leading up to the session. At the meeting the element of the session that was finalised was the opening activities, this was where all learners and parents came together as they arrived taking part in a medley of activities that became known as 'Raising curiosity'. This part of the session had a focus around the **experience** and **transferability** elements of the RWL model, and was explicitly discussed as such checking in with the ripples on the model for guidance during the planning.

Recommendation: Use the ripples on the model for inspiration and to help guide the planning process.

Throughout the planning process it was found that the values and empowerment elements of the model were the most challenging areas to explicitly build into the session structure. The **values** outlined in the ripples of the model, and also those explored in the background research summary Common Cause, were used as a lens for all elements of the planning. This brought forward the strong realisation among the facilitators that values will inevitably come through in everything we do in the session, especially how we model them as facilitators, and how the session is set up, resourced and delivered. This helped the thinking greatly and particularly informed how the sessions were resourced. The frame was also seen as key to bringing through the values, if used explicitly and appropriately. **Recommendation:** Use the values as a lens for everything you do in your education work. During the planning allow them to inform how you resource, structure and communicate before during and after the session.

In order to ensure that the sessions offered a strong element of **empowerment**, as well as carefully considering how the main activities were structured, the afternoon activities were focused around self-directed further exploration of the cycle being explored in the morning activity. During the planning this created a lot of discussion around how to differentiate and scaffold this session to allow learners to get the most from it while still having enough structure to keep them focused. This will be discussed further in the delivery section of this report.

Recommendation: Build-in time within the session/programme for some truly self-directed element of the learning using the frame or a hook from previous learning as a guide for the learners.



Plan Structure

In order to help develop a programme that embodied the RWL model's thinking the sessions were planned with a structure that embodied certain elements of the model more strongly during different parts of the session. This was not to treat the model as a tick list, rather to offer structure for thinking and delivery of a holistic learning experience. This looked as follows:

Session Structure	Outline	Focal elements of the model
Opening activity - <i>Raising Curiosity</i>	This part of the session involved a range of activities for all ages to stimulate curiosity. It aimed to provide a hook for all learners to take into the main activity, while also connecting the learning to their lives. This included finding and piecing together large jigsaws created by a local artist visually depicting the cycle and its interconnections.	Experience, transfer.
Main activity - <i>Us, the woodland and the planet</i>	This element developed the thinking around the cycles concept, taking the learners on a journey that connected their lives with that of the woodland and the planet.	Frame, understanding, experience, empowerment, values.
Lunch	Lunch times offered a chance for free play as well as the occasional thought stimulator related to the cycle for that session (e.g. Where are your nutrients from in the world?).	Transfer
Self-direction - <i>Exploring self-direction</i>	This session offered the chance for the learners to further explore their learning from the morning in a self-directed way. The level of guidance varied from week to week and group to group.	Empowerment
Closing activity - <i>A sharing community</i>	The last part of the session brought everybody back together to share what they had explored that day. This allowed an open sharing process between all ages, a very values rich activity, and the chance to consolidate the learning experiences from the day and the connections with other areas of life and sessions.	Empowerment, values, frame.



Session Delivery

The session delivery took place within the woodland, utilising different areas for different purposes, allowing the three age groups to have their own space while still sharing a common learning experience. The delivery was designed to stand apart in structure from the familiar Forest School rhythm the learners had experienced previously in the woodland, while still retaining some familiar elements. All age groups started and finished the session together, with differentiated sessions in between. Lunch was shared around the familiar Forest Home fire circle, with free play taking place in nearby areas.

Recommendation: Ensure the delivery and structure of the learning experience offers sharing opportunities, particularly if working across age groups.

Detailed session plans for all six sessions are available in Appendix A1-A6.

The facilitators and volunteers met before the session to set up the site and to talk through the plan. This included a time to have any final discussions and voice questions about any elements of the RWL model in the session. This proved a useful process to have the model centrally in mind going into the session. **Recommendation:** Build in time before a session to have final discussions around the model if working collaboratively.



Learners of all ages come together to share their experiences at the end of a day-long session.

Evaluation

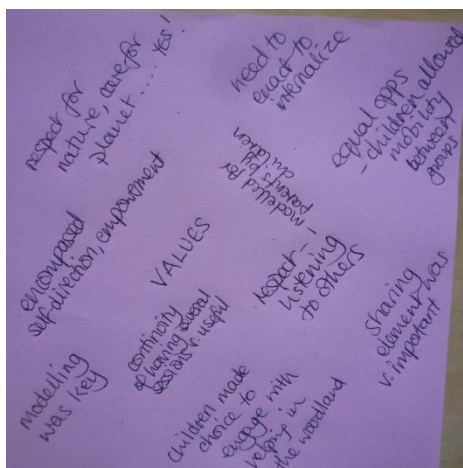
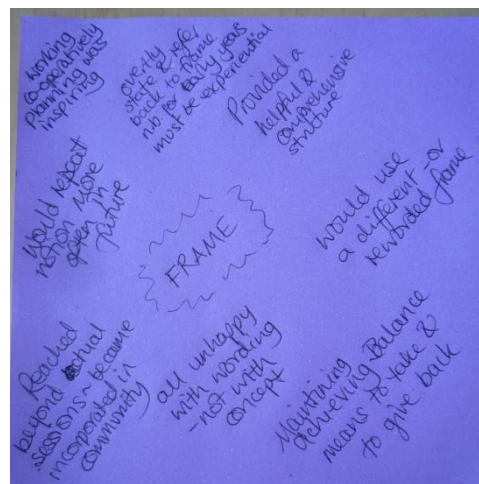
A range of evaluative techniques were employed and trialled as part of this project. The main form of evaluation with relation to the RWL model took place as a structured discussion between facilitators directly after each session, in the form of a feedback questionnaire at the half way point of the project and a project evaluation diner at the end of the project. In addition to these methods feedback was sought from the home educating parents and a Volunteer Employed Photography evaluation was trialled with members of the KS3 group.

Session Evaluation

The session evaluations focused on both the logistical, educational and theory based elements of the session. This was done through an hour long discussion at the end of each session which was recorded and then summarised. Here the relevant elements useful for the evaluation of the RWL model will be brought forward, with more detailed evaluation available in Appendix B.

- Bringing the elements of the RWL Hand Model to life

Frame – The frame ‘All taking requires giving back’ provided the strong narrative to the whole project. This not only informed the learning process in relation to the understanding of cycles, it went much deeper into the way the project was run, both during and outside the sessions. This way of thinking about the world provided opportunities for a lot of reciprocation. Reciprocation between all participants and the woodland, reciprocal support between facilitators throughout the project process, and reciprocation at an organisational level in terms of the project’s purpose as a trial on a local, national and international level. Throughout the delivery applying the frame explicitly was often found challenging, this was in part related to the wording. It was agreed at the end of the project that reviewing the frame would have been a useful process – *Maintaining balance means to take and to give back.*

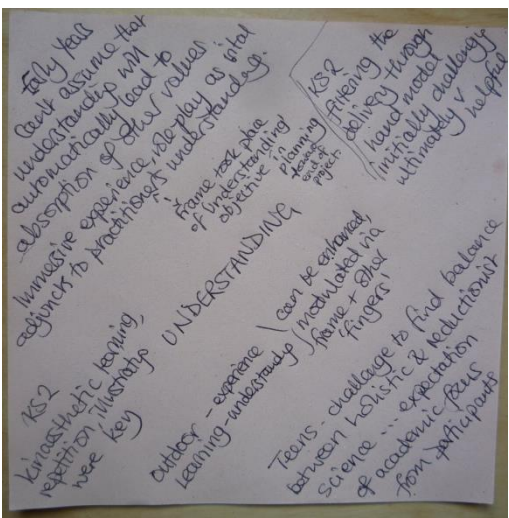


Values – It was found that modelling integral values that embody sustainability throughout all aspects of the project was key to bringing them through into the learning itself. The importance of this ‘authentic’ approach was powerfully evident for the facilitators through the evolution of a highly communal planning process, the careful choice of materials sourcing for the sessions, and communication with parents, the learners and each other. The structure of the sessions came out of this approach, and guided by the strong frame brought through values around respect and care for each other and the world around us. It was agreed that values

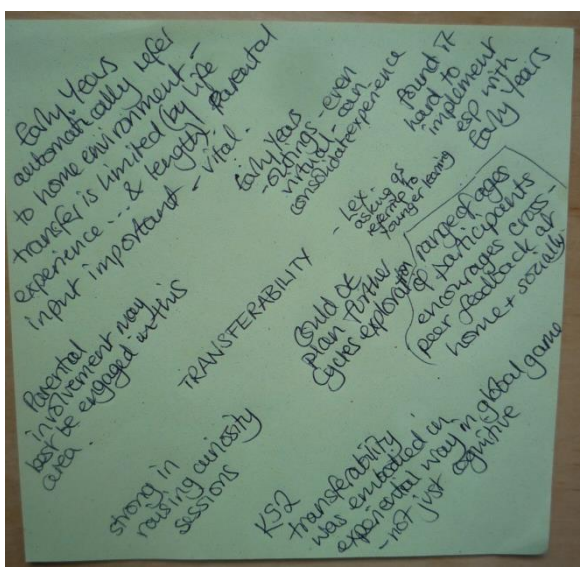


would not be explicitly explored as part of the learning, but rather provide a lens through which to view all aspects of the project. Discussions of ethics of handling organisms, altering habitats through our actions and ways if minimising our disruption of natural balance were regular parts of the sessions, lying very close to the values. Being mindful of values as facilitators throughout the process offered huge benefits on both a personal and professional level, setting the tone for the way the project ran.

Understanding – This was felt to be one of the stronger and more comfortable areas of the model for most of the facilitators coming into the project, and was therefore used as the entry point to planning the sessions using the Hand Model. However it also provided plenty of stretch in terms of knowledge of the scientific principles around cycles, and also realigning thinking toward a systems approach. Discussion and sharing of expertise was vital to the process of preparation for the sessions. The different age groups offered their own challenges with regards to this element of the model. The older group had stronger expectations on detailed more reductionist science learning, which took a mind shift to explore science more holistically. It was very helpful to explicitly explore the idea of a spectrum between reductionist and holistic science later in the programme with these participants. The youngest learners posed the challenge of how to explore conceptual big-picture thinking, the experiential learning and transfer aspects played a large part in supporting this.



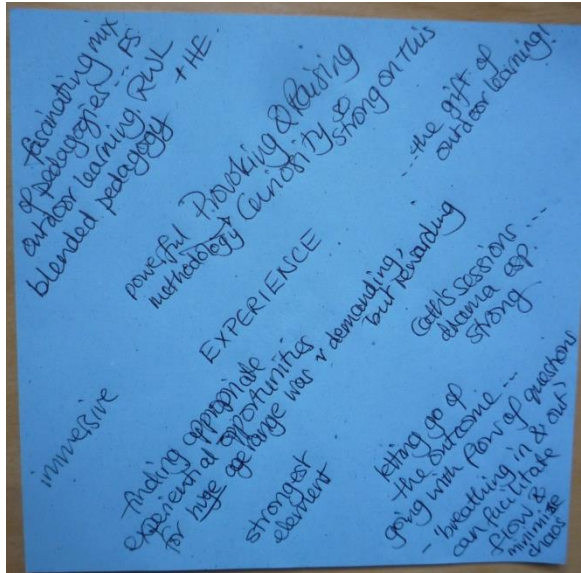
Transferability – It was important to carefully plan this element of the model into the delivery, and often proved challenging. Through facilitator discussion it was agreed that this element was one of the most important with respects to learning for sustainability, and therefore had to be built in as an



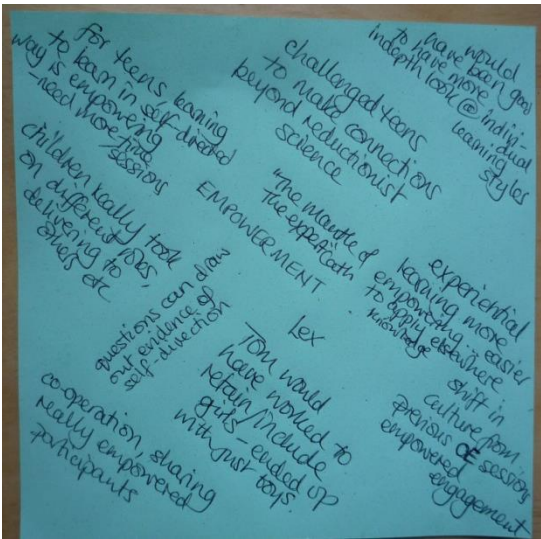
integral part of the session. Asking participants to bring related items from home as a hook for learning in the session proved an excellent tool to help facilitate transfer; this was true for all ages. The scale to which transfer was possible was age dependent. For the younger learners transfer was mostly limited to themselves, their communities and the natural world, while for the older learners it was possible to extend the transfer to all levels. Transfer worked effectively through both experiential active learning as well as the more cognitive learning. Starting each session with 'raising curiosity' activities that were designed to link the learning with the learners' life proved highly successful.



Experience – The project brought forward an exciting blend of pedagogies - each facilitator bringing their own expertise and background in formal and informal learning to the mix; theatre with science, Forest School with fieldwork, sustainability education with arts. These ‘blended pedagogies’ gave a colourful and exciting edge to the project, bringing forward a wealth of experience for the learners. The collaborative planning process bred a creative atmosphere in which to explore different ways to bring the learning to life. The Hand Model acted as the catalyst and guiding light for this creativity, focusing thinking through the ripples – provoking and raising curiosity, involving learners with the heart, hand and head, relating to the site and providing opportunities for action and enjoyment were all core to the project. Through offering new outdoor learning experiences it was possible to reveal something new about the learners’ familiar surroundings, and thus deepening their connection to the site. Remaining open to the outcome was a hugely challenging and rewarding element that applied across the learning, especially within the explorations of self-directed learning.



Empowerment – The empowerment in the learning came through in the way the sessions were conducted. Through working together, through collaboration and respecting everyone’s input, and through allowing the learners to take ownership of their learning. By shifting the experience of the group in their familiar woodland setting from a Forest School experience to a strong outdoor learning for sustainability experience brought with it a new responsibility for the learners, a responsibility to engage for the duration as part of a group and bring something valuable to their peers learning experience. Explicitly building-in a self-directed learning element to each session (covered in more detail below) ensured that empowerment, and therefore the learners’ themselves, was brought to the centre of the learning experience. The enthusiasm, energy and different ways with which everyone involved collectively gave back to the woodland during the final session truly brought to light how empowering the experience had been for all.



- Using the Hand Model with different age groups

As this project worked with three age groups simultaneously engaging with differentiated sessions around the same frame and content it gives a useful opportunity to comment on the use of the model in this respect.

It was generally found that the model was easier to pick up and apply with the older age groups due to the learners' ability to engage with more conceptual thinking and discussion. While all the age groups were engaged very experientially in the learning process this proved particularly important for the youngest learners. Applying the learning to their experience of the world, in their own bodies and within their families and homes, proved key to opening up learning about the natural world and their connections to it.

- Self-directed learning

This element of the model, which sits deeply within empowerment and being open to outcomes in terms of experience, can be a challenging thing for educators to approach. For this reason it was given explicit prominence in this project to allow the facilitators to explore ways of allowing this type of learning to occur effectively. Different approaches were taken with the different age groups.



Peer learning taking place during the self-directed element of the session, a valuable aspect of mixed ages working together.

KS3 – What worked?

- Using the frame as a guiding narrative.
- Giving thinking time, starting their thought process over lunch.
- Having a range of equipment for them to choose from.
- Using scaffold questions if support was needed (e.g. What are you interested in exploring further? What information will you need to collect? What will you need to do this? How will you do it? What will you have at the end to share with the whole group?)
- Allowing them to self-select groups/work alone.
- Giving the option of approach e.g. scientific, photographic, literature, arts or any other methods to carry out their explorations.
- Providing the opportunity for them to act as mentors for younger members of the group.
- As a facilitator remaining open to the outcome at all times.

KS2 – What worked?

- Setting up active and empowering activities that entailed choices based on the earlier learning.
- Giving initial direction to these activities then stepping back and becoming a participant, only facilitating when needed.
- Providing a range of suitable materials and equipment.
- Injecting a lot of personal enthusiasm and energy into the process.

KS1 – What worked?

- Using stories as a connector between the morning learning session and self-directed play.
- Bringing the learning back to the learner's life through the story, then allowing them to explore the connections to the outdoor setting through free play.
- Having suitable equipment to stimulate play opportunities.
- Have suitable clothing to allow for hands-on exploration of the natural world.

Parent Engagement and post-session feedback

Due to the unique nature of the parents all being educators of their own children, and in some cases the sharing of educational responsibility with other families, it was felt an important opportunity to engage the parents with the RWL model as a learning process. To do this a handout was created for each session, outlining a different area of the model for the parents, sharing ideas for taking the learning further between sessions and requesting feedback on the whole process (see Appendix C1-C6). While parents were very keen to receive this information, unfortunately their overall response rate was very poor. Feedback was sought on all levels of the learning experience, encompassing all areas of the RWL model. It is very difficult to draw out any solid conclusions from the feedback that was received as to the effectiveness of the RWL approach, especially considering the inability to put any controls in place. Learner focus groups would be recommended in future to gather more feedback.

The feedback was generally focused on the understanding element of the learning, such as:

We read your sheet on the chemistry of water. Following this we had to look at what hydrogen bonds and covalent bonds were. We read about Hydrogen and Oxygen in Theodore Gray's book "The Elements". I now know that Hydrogen is the most abundant element in the universe and is the source of all living things.

I am looking forward to the session on rocks and minerals and finding out more about the water cycle.



Photographic feedback from one of the KS3 learners regarding further exploration of water.

However there was also some evidence that the RWL approach has also been taken forward in certain ways by parents, though difficult to discern what influence the project had in this process:

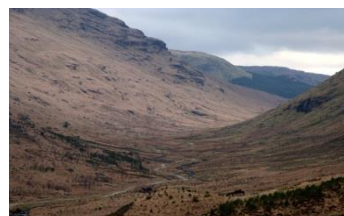
As I am reading 'The Sacred Balance' I decided to read the water chapter with J. It is a nice book to read together, as there are so many stories and examples and it connects the science with our daily lives. The Canadian connection is nice, too, as that is where P and I [former participants] are now, and J speaks to P quite regularly. Starting to explore the elements in this way, via water, air etc. leads to so many other discussions and discoveries.

The sessions have also promoted some very reflective and humorous explorations to develop the learning from the session showing high levels of transferability and interconnection, however again it would be a giant leap to attribute this solely to the use of the RWL approach. An extract from one KS3 participant's reflection on the rock cycle's role in their country of birth's history exemplifies this:



You take the high road

This year we will see the Scottish people vote on whether or not they wish to remain a part of the UK. No matter what their eventual decision, Scotland will never feel like the same country to me. As soon as I cross the border I feel as if I have set foot upon another land: the earth just feels different. Well, that's because it is. I discovered that for millions and millions of years Scotland was an entirely different continent, half the world away from England and Wales. I decided to track Scotland and its history as far as I could, so I begin with.....



[detailed research on the geological past of the British Isles]

The Holocene epoch in which we currently live stretches over the last 12,000 years. During that time, new geological features include the development of coastal alluvium and deposits of peat. The relative sea level in most areas has fallen due to a combination of isostatic land rises and glacial melting. Scotland still moves northwards, dragging England like a dead weight behind it!

Feedback was also received through informal conversations with participants, asking them to reflect on how the learning in the sessions has been different from other learning experiences.



"I've recognized that this way of learning has helped me think much more outwardly. I don't think the actual revelation moments have tended to be at the sessions, it's been while I've been outside and something that had connected in the session would then connect with something that happened in my life."

Volunteer Employed Photography

This technique involved handing over cameras to participants both before and after the project, asking them to take photographs in response to certain questions. By doing so the control of the study is handed to the participants. In previous research use this technique has been shown to be good at eliciting in-depth perception of the participants lived experience in the context in which they are being asked to take photographs.

This methodology was employed in the hope that any change in perception, values and understanding might be deduced from the responses. However, the data that returned proved too limited for any significant conclusions to be drawn. Due to change in learners attending between the start and end of the project only two full responses were returned. Some evidence for a broadening of understanding can be suggested from these; however this data has not been taken any further.

Volunteer 2

Photo task	Pre-project responses	Post-project responses
1. Take a photo that for you represents nature.	 I found this most difficult and decided to take a detailed/close-up image showing life, death, animal, plant, mineral...	 All the interconnecting cycles.

An example response from the VEP showing some extension of thinking to more holistic science understanding.

The background to this methodology and the limited data received is included in Appendix D1.

Looking forward

This project has brought a new way of thinking about, approaching and delivering outdoor learning for the facilitators involved. The RWL Hand Model has played a central part in this process, bringing a huge range of benefits not only to the learning process itself but also to the work and lives of those involved.

– reflections of the facilitators on using the Real World Learning hand model



'It has been great having the model as a way of thinking about our education work, a frame. I'd love to do more with it, it's so positive – leaving a positive hand print instead of a negative footprint.'

'It has meant that we have all learnt new things through exploring it together in such an open way.'

'The Hand Model has a lot of integrity, both structurally and ethically. I like it because it is a whole, because of its integrity, I feel very safe using it.'

"Try to see the model as a holistic approach that will enrich lessons rather than a target list where every aim is to be achieved in every activity – I still struggle with this. Over a day/a few sessions, the criteria will balance out, and with careful review, gaps can be addressed."

"The frame is the bit I like best about using this model – being aware of frames - recognising how we do have frames in our lives – realising that education influences people's frames -thinking slightly strategically about what we want that influence to be. I think it's very subtle and powerful and that every little part of a programme could be contributing to a how a child frames their life.."

"Through using the model I was more consciously holistic in approach to session planning and (tried to be in) delivery. On a personal level, I became more conscious of how/where to source materials for activities as modelling sustainability felt important."

"Using the model has got me thinking a lot about how much we might affect change in a world in which it can often feel somewhat hopeless, this gives me hope...a structure to take my work forward."

"What might at first appear to be a set of criteria you are trying to follow, actually inspires great creativity because it makes you look at ways to incorporate it, embody it, rather than just tick boxes."

"Using the model has steered my thinking to a place from which it will never go back, this has driven a step-change in the way I will approach and think about outdoor learning."

