

Drawing the phenomenon of shadow formation at preschool

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Résumé : This presentation aims at exploring the use of drawing to identify children's ideas concerning shadow formation. A qualitative research approach was adopted using two sets of data (89 drawings in total) collected over a period of 6 months in two kindergartens, one in France and a second in Greece. The drawings in each group were realised using similar instructions defined jointly by the team of researchers. The indicators that were used to analyze the drawings were grouped in four categories: (1) presence of the three entities needed to represent the phenomenon of shadow formation, (2) shadow characteristics, (3) alignment, and (4) nature of light. Results are presented with the disposition of highlighting the diversity of categories that emerged. Findings and educational implications for science at kindergartens are thoroughly discussed.

Mots-clés : Physics learning; Preschool; Shadow formation; Early science education; Drawings

Drawing and understanding the phenomenon of shadow formation at preschool

Children's drawing activity is frequently used in Early Science Education as a mean for eliciting children's ideas combined to individual interviews (Kampeza & Ravanis, 2012). In that case, drawing is not only used as an enjoyable activity for children but reinforces the development of individual skills (e.g. observation) and understanding as well as the learning process (Hayes, et al., 1994). Chang (2005) underlines the fact that using drawings can help children "revisit their learning and rethink what has been addressed" (p 104). In addition, with the aid of drawings, educators can keep track of children's ideas and therefore reshape and adjust curriculum plans and teaching strategies.

In the present research, the aim is to feature the potentials of drawing as a medium used by children in order to express scientific ideas about shadow formation. Previous research has highlighted children's difficulties to understand the phenomenon of shadow formation (Ravanis, 1996, Parker, 2006). In particular, they stress the difficulty to recognize the role played by light in the process of shadow formation, and to identify non-transparent objects as an obstacle to a light beam. Young children show difficulties to define the position of a shadow with respect to its corresponding object and a light source (Ravanis, 1996). Moreover, young children might see the shadow as an autonomous entity, with colors and features reminding the corresponding object (Gallegos-Cázares, et al., 2009). As such, asking children to draw the phenomena of shadow formation represents a challenge linked to the intrinsic nature of the phenomena. The formation of shadows is explained by a relationship between 3 entities: a light source, an object and a projection plane. In order to work with young children, the approach of the phenomenon can be described identifying a dark area of similar shape to the blocking object with no other details than its outline. This

has been previously expressed under the idea of “precursor model” where shadow is seen as light being blocked by an object (Delseerieys, et al.,2014, Ravanis, 1996). An important presupposition is the understanding by children of light as an independent entity that enable children “to understand the process of the notion of a straight path of light” (Ravanis & Boilevin, 2009, p 183). The drawing of a shadow therefore pushes children toward an abstract form of representation and modeling of a scientific phenomenon. Considering the difficulties for preschool children to explain the phenomenon of shadow formation and the complexity to collect and construe young children’s ideas, drawings were used in order to communicate ideas and criteria of analyses of children’s drawings of shadow formation are proposed.

Methodological Framework

A qualitative research approach was adopted; categories derived from empirical data. The research used drawings collected over a period of 6 months in two kindergartens. The research is part of a larger project concerning children’s understanding of the formation of shadow. Similar series of activities were designed jointly by a team of researchers and implemented in France and in Greece. In this communication, the focus is made on the drawings themselves, the diversity of representations used by young children, and the possibility for educators to use these drawings to identify children’s ideas about the phenomena of shadow formation. The drawings were done on blank sheets of papers with the same instructions from the teachers: “Draw yourself with your shadow and everything needed to have that shadow”. The children were invited to explain their drawing to the teacher with open questions. Children’s expression was written on each drawing by the teacher. The research was organized in two public kindergartens with two experienced teachers in France and in Greece. In total, the corpus data consists in 48 drawings in France (29 from children aged 4-5 and 19 from the children aged 5-6) and 41 drawings in Greece (9 from children aged 4-5 and 32 from the children aged 5-6).

Results

In table 1, the categories that emerged from the analyses of drawings are presented as well as the frequency of occurrence of the different characteristics identified in the drawings.

Categories		Children aged 4-5 38 drawings	Children aged 5-6 51 drawings
Presence of drawing elements	Light, object and shadow are represented	19	41
	Light is missing	14	9
	Shadow is missing	4	0
	Unrelated drawing	3	1
Oral comment	Role of light mentioned	3	1
Shadow characteristics	The shape of the shadow matches the shape of the object	24	47
	Shadow represented as a dark area	11	33
	Shadow with light colors	7	7
	Shadow with dark colors	4	17
	Shadow is outlined and empty inside	16	13
	Shadow includes unnecessary details (eyes, mouth, etc)	9	11
Alignment	Rough vertical alignment	1	3

	Rough horizontal alignment	11	29
	Projection on the floor	3	9
	Shadow behind	5	0
	Light on top and middle	4	4
	Shadow between object and light	8	3
Nature of light	Natural	16	27
	Artificial	4	14
	Both	1	0
	Ray of light modelised	0	8

Table n°1 : Categories and frequency of drawings for each characteristic identified

In general, the results obtained showed a good engagement in the drawing activity and a majority of children, and in particular, children aged 5-6 were able to depict and describe the formation of shadow through their drawings. For only four children, the task itself represented a challenge and they drew something that was not related to shadow formation (geometrical figures, a house and flowers, etc).

Sets of drawings highlighting each category will be presented along with children telling about their drawings. For example, we focus here on how children represent the shadow itself. In most cases, the shape of the shadow matched the shape of the blocking object and is represented as a dark area filled in black or dark colors (Figure 1c) and represented as a solid entity. Figure 1b and 1c are also examples of the dynamic of the drawings with traces of errors and changes made while drawing. Examples of children's comments are characteristically in that sense: S. 2: "I'm gone make it the same [as the figure of herself that she drew], but I will not form it, I'll make it all grey.", S. 7: "That's my shadow! Oh, no... I shouldn't have drawn it inside in order to understand that it is a shadow... I'll do it again." However, it was common to find representations of shadows sketched with an empty outline (Figure 1d), including unnecessary details such as eyes and mouth (Figure 1b and 1c), or sometimes colors (S. 13: "I know that shadow is grey in reality, but I want to draw it colorful.").

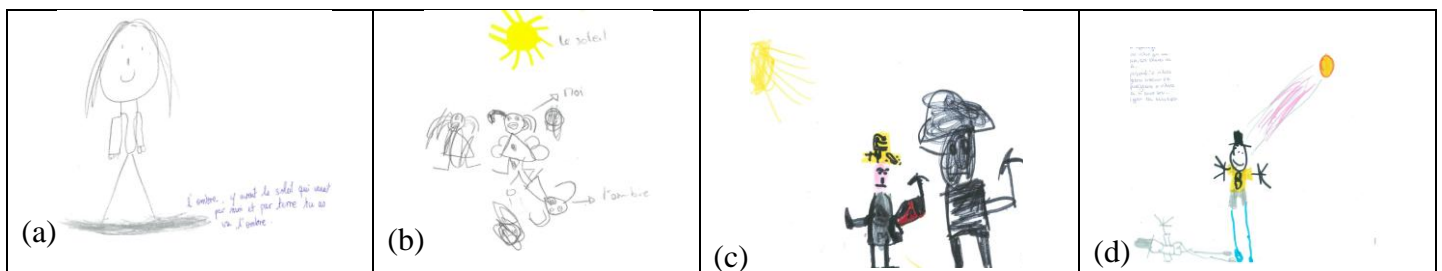


Figure n°1 : Representation of shadow as (a) dark zone without a specific shape, (b) shape that matches the blocking object and includes unnecessary details, (c) solid figure that also include unnecessary details, and (d) empty outline

Discussion

In this communication, children's drawings related to the understanding of the scientific concept of shadow formation are explored. In particular, a possible methodological way to analyse children's drawings was proposed. It is worth noting that the ideas that emerged through the drawing activity revealed similar alternative conceptions found in relevant research using different methodologies, such as difficulties acknowledging the importance

of the light source in order to form a shadow or difficulties concerning the relevant positions of the light source, the obstacle and the shadow (Herakleioti & Pantidos, 2016, Parker, 2006, Ravanis 1996, Ravanis et al.,2010). In addition, drawing activity enabled children express conceptions that are not extensively recorded such as shadow's anthropomorphical characteristics (e.g. eyes, mouth) (Fleer, 1996).

An interesting feature is also the representation of light as an independent entity. This is interesting to note because it shows that it is possible to construct a representation of light and its presence in space with 5-6 years old children. Even if it is characterised as a major cognitive obstacle at that age (Ravanis & Boilevin, 2009), drawings could serve as a medium to help children construct a first model of this phenomenon.

Regarding to the drawing activity researchers as well as teachers should take into consideration some of the limitations concerning its effectiveness; dialogue with the children should ensue from the drawing activity in order to obtain a clear picture of each child's representation. In addition, despite the fact that drawing may lessen the stress for some young children in the acquisition of science concepts, there may be children who have little interest in drawing (Chang, 2012), have limited drawing ability, or believe that drawing has to do mainly with "realistic" representations. Therefore, drawings can be used as a complementary tool and combined with other forms of representations. For example, regarding the shape of the earth using 3-D shapes is necessary in order to define the difference between spheres and disks (Kampeza, 2006) or regarding the formation of clouds discussions with children can provide details that otherwise could be hidden (e.g. the dynamic of how clouds gain height or their composition on a microscopic level) (Fragkiadaki & Ravanis, 2014). Helping children realize that the drawing activity is about making meaning in a symbolic way, creating a representation of reality in terms of modelling or codification of experience may enhance the use of drawing as a dynamic tool in science education that serves communication and learning. Taper ici votre texte (style normal).

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