Essential stage in Science learning: Play and narratives – meeting Challenges in the present age of need for Sustainable Development

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Abstract

Learning is socially constructed. At the present time there is an emphasis on interactive learning as well as the socio cultural aspects of learning. Dialogic talk is encouraged rather than what we, in England would term a didactic or declarative approach, talking facts at learners. Constructivism places importance on determining the learners existing ideas. Learning is exemplification of Science in their everyday worlds, and narratives constructed for the learner, either as text books or as a means to explain to citizens the science in everyday life, but a there are also those narrative heard not designed for them. This paper considers two aspects of the learning partnership in science educations, namely , play and narratives in pictorial fiction books.

Key words: STEM, science, play, inquiry based learning, ' stories, science capital' narrative

Introduction

Learning is socially constructed. Today, in the 21st century, there is an emphasis on interactive learning as well as the socio cultural aspects of learning. Dialogic talk (Alexander, 2008) is encouraged rather than the 'tell' approach, what we, in England would term a didactic or declarative approach. Essentially telling through talking facts at learners. Fleer (1992) reminds us that constructivism places importance on determining the learners existing ideas. Learning is exemplification of Science in the everyday worlds to learners Learner's understanding of science contributes to the development of their individual Science Capital, (Archer et al. 2015). Narratives constructed for the learner but also those narrative heard , but not designed for them. Narratives have an important role in the development of learners science understanding (Avraamidou and Osborne, 2009).There are two aspects of the learning partnership in science education, namely, play and narratives in pictorial fiction books written for early years participants about which is the theme of this paper .

Whose Voice? Child or teacher?.

Teachers often talk, indeed lecture to their pupils, in many countries. However, the voice of the child, the learner is of the upmost importance and must be heard too. Their voice must be heard too. As both Driver (1983 Driver. Driver et al.1985), and Fleer (1992) observed, real teaching engages in a 'handover' process and the support of the teacher or facilitator is gradually withdrawn as the learner gains confidence and skill at interpreting their own observations and ideas. Such development of confidence and understanding can be partially achieved by the effective use of questioning, particularly the 'throw back' technique, not telling the learner but asking challenging their statements to encourage them to rethink, a type of cuing process (Chin, 2007), in other words the pedagogical approach. As many of us develop inquiry science we seek to develop with our emergent scientists or STEM practitioners the ability to:

- Ask a question about objects, organisms, and events in the environment, natural and human created
- Plan and conduct a simple investigation
- Employ simple equipment and tools to gather data and extend senses
- Use data to construct a reasonable explanation
- Communicate investigations and explorations
- Problem solve
- Develop critical thinking
- Construct narratives
- Interpret narratives

Intuitive scientists in Play

In the developing early years, at pre-formal school children are intuitive scientists (Gopnik, 2009) who, interpret the world around them from observing and investigating and also have the ability to acquire viable realistic concepts of the living world when involved in relevant activities (Hadzigeorgiou, 2015). Research in early years shows that young children can investigate, collect evidence and conclude via play (Monteira et al, 2016; Piekeney et al, 2013). Many adults consider play a waste of time (Moyles, 1989). Roth et al. (2013, p. 14) state that 'Play is children's work'.

The purpose of one my present studies is to observe children from earliest of years, before they enter statutory school at a variety of venues, to observe as a non participant as they develop their interest in beginning exploring scientific concepts via play. This research applies a non-participant observer methodological approach within several contexts such as Bangladesh, where mothers and children are encouraged to explore scientific concepts by using everyday items and naming actions, to UK context in playgroups and non-formal venues.

Genre of Play

The starting point of STEM learning is not to simplify and simply advanced science which seems to be basis of curricula, a 'top down' scaffold development of concepts from their staring point, but a 'bottom up ' approach, listening, watching what the youngest child instinctively does, and developing support strategies for the children to experience involvement with items or phenomena which will develop their understanding, practical, hands on experiences and problem soling prowess as the children develop and build on their express and discoveries to more formal learning experiences into a sound experiential ‘science capital’. What ‘science actions’ are used? These experiences form the foundation of their science and STEM capital. From my observations over some years distinct types of play arise, categorised in adult terms, such as:

Free choice play where there are no ‘toys’, only resources that you can find outside, or/and inside.
Mediated play when toys are available and the children choose with what they are ‘playing’, moving often from one to another,
Facilitated play when specific items are made available and the child expected to ‘play’ with, but often in fact adapt by the child the items for their own exploration.
Instructional play, where the aim is the child to try an activity and lead to develop some specific skills.

Representational Play is particularly a sub genre of Free-Choice play and mediated play.

Hands on investigations and observations, instinctively carried out by these emergent scientists provide a sound basis for the learning of the authentic science and once in formal education the rescrubbed curriculum

Other forms of Play

The above categorisation is not exclusive of some other genre, which also fit the above categories. *Representational play,* is particularly free choice play when a child re-enacts an idea or activity/incident he has witnessed. Such as covering himself in cushions and bursting up, out of them announcing that he was, “a baby dinosaur hatching from an egg", a follow up to a recent visit to an exhibition about Dinosaurs at a Natural History Museum. Or of Mediated play with miniature replica utensils available , young children using toy imitation utensils such as a miniature sweeping brush or vacuum cleaner and imitating a grown up using the real thing in cleaning their house. This latter example encroaches into the realms of Role Play. Children without small sized versions of replica artefacts, such as cups and spoons, recreate giving a tea party, by, for example, tearing up green leaves into small pieces, representing tea leaves and creating a container from other leaves to stand as a drinking vessel which they offer to a friend as a ‘cup of tea’ when they host a ‘visit’ from another toddler for example

Representational Play is particularly noticed in preschools and playgroups where small sized scenarios such as kitchens, shops, and hospitals are set up for children. This is Facilitated Play by adults but *Representational play* through children collaborating with the intention. At mother and child play sessions I attend in England, older toddlers, before 5 years, often head straight for the small sized toy kitchen nd entertain their ‘friends, dolls often, for a tea party. Younger children zoom in to the room to collect a doll, toy shopping basket and pushchair propelling it around the room pretending to be shopping. Young boys particularly just choose the pushchair and push it quickly around. These children age in fact creating narrative themselves.

Science Actions in play

This paper does not focus on children over 5 where some work e.g. Bulunz (2013) where instruction and play are integrated in more formal learning situations, facilitated and instructional play. If you observe preschool children, and indeed older ones, playing, whatever genre of play, you can identify science actions which they use and experience as they play. This is medicated play as the means needed to execute these activities are provided.

Children in England's choice of activities

An experienced nursery teacher (physics and maths graduate) in England suggested when asked that the following were her pupil's free choice preferred play options when they could choose.

Children choose to do following activities.
Forces
any playdough activity
building with any type of construction resource and they love nuts and bolts - (and they prove to be quite imaginative)

Creative
mark making
computer drawing and games
chalk drawing, painting
overwrite their name
colouring
cutting
puzzles, magnetic puzzles

Representational
dress up
role play

Out of doors activities
explore with magnifying glasses and magnets
ride bikes
climb on playground equipment

Materials
play with sand
play with water

Control
remote battery operated cars
-

Facilitated play activities these children liked to do but not necessarily independently"
sewing
ordering by size/shape/properties

The science actions above require science(and engineering) actions. Taking as an example sand paly. Throe are the science actions and skills but also the nature of science procedures.

Here I use Sand Play as the choice of material for free choice play, or mediated , as is common in nurseries, some homes and playground some implements are available
The following activities are common":

Material of play	science concepts	science skills required and practiced
Sand play	Forces, properties, feelings, mixtures, evaporation, friction, surfaces, materials	Picking up sand, Filling container, recognising empty and full, pouring, capacity, emptying, making tunnels, using wet and dry sand and the properties. Effects of sand via friction.

In all these play episodes the nature of science(NoS) is evident. These emergent scientists use the following skills of both problem solving, critical thinking, experience and manual physical dexterity.

Sand play	Forces what they do different types of effect, pushes, pulls, twists, ramps, inclines, screws, properties, feelings, mixtures, evaporation, friction, surfaces, materials, centres of mass, balance.	How to fill container, to empty, pouring, capacity, making tunnels, building with wet and dry sand. wet and dry sand. Which sand type most effective for particular jobs, like tunnelling, creating landscapes , pouring, as abase for a construction.

During paly such as above children are also involved in emerging engineering through construction of tunnels and mounds, experiencing the different properties of wet and dry sand, i.e. materials. In using wheeled toys to move across sand on the floor they experience friction and work out how to solve the issue. In filling up containers, and emptying they learn basic skills of pouring,(aiming flow , rate of flow, recognising full, using implement e.g. folded leaf or paper as a funnel, to fill one item with a material. In constructing towers or landscapes in the sand for a narrative they are comprising they learn about use of materials.

These children use intuitively Observation, recognising data, recall of past experiences, analysis of issue, planning investigation, choosing what is needed, organising items, other children or adult, instructing, data gathering, recording, evaluation, reporting, communication, repeating investigations, changing variables. identifying patterns, and over time

Science teaching is a narrative. This has been identified and discussed, e.g. Aaravandou and Osborne, (2009). Learning science is the learner's narrative too. Not only is such seen in science play, science is identifiable in text narratives, particularly highly coloured illustrated storybooks.

Narratives in early science education.

Another important aspect of early science and other learning is the narrative involved. Narratives are what teaching and learning is about. Yet the use of special scion books that often are provide in play group, nurseries and child care facilities, as well as in y man homes age an overlooked a phenomenon in early years learning. These books are highly illustrated series, pictorial fiction books, (pfb.) The study of these books and the science information delivered is not complain about the science 'told' but intertwine with myth to deliver a 'good story', thus to identify both essential elements. The key is understanding both so that each 'facton' can be discussed, myth or reality.

It is to be borne in mind that narratives are not confined to the written text. Oral stories area feature of a number of cultures. Even Western society have traditional stories which are told to children for whom there are various ways in which they hear them. However such narratives are not part of these studies.

In developing dialogic talk in science lesson, working to together as understanding OD the learner is ascertained, explaining content as needed, a narrative is being contracted, transmitted and received. `Not only are science lessons narratives but so are the pictorial fiction books, (pfbs). The narrative form represents "the greater use of the most powerful and persuasive way of conveying ideas" (Reiss et al, 1999, p.69) because the narrative form reflects the way the human mind orders experience, in terms of telling sequential events (Bruner, 1997, 2002) but also gives shape and meaning to the world around us, by domesticating the unexpected and the extraordinary, by bringing together the disparate and the fragmentary into a meaningful, coherent whole (Bruner, 1997, 2002). These children's books, brightly illustrated with stylised drawings, Pictorial Fiction Books (PFB) for the earliest years are a fiction that invents a "possible world" which forces us to return to knowledge of the real world in order to understand it (Lewis, 1986).

The science element is not included to teach science but as a vehicle around` the narrative is woven, often inaccurately and embellished with myth and anthropomorphism. Bruguiere and Tunnicliffe (2017) maintain that if teachers and parents, and indeed authors and illustrators were aware of the affect that these chimera tales have on the emergent science learners understanding as they construct their understanding of their world. There is also a genre of pictorial books for early years called Realistic Pictorial r Fiction books, (RPFB) which are written explicitly to deliver a science story, albeit with anthropomorphic elements, such as in *Tadpole's Promise,* (Willis and Ross 2003*)*, benefit to the development of science capital and restrict he development of misconception. These are not realistic pictorial fiction books.

However, Realistic Pictorial Fiction books, (RPFB) are written too more accurately (within the confines of anthropomorphism acceptable to deliver the story, such as is *Tadpole's promise* (Willis and Ross 2003), to introduce an understanding of metamorphosis concept in the story. We suppose that the plot structuring for the story is also structured to generate scientific questions about metamorphosis among children. This storybook is about a ‘love story’ between a caterpillar and a tadpole based on an impossible promise in the real world, the promise to never change although time passes. The story shows us all the development’s stages of a frog (eggs, larva, adult) and of a butterfly (eggs, larva, pupa, adult). External changes and internal changes (diet and habitat) are evoked. The changes of the both animals take place during the different seasons. It is essential that teaches and other adults and parents know two basic biology in all cases and need recognise the poetic licence of authors and artists in creating their story line and illustrations, particularly of the pictorial fiction books.

Furthermore, the work of Bruguiere and Tunnicliffe (2017) identified the various ways in which adults read these stories to children at home but particularly in ‘classes’. We suggest that such a hierarchy of reading behaviour be an essential part of teacher trading together swith learning to analyse the science information and opportunities for developing critical thinking and problem solving through using these books.

Through observing teachers read out loud fiction book to children, analysing by seeking themes (Braun and Clarke, 2006) the recorded and transcribed out loud dialogue of he lesson and our field notes we produced a rubric of eight categories of reading technique, from simplest to complex emerged, 1 - 8;

1 Read (R) Just read, no breaks
2READ BREAK SHOW PICTRE, RBS read stop show page pictures
3READ BREAK DRAW (RBD) stop ask children to draw the story, i.e.
the MENTAL MODEL CREATED BY THE NARRATIVE
4 READ BREAK AND CLARIFYY THAT THE CHILDREN UNDERSTOOD THE WORD RB U, THE READER stops to clarify meaning of a word WITH CHILDREN
5 READ BREAK BY ADUKT (RBA) adult interrupts for a shared memory
6 READ BREAK AS A CHILD INTEREUTS (RBC) read and break as child interrupts
7 READ BREAK AND INVITE CHILDREN TO COMMMNET (RGIC) read break invite child to comment
8 READ BREAK AND EXPLOR) (RBE) break and explore a child’s comment

Thus, in the earliest of years, when a child is in the community, with family, who care for him or her and are essentially the first and most important teacher of this child, laying the vital foundations for later formal schooling but also all the learning which occurs out of formal education, in leisure time, but also on in venues of field trips organised as part of the formal curriculum where learners are given the opportunity for free choice involvement with whatever is the focus of the formal school learning objective.

These two components, the identifying of science in particularly free choice play and the narratives of the pictorial story books used with preschool and early years of formal schooling are essential partners in developing the science capital of these emergent scientists.

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