Miaconceptions in science essay sample

Being a mum of four and speaking from experience, it is important to understand and accept that children create their own meanings of particular scientific concepts at a very age in their life, concepts to which they have no apparent answers. Driver et al (1985) cited in Littledyke (2000) supports this by saying that' even before encountering formal school science, children have constructed their own ideas of how the world works'. (p. 46)

As they become older and gain more experiences their conceptions may be challenged and they need to rethink about their ideas regarding science. Unless these children (and sometimes adults) explore and experiment for themselves, they will not be able to elicit their previous misconceptions about certain concepts. Therefore Effective science teaching should take account of these ideas and provides activities which enable pupils to make the journey from their current understandings to a more scientific view (Driver et al. 1994, p. 1).

Keeping this in mind, this assignment will investigate the misconceptions of 6 children in Year 5, regarding Forces and in particular sinking and floating. Science may be seen by many as being a search for truths, a mean of discovering new ideas and theories associated with reality. The constructivist theory claims that through the varying senses of sight, hearing, smell, touch and taste we learn about physical phenomena. With these messages from the senses the individual is able to understand and build a picture of the world. (Lorsbach & Tobin 1990)

Bruner (1966) believed the constructivist theory was a general framework for instruction based upon Piaget's theory of cognition. He believed that the active process of learning was allowing pupils to construct new ideas or concepts based upon their current or past knowledge. By selecting the information and then making a meaning out of this given information, the learner is able to construct hypotheses, make decisions, thus enabling the individual to look at their previous ideas in new light and enabling them ‘ to go beyond the information given’ (Bruner. online)

Dyson and Gates (1987) agree with the constructivist view of learning by recognizing pupils as active learners, already holding ideas regarding natural phenomena which, they use in their everyday lives in order to make sense of the day-to-day experiences. They also state that children do not come into the classroom as empty vessels waiting to be filled, they come with existing ideas that they have already gained from previous education and the world around them. Harlen (2000) states: ‘ Building understanding has to begin with the objects and events familiar to them.

From the ideas used in understanding specific aspects of their environment (‘ small ‘ Ideas) more widely applicable ones (‘ big ‘ ideas) are created… ‘ (p. 13) Ausubel’s theory of meaningful learning as cited in Johnston (1996) has formed the basis for much recent research into how children learn the importance of their early ideas as the basis for future conceptual development (p. 24). Forces is a difficult area of science to explain to a young child, because according to Wenham (2005, p200)Scientists cannot say what forces are, only what they do, so in order to learn about them, their effects have to be experienced.

The SPACE project (1998) puts further light on this topic saying that: ‘ Although Forces is a very well researched area of science education, much of the ideas about forces have, in the past, been conducted with adolescents and college students. More recently there has been increased, though less extensive, interest in the conceptualisations of younger children’. (p. 17) Some of the research points to the lack of awareness (or use) of the concepts of gravitational force in explaining objects motion.

This is consistent with Piaget (1929) who also recorded children not using gravity as their explanations. The SPACE project 1998, p. 18) Ruggiero et al. , (1985) cited in Russell et al(1998) found that children tend to believe gravity is not closely connected with weight but acts with weight to hold things down. Osborne et al,. (1981) examined the understanding of students between nine years and tertiary level, some of whom expressed the belief that it is possible to have weight without gravity(p. 19) The 6 bilingual children chosen for this activity were a combination of 2 pupils from each ability groups, which consisted of 3 girls and 3 boys.

This ensures that information is gathered equitably about all children, not just the ones who need most help or claim most attention (Harlen 2000, p. 155). To elicit the children’s ideas regarding sinking and floating, I thought questioning would be the best technique to use as, Harlen (2000) emphasises that open questions and person – centred questions prove the most effective types of questions in order to find out children’s ideas and what they are thinking(p. 112). Therefore, I decided to use these two types of questions as many times as possible.

The first question asked was; ‘ what do you think will happen to this object, when I place it in water? ‘ thus reflecting a person-centred question. Two boys (from the high ability group) looked at the apple in my hand and replied; ‘ it will sink’. Hearing this I soon realised that the question needed to be more focused and perhaps phrased differently to ensure a clear scientific and precise answer. Ollerenshaw & Ritchie (2000) maintain that ‘ children’s alternative ideas are rarely illogical – for this reason they should not be dismissed as ‘ wrong’ or ‘ immature’ where they differ from a conventional scientific view'(p.).

Ofsted (2000) supports this view, stating that pupils should be allowed to get things wrong using the opportunity to promote more rigorous scientific enquiry. When I rephrased the same question to; ‘ Why do you think this apple will sink? ‘ two more children joined in the discussion, saying that ‘ the apple is heavy, so it will sink ‘. I asked one of the girls to take the apple and place it into the water tank. The children watched the apple half float in the water. ‘ Why isn’t it sinking’ asked a boy in the lower ability. Because the water weights more than the apple’.

Replied one of the boys who were from the top group. Although the language used by the boy in the top group was not scientific, but his understanding of sinking and floating was excellent, because in a study carried out by Bar et al (1997) citied in SPACE project (1998), no pupils in Bar’s sample of 9 to 18 years olds expressed a view that gravitational forces act between two masses (p. 19). This boy’s simple explanation helped the other child to get a better understanding of what was happening.

There is increasing evidence that shows that children's' language is often a barrier to adequate communication of science ideas, and that this is more serious with young children and those learning a second language (peacock. 1997, p90). To get a better understanding what the children were thinking, I presented each child with a work sheet (see Appendix). On the table I placed a number of different objects such as, an orange, banana, paperclip, tennis ball, golf-ball, a small nail, a large nail and blu-tac.

Each child was asked to predict what would happen to each object once it was placed in water. In addition, the children were presented with the opportunity to touch and feel the weight of the different objects on the table. According to Qualter et al (1990): ' The important process of exploration cannot be treated in isolation from knowledge and understanding. When children formulate hypotheses they inevitably use their knowledge and understanding, whether in a tacit or an explicit way. Their experience must, unconsciously, frame the way in which they perceive any situation'.

From my observation I noticed that whilst the rest of the children were writing down the names of all the objects, the 2 boys in the top set had started a small discussion between themselves, forming a prediction; if the weight of the object is more than the weight of the water then it will sink. This prediction coincides with the idea put forward by Wenham (2005, p. 219) who also states that floating object does not continue to fall; the water must be exerting an upward force on it, which balances the weight of the ball.

These boys than presented their idea to the rest of the group, the rest of the group took their idea on board without hesitation (this happened because of the fact that they were in the top set and were known for being right most of the time) who then started to put the heaviest and larger objects to one side and all the small ones on the other side. Discussion with peers may serve a number of functions in the process of knowledge construction. It provides a forum in which previously implicit ideas can be made explicit and available for reflection and checking.

When this task was completed, each child was presented with an object, which they placed in the water. Some of the children's predicts were not correct as the objects which the children had put down for sinking, such as the golf and blu-tac sank to the bottom of the water tank. The larger objects, such as the orange, tennis ball which they thought would sink, was partly floating and partly sinking. Upon seeing this, the girls thought that it will take a few minutes and then the items will sink. We all waited, but nothing happened.

The children's ideas were almost (except one) identical to the findings of Biddulph and Osborne (1984) cited in Driver, etal (1994) the majority of the children in the group could offer one single reason why objects but resorted to giving different reasons for different objects (p. 102). The one exception was the idea mentioned earlier; if the weight of the object is more than the weight of water, then it will sink. The 2 boys have a good understanding of the concept of sinking and floating, however as Piaget (1929) found not one of them was using gravity to explain their findings.

Most of them were concerned with the weights of the object but not what was pulling the object down. To get the children to think of other forces beside weight, I took a sponge out of the bag and asked the 2 children in the lower group ‘ what will happen to his sponge once I place it in water, will it sink or float? ‘ ‘ It will float, because it is not heavy, but it can sink as well’. ‘ Can you tell me why that will happen? ‘ He had no answer. I directed the same question to the other children. The boy in top group said; Is it because it has tiny holes filled with air, that let it float, but when the holes are filled, it will sink’ He had a clear idea of what and why it was happening, but the rest of the children could not understand his concept.

According to Littledyke, et al (2000): With new ideas moving in alongside the old, or even replacing some of them… , children need time to build or reinterpret these ideas into their own cognitive structure. They first need to be able to do this verbally, by explaining the ideas to each other. p. 8) To move the children forward in this area, they need explore these ideas in everyday situations, for example; when they go swimming, or when they have a bath, what happens to their body, what keeps their body afloat and above water? Qualter, et al (1990) explains that: Exploration involves much more than mere’ practical’ work; it is the tangible basis in experience upon in which a firmer understanding of science can be built by the pupils themselves . (p. 19)

To conclude, it is important to understand that children will always have un scientific ideas regarding certain areas of science. To be able to elicit children’s misconceptions and let new learning to occur, children should be allowed to construct their own meaning through experience with the physical environment through social interaction. As Johnston (1996) rightly states: ‘ Children should be encouraged to explore as many diverse resources as possible and should only be restricted by a concern for safety and consideration of other living things. ‘(p. 7)