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## Kindergarten class – inquiry and magnets

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### Background

We will present results from children aged five engaging in an activity and learning about magnets and inquiry in a kindergarten session. We want to understand how they learn and grow and in what ways the kindergarten teacher orchestrates the activities in order to engage the children in magnetism through inquiry. The study is part of a broader project in the kindergarten, aiming mainly to understand how and what skills and learnings are developed through understanding and inquiry. How do children develop inquiry skills (making observations, asking questions, making predictions, designing investigations, analyzing data, and supporting claims with evidence)? How do they conceptualize mathematics (classification, representing mathematical ideas in drawings, types of reasoning, number sense, comparison of sizes, problem posing)? The results show the importance of the questions (Carlsen et.al, 2010) and an appropriated orchestration for creating an inquiry interdisciplinary learning environment.

The Portuguese curriculum for kindergarten education (age 1-6 years old) requires an integrated and global approach to subject areas. It seems that few kindergarten teachers integrate physics into their teaching, and according to Tu (2006) only half of kindergartens are equipped with an area for experimental activities and few of those kindergarten teachers promote science and mathematics tasks. If such an approach were performed early, it would allow scientific reasoning and it would foster a better understanding of science with effect upon the children's achievement (Eshach & Fried, 2005). In this study, we adopt: an interdisciplinary approach between science and math; the perspective on early math of Clements and Sarama (2009); and a sociocultural perspective on learning and development. We view learning as a social and a situated process of appropriation where individuals make concepts, tools, and actions their own through collaboration and communication with others (Rogoff, 1998). Also, as Hedges and Cullen (2012), we consider that in the early childhood context, participation is more active than mere presence, which in itself may not engender learning without attention relationships, content, change, context and cultures. This sociocultural perspective is useful for our emphasis on the orchestration of participation in social magnet activities.

The theoretical stance of our study is in accordance with Inquiry-Based Science Education (IBSE), (Worth, Duque and Saltiel, 2009). It is an approach to teaching and learning science and math that comes from: an understanding of student learning; the nature of science inquiry which may be represented as a set of four stages (explore, investigate, draw conclusions and communicate); a focus on content and heavy dependence on the local context and the interest of students and teachers. The inquiry-based approach has important principles such as: direct experience is key to conceptual understanding; students should be taught skills (making observations, asking questions,

making predictions, designing investigations, analyzing data, and supporting claims with evidence); reasoning, talking with others and writing both for oneself and for others.

## Method and results

The study was carried out in one private kindergarten in Lisbon and adopted a qualitative research methodology under the interpretative paradigm, emphasizing meanings and processes. The researcher, first author, took the dual role teacher-researcher, conducting the study with her own 25 children (aged five years) in her own environment. In this study, we collected empirical data through the use of video camera and audio as well as field notes from one session out of seven sessions implementing the IBSE approach. Interaction and communication were captured as children engaged in magnet activities and the teacher orchestrated the group of children who were participating. Mathematical features used by children were elicited through the class interactions. We decided to analyse deeply the participation of the children in that interdisciplinary environment session above mentioned in looking for supporting the remaining research analysis.

The results imply that children's learning is influenced by their active participation and by the kinds of questions and learning opportunities that emerge, and how kindergarten teacher respond to children's ideas and orchestrates the activities. The collected data from that session indicate such an interdisciplinary environment involved playful learning and inquiry. The children developed content and competencies in science such as vocabulary (*to attract* and *magnet*) and experimentation. The children also developed: imagery, quantitative and critical reasoning; number sense (object counting, counting mental images, comparing numbers and early addition); as well as representing mathematical ideas in drawings. The children had opportunities to pose and to solve problems. Children connected ideas in play with the whole class in the game "fishing" and they learnt through collaboration and communication with one another.

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