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Early Science Education. Discovering and understanding the wonders of Nature.

The progression of children in learning about 'nature', our living world.

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Abstract

Play in the earliest years is studied in teacher training for practitioners particularly who seek to work with this age of children, birth to formal school. However, such studies tend to focus on development of literacy and numeracy and socialisation. science is not a particular focus other than when it appears in play, such as water play, painting, mud kitchens. (Moyles, J. 1989).
Numeracy is featured, but not particularly in relation to play. Yet through play the emergent learner acquires both knowledge and skills that form a basis for later development into formal STEM Whilst different genre of play has been recognised, for example Moyles (1989) or Tunnicliffe (2019) there is little written about the development of science from play, Although, as Tunnicliffe and Gkouskou (2019) showed, it is inherent in much of play in nursery and outside. However, play is to a case of one size fits all. Skills, competency and concepts development are progressive.

Introduction
Children begin learning biology through experiences from the moment of birth. The first animal about which they learn through observation and experience and provides them with a template with which they interpret other living things as they become aware of them of is themselves. Consequently, the needs, actions and feelings of other living organism are deduced it in an entirely anthropomorphic way. Whilst they learn something through play particularly in physical science (Tunnicliffe and Gkouskou, 2019, Lynneth Solis, Curtis, and Hayes-Messenger, 2017), much of their beginning biological literacy, like that of other sciences, is learnt through direct observation and personal experiences. However, learning biology has challenges. There are three interrelated dimensions: OBSERVATIONS identification of organisms, naming, personal names, everyday names and scientific perhaps, locations, criterial attributes; SYSTEMS interrelationships horizontally and vertically and there is the TIME dimension, evolution, life cycles, change in form and function. Which for the early years is a very difficult idea. Furthermore children become aware of the living world, where different things particularly animals and plants are found (Korfiatis and Tunnicliffe, 2012) .

Children begin life with biological needs which are met by usually the mother. Babies begin to recognise sensations of functions and experience their external body anatomy and its properties. They develop rapidly and acquire independent movement.
Children know things themselves and tell, by words, drawing, or miming, for example, other people, thus producing an expressed mental Model (Duit and Glynn, 1996), they produce more realistic drawings of both external and internal anatomy. Using drawings and subsequent interviews with the child and their drawing yields most information and the use of such data can show the development of that child's understanding. Such research has also

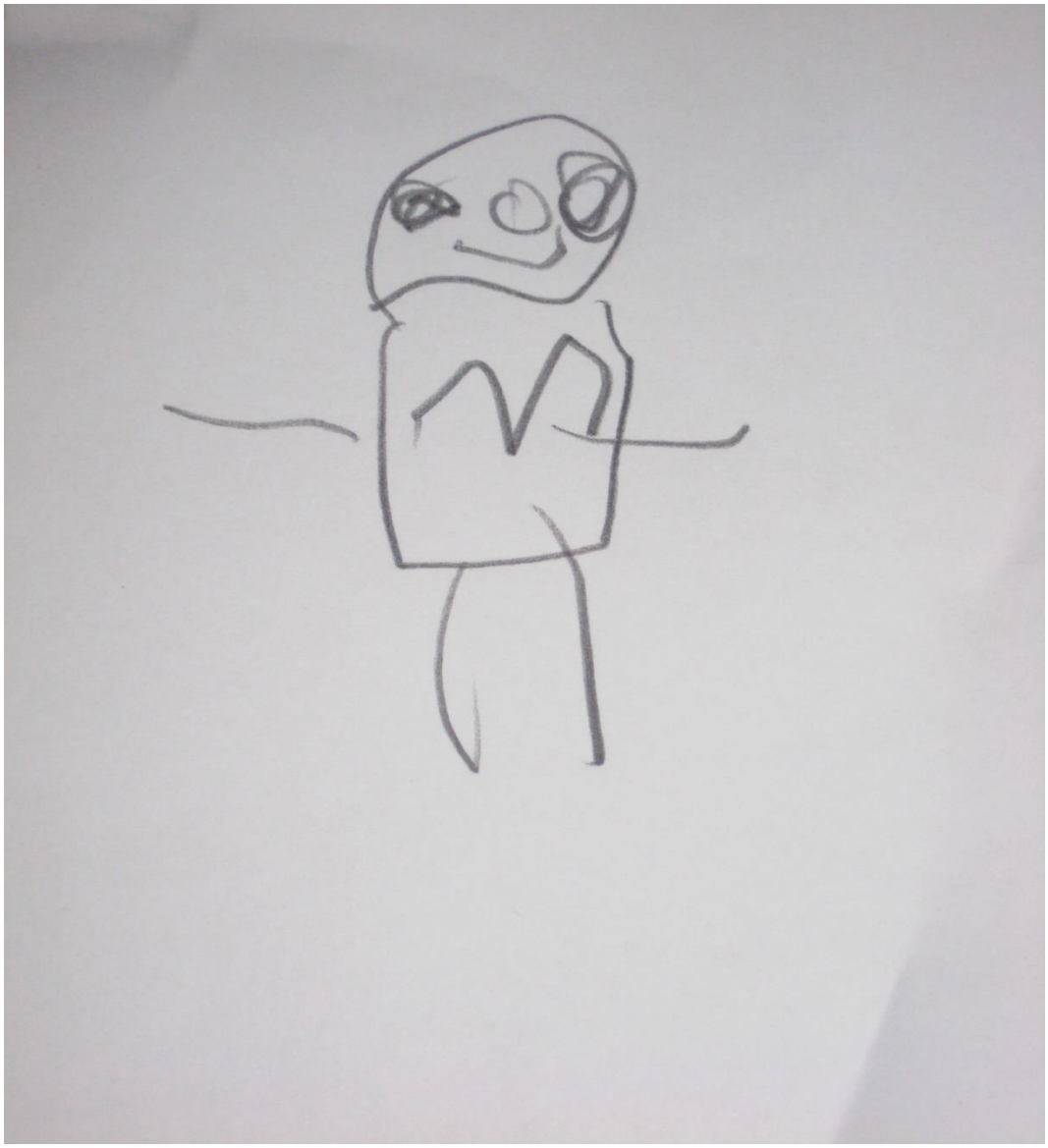
shown that despite what formal school curricula imply, with certain topics being taught at certain stages and stages, that is not how children actually learn (Tunnicliffe, 2018, 2020)

One of the earliest activities carers introduce to babies is the naming of external parts of their bodies. These activities are often associated with various rhymes, through which they also learn the rhythm of their first language. Babies learn as they encounter various external parts of their own bodies, and those of others, particularly their mother.

Children hear references to parts of the body, internal and external. For instance, people say 'stomach' or 'tummy', and rub over its internal location or touch the child's head and say 'use your brain'. They can point to an external part if asked, even before they can speak. We observed that when asked to put a small card featuring an external body part, for example, a nose, a foot, the head, an ear, on a cut-out of a child's shape, very young two-year-old children took great delight in placing the card on the actual named part of the body. Older children in this pre-school group placed the cards on the picture. After we noticed this progression, we made a sticky note with the name of the part written on it and gave it to a child when we had shown them the picture card. The sticky notes proved an interactive, fun and effective way of teaching early learners to recognise and name body parts. Young children took great delight in walking around as a 'sticky-note' person.

Children also hear references to some parts of the body through daily life instructions. They begin to associate requests such as 'please wash your hands' with that body part before they can speak. One of my grandsons, when he was 4 years old, kept drawing himself. (Figure 1). I have many copies of these drawings, all similar. He could not explain the symbol 'M' which he drew. This drawing is typical of young children, the 'Tadpole man'. We have found similar drawings in many parts of the world irrespective of language and culture. essentially, they start with marks on paper, or elsewhere, such as walls. They enjoy making marks and controlling the crayon or whatever implement they pick up. Development through these stages has been described by various researchers, e.g. Symington, Boundy, Radford, and Walton (1981). When children begin formal school, they already understand something of animal forms. Their drawings abstract out the basic shapes of component parts. For example, drawings of 'tadpole man (Figure 1) drawn by a 4-year-old boy has a circle for a head, a vertical rectangle for the torso and two pairs of stick rearranging the two pairs of arms and legs. (Tunnicliffe 2020 p, 15). Watching thinking, listening to their narrative will yield more. Insights into a child's understanding. There are published accounts of children's understanding of vertebrates, themselves, birds, fish, and invertebrates, namely crabs, earthworms and snails, derived from analysis of drawings (Tunnicliffe, 2020). children will draw a basic, but scientifically inaccurate, 'butterfly shape. If asked or a stereotyped caterpillar with many legs. When asked to draw a plant they invariably draw a simple Compositae flower, and a lollipop shape if asked to draw a tree. Trees in the understanding of young child at least, 'are not plants'.

INSERT Figure 1 Tadpole Man - one of many similar drawing created by Luc. All were identical.



Biological literacy thus develops from these earliest years, as children are biological beings; they acquire an understanding of basic life functions from first-hand experience as well as a rudimentary understanding of the biological form and function of organisms in their relationship with the environment e.g. Ghazili and Tolmie, (2014). However, even in the first quarter of the 21st century, the situation has not improved since Tunnicliffe and Reiss (1999) stated that, '…. to date, insufficient work has been carried out on how children view living organisms in the environment'. Tunnicliffe, (2012 page 11), records that a two-year-old boy had five words for animals in his first fifty words and observes that observing animals feeding, as well as what they do and where they live, is a frequent pastime of very young children and this biology becomes part of a child's conceptual framework from the earliest years. The early years of recognising biology all around and its interaction with the environment and adaptions to habitat is recognised as essential foundation experiences. Tunnicliffe and Uckert, (2011) maintain such is the critical age for children's biological learning A study in England of pre-school children's taxonomic knowledge, Allen (2015).

found that they held simple but fundamental ideas, but hey may build on such with careful teachers, but such naïve ideas do persist without competent, accurate biological education. Allen also concluded that children learn about animals in a variety of places, formal and informal. School is but one source of a child' biological education.

We little understand how children perceive plants, yet they are a key part of the environment. Plants are key members of the environment, yet plant blindness is a recognised phenomenon, Plants are frequently neglected in formal study, yet without plants there would be no animals. Because Plants are an integral part of our world. open ground, the soil, is covered by them and kept in place Plants and are used by a group of animals, all eaters and plant eater, including humans. Some animals e.g. birds, beavers, and humans use them in constructions. and as a supply for humans of fuel. However, some, humans also regard them as aesthetically pleasing and cultivated them for pleasure. Children, and adults, usually notice plants as a background to other objects of interest such as moving animals. If children see specimens of plants as part of the scenery of their everyday lives they may exhibit 'plant blindness' (Wandersee and Schussler, 2001). However, plants are usually the background for more interesting living things – animals. The recognition of plants and animals, their habitats, adaptations and interactions are vital in maintaining a sustainable world (Tunnicliffe and Reiss, 1999).

Children learn about living organisms gradually. There is a distinct progression in an emergent learner's noticing, observing, interpreting in constructing their knowledge of the living world as well as input s from peers, adults and other media which they receive. All such inputs are accommodated and constructed into their model of their living, and non-living, world.

A tentative attempt to document this is shown in Table 1. It is very rudimentary and the beginning of a study.

There is distinct progression in the development of observations and understanding of their biological world and the associated pertinent influences, physical and planetary such as weather. These data are progressions based on observations

Table 1 PROGRESSION ANIMAL AND PLANT UNDERSTANDING A DRAFT

Stage	Animals'' first encounter in West may be image- soft toys of similar shapes)	Observation animism living/nonliving realisation. Endowing with human properties
1	Move, different ways. Fly, swim, walk, crawl and independently	Toys move through child's will
2	Have different shapes, coverings, appendages, disruptors to outline	Learn can not grab at fur but need to stroke in one direction
3	Have basic shape- front end back end, sensory organs.	See basic shapes e.g. stick animals, round bodies no segments- e.g. butterflies' drawings

4	Animals have same basic needs themselves- anthropomorphisms	Think all animals meet life needs in same wat, anthropomorphic interpretation until learn different kinds solve same need in particular and different way.
5	Different animals live in different places (habitats) land, water, land/ air	Live on land, or in sky, in water, under the soil
6	Shapes, colour, habits etc may change as animal grow – metamorphosis, aging	Gradual metamorphosis - stages in complete metamorphosis seem to be two distinct animals e.g. caterpillar/butterfly
7	Start recognising and naming e.g. Animals, but our dog, Birds but seagull, butterfly but 'bugs'.	Name all similar by name learnt of first animal e.g. dog, first flying object if it is a plane is used for all until the other objects in air- learn birds, (except butterflies etc)

Plants

Stage	Plants	Observation
1	Flowers recognise and call plants unless know name e.g. rose.	Anything else has an everyday category name- tree weed, bush, vegetable
2	Plants have basic shape	Lollipop tress daisy-like flowers drawn
3	Flowers and other organisms outside e.g. trees have green parts	flowering plants
	Don't move from place to place, move in position by agents usually wind	Later learn about, some movement, like fruits and seeds move by various means, wind movement, animals, mechanism. moves them from where live- invading species, seed dispersal
4	Some plants have flowers. Flowers ae coloured, have parts which can be pulled off.	Bees and other animals visit plants Plants need water or they wilt
5	Plants have parts under ground	Different kinds of roots e.g. tap, adventitious, spread.
6	Plants don't always look the same during a year or over some years There are not always have flowers, flowers die, above ground parts of some plants die back, or leaves in some trees	The idea of Life cycles and growth similar to animal metamorphosis TIME

	Change through the year. Seasons.	
7	Seeds are parts of plants and grow into new ones made by parent plant	Root grows first downwards need water to absorb look different then will grow

Whilst Our living world is dependent on the earth. Without earth science there would be no biology, no living things as we know them, no us. The recognition of the role of earth science in creating the biological world is neglected, like plants, there is an acute 'earth science blindness '(Tunnicliffe, 2020, p119) and the realisation and recognition of features that have formed our environment is part of learning biology. The seasons or monsoons affect the living world but are created by the planet, as are the types of soils. Children learn to recognise different types of landscapes and the plants and animals that occur there. They learn that snow on the ground indicates a certain type of climate and when it is permanent, certain kind of animals adapt to that environment, they observe, for example, the colour of a mammals' fur. When they see pictures or reconstructed scenes (as in dioramas), with sand and particular vegetation, such as cacti, they recognise desert and water features such as ponds and lakes and determine the types of things that live in those habitats. We find that this learning can occur though media representations, in particular, the books they read as well as through museum visits and observations in actual locations.

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