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CAPTURING CHILDREN'S IDEAS IN SCIENCE THROUGH THE USE OF MINI WHITEBOARDS: A CASE STUDY OF CHILDREN WITH SEND

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Research which has aimed to understand how children come to acquire ideas about different science concepts has had a long history (Vosniadou, 2008, Driver et al, 1994). However, these studies have explored conceptual knowledge largely through verbal reports, whilst successful, these approaches were critiqued as they did not capture a comprehensive understanding of knowledge growth particularly if children are not able to clearly or fully articulate their ideas (Goldin-Meadows, 2000). In more recent research this bias towards language has been challenged and investigations have begun to consider multimodal aspects of children's communication in science lessons (Jewitt, 2011). Multimodal research has begun to demonstrate how other communication strategies can provide a more holistic understanding of children's knowledge growth (Callinan, 2015). This paper discusses the results drawn from a recent case study which aimed to explore how children with SEND use mini whiteboards in order to express their ideas about floating and sinking. The case study focused on a four week science intervention undertaken with a class of 8 children (10 – 11 years old) with behavioural needs and attending a special needs school. The children were encouraged to capture their ideas about the topic throughout the course of the intervention, this paper focuses on how the children used mini whiteboards to demonstrate increasingly complex scientific ideas. The children's whiteboard representations were captured using a camera throughout the lessons. Preliminary findings indicated that the children preferred to discuss their ideas using the whiteboard rather than in the formal test and through verbal discussions. These findings demonstrate that the children were more confident when drawing on other multimodal resources than those typically used in school assessments (e.g. spoken or written word forms). This presentation will explore the initial findings from this pilot study and will discuss plans for further development of the intervention.

Keywords: Primary science, multimodal research, SEND

INTRODUCTION

Constructivist approaches to science learning are well established (Driver, et al., 1994). According to the constructivist perspective children will have used their previous experiences to have formed some representations of the phenomena studied in school science (Driver, et al., 1994). In more recent work links have been made between constructivism and the different ways that children can communicate their science ideas when using different communication strategies including gestures and drawings as well as written and verbal responses (Callinan, 2015). This multimodal approach is becoming well established in educational literature and it is proposed that children utilise a number of different expressive modes, these modes include verbal dialogue, written pieces, drawings and other expressive art forms and non-verbal communication such as gesture, eye gaze and body posture during learning (Kress, et al., 2001) each of which has its own communication affordances. Different modes enable the communication of different aspects of knowledge. Whilst Kress, et al.'s (2001) research focused on how different modes of activity support children's acquisition of concepts in science other researchers (Goldin-Meadows 2000) have investigated the role that non-verbal language such as gesture has in revealing children's existing conceptual knowledge. This developing body of multimodal research taken as a whole supports the use of this approach for both teaching and for assessing learning especially in children who may experience difficult to communicating what they know and can do (Callinan, 2015).

One specific population of children who may find communicating scientific ideas difficult are children with special educational needs and disabilities (SEND). In the UK supporting children with SEND is a national priority in education at all levels because they have the largest attainment gap compared to other pupils. The Department for Education 2015 statistical release revealed that only 20.5% of pupils with SEND achieve 5

or more GCSEs at A* - C grades. SEND is a broad category; however, one group that may particularly struggle are children with behavioural needs (BESD) such as Attention Deficit Hyperactivity Disorder (ADHD). Due to the nature of their needs (an inability to concentrate over long periods of time, or sit still during prolonged discussion) these children can find engagement with more traditional approaches to teaching challenging, and are thus vulnerable to underachievement. However, many children with BESD needs can benefit from more activity based learning approaches, and find that a more hands on approach to subjects, such as science, can be helpful for supporting learning. In this project we developed a four week teaching sequence, drawing on a methodology used by Callinan and Sharp (2011). The multimodal approach had been shown to be helpful for supporting the development of mainstream primary children's scientific ideas, because it encouraged active engagement with practical science activities, and also because it allowed children to express their ideas across a range of modes, including through the use of gesture and drawings. Underpinning this project was the conceptual framework of constructivism and multimodality.

METHODOLOGY

Although part of a larger analysis this paper aims to specifically explore the following research question:

- What does children's use of mini whiteboards reveal about their understanding of floating and sinking?

A total of 8 children (one class, 7 males, 1 female, aged between 10 and 11 years) attending a special school that supports children with behavioural needs participated in the project. All of the children participating in the project had been excluded from mainstream schools. Consent for participation was received from all parents and children. The intervention was held in the normal classroom environment in order to support the needs of the children, throughout the sessions the class teachers and two teaching assistants remained in class and supported the researchers in delivery of the intervention.

The intervention lasted for four weeks and focused on teaching concepts related to floating and sinking, activities included a plasticine modelling activity, a science story and a demonstration of upthrust and water displacement using an inflated balloon. The intervention was delivered by the researcher, adopted a multimodal, task-based approach, which included practical science activities, a dialogic teaching approach, and used mini whiteboards to capture children's ideas. All intervention materials were reviewed and approved by the class teacher before being used with the class.

One week prior to beginning the intervention a pre-test of children's ideas about floating and sinking was conducted, a post-test was undertaken one week after the intervention had finished. A post-test interview was conducted with the class teacher as he had been present for all sessions.
This study adopted a multimodal approach to data collection, specifically throughout the course of the intervention all sessions were audio and video-recorded using one static camera and one mobile camera which was operated by a research assistant. Photographs were taken to capture the ideas that the children represented on their mini whiteboards. Open-ended dialogic questions were used by the researcher throughout the teaching and data capture sequences, these encouraged the children to share their ideas using the approach that they preferred (e.g. in writing, on the mini whiteboards, using gestures). All subsequent data was analysed using a content analysis approach.

FINDINGS

Overall the results to the study revealed that the majority of the children (N = 7) developed their understanding and were able to articulate more scientific ideas about why some objects float or sink at the end of the intervention. Many children were also able to understand the complex concepts of forces (e.g. gravity and upthrust) as demonstrated through their drawings on the mini whiteboards. However, one striking result drawn from the study was in relation to the information that was captured in the children's mini whiteboards. Most of the children included both text and images when they captured their ideas on this medium. Interestingly, the children captured their ideas using the mini whiteboard more readily and returned to them more frequently than they did for their drawings on the formal tests sheets used during the pre and post sessions. In most cases the children included more information on the mini whiteboards and they returned to these many times in order to adjust what they had either written or drawn so that they more

accurately represented their ideas. For example, one participant, D, spent a large amount of time capturing his ideas about what floating and sinking is using the mini whiteboard. D's responses pre and post (see figure 1) intervention show that over the course of the science lessons he had learned about gravity and upthrust and that he was able to represent these forces effectively by using arrows in his drawings in order to show how they would influence whether an object would float or sink.

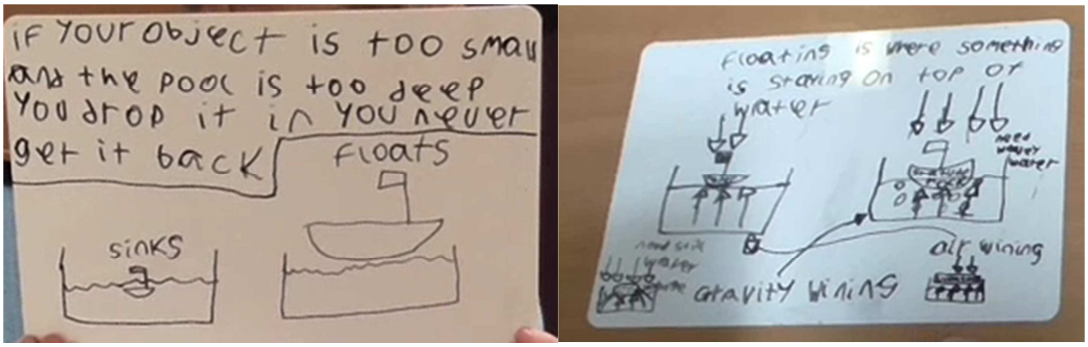

Figure 1. Photographs of D's initial ideas (image 1) and ideas captured following (image 2) intervention about floating and sinking.

DISCUSSION

This multimodal study demonstrates the usefulness of the mini whiteboards as an approach to capturing children's ideas in science. Importantly, more information about the children's ideas was captured on the whiteboards than using the pre and post test materials. These results suggest that the children preferred to use this medium as a resource and that they offered a more detailed understanding of the content of the children's ideas. It is proposed that this may have occurred as this particularly sample of children dislike formal writing, perhaps the mini whiteboards offer a medium that could be more easily erased and adjusted until the drawings met with the children's intentions. Furthermore, it may be that the sensory experience of using the mini whiteboards was more rewarding for the children, thus encouraging more sustained attention and effort. These results demonstrate that the mini whiteboards may offer a unique approach to assessing children's ideas in science and that they may be used in support of learning in order to help children appreciate their ideas and help teachers and researchers understand the full content of children's responses.

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