Teaching magnetic attraction to preschool children: a comparison of different approaches

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Abstract
The paper presents a comparison of different approaches for teaching magnetic attraction to preschool children. Three nursery school classes were involved in the study, two of which served as experimental groups (Experimental Group 1, N1=24 and Experimental Group 2, N2=25) and one as control group (N3=24). In Experimental Group 1 a socio-cognitive perspective was promoted, putting an emphasis on children’s alternative conceptions about magnets and magnetic forces as well as on their collaborative experimentation and their interactions within the groups and with their teacher. The intervention implemented in Experimental Group 2 also took into consideration children’s conceptions and combined specifically designed activities using storytelling, hands-on experiments, and drama. A traditional approach was adopted in the Control Group. The three approaches were evaluated on the basis of pre- and post-tests in order to estimate the evolution of children’s conceptions about magnetic forces. The results indicate that the traditional approach used in the Control Group had no significant impact on children’s understanding of magnetic attraction. On the other hand, the two experimental interventions lead to substantial improvements in preschoolers’ thinking. Moreover, interesting conclusions can be drawn from the comparison of the two experimental settings.

Introduction
From their early years children process and internalize their personal everyday experiences with the world around them, constructing conceptions and representations that are often complex and rather general. This early knowledge is formed on the basis of children’s interaction with the natural, social and cultural environment in which they develop, while it often diverges from the knowledge taught at school. The conceptions held by children about natural entities and phenomena influence the way they understand science activities in the classroom and consequently what they learn in the context of formal schooling (Fleer & Robbins, 2003).

The point of departure for teaching science in the early years is the contention that the children’s pre-existing knowledge about science as well as their inquiry and reasoning skills can be cultivated and developed significantly if preschoolers are initiated to scientific culture. Their engagement in systematic and appropriately designed science activities provides them with new tools for understanding the natural world, beyond direct perception and intuition, while it enhances their future understanding of formal scientific concepts (Eshach & Fried, 2005; Havu-

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1 Earlier version of the publication

However, despite the extensive research on pupils’ common conceptions about a variety of scientific concepts and suggested ways of coping with them, these seem to be particularly persistent and resistant to change (Driver, Squires, Rushworth & Wood-Robinson, 1994; Pfundt & Duit, 1994), especially after traditional instruction (Kang, Scharmann & Noh, 2004).

On the other hand, crucial characteristics of teaching approaches considered as favoring conceptual change include a) discussions among the students of a group about their predictions on a problem, or about an alternative explanation suggested to them; b) pupils’ experimentation and discussion about the experimental results within the group; c) symbolic representations of ideas; and d) comparisons between the children’s initial and newly acquired conceptions (Skoumios & Hatzinikita, 2006).

Moreover, within the framework of social construction of knowledge children actively build their conceptions of scientific phenomena through their participation in activities and practices of their community (Gauvain, 1998) and in particular through their interaction with others (e.g. peers, teachers). Science learning is thus considered as a dialectic interdependence between the child and the sociocultural influences s/he receives; experimental activity and the guidance provided by the social environment of the classroom are both critical for cognitive development in science (Fleer & Robbins, 2003; Robbins, 2005; Shepardson, 1999; Tytler, 2000; Tytler & Peterson, 2001).

An instructional strategy considered as inducing conceptual change in this context is cognitive conflict (Skoumios & Hatzinikita, 2005/2006), i.e. the presentation of a phenomenon or a situation that cannot be explained by the pupils' initial conceptions but may be explained by the concept that constitutes the topic of instruction (Davis, 2001), which is caused by dissatisfaction with these initial concepts (Posner, Strike, Hewson, & Gertzog, 1982). A conflict can occur from the individual’s reflection, interaction with the physical environment, or from one’s contradiction with another’s response to a problem, which is known as ‘sociocognitive conflict’ (Doise, Mugny & Perez, 1998).

Moreover, practices which are quite common in early years education, namely drama and storytelling, are considered to be valuable tools for teaching and learning science (Fadali, Robinson & McNichols, 2000; Hadzigeorgiou, 2001; Hadzigeorgiou, 2002; Hadzigeorgiou & Stefanich, 2000). They motivate children’s interest and engagement (Begoray & Stinner, 2005), connect scientific concepts with children’s experience (Hugerat, Elyian & Zadik, 2005; Yoon & Onchwardi, 2006), provide opportunities for prediction and negotiation of different viewpoints, analysis and synthesis (Farrow & Bailey, 1998), and therefore enhance conceptual change (Resnick & Wilensky, 1998).

A review of the research literature reveals that there is only a limited number of studies concerning children’s conceptions about magnetism, despite the fact that children are quite familiar with relevant phenomena, which are also typically included in the thematology of science activities in nursery schools. In regards to magnetic attraction the children tend to adopt two levels of thinking: according to the first level they simply connect different events, while according to the second they claim that an invisible force allows magnets to ‘pull objects’ (Selman, Krupa, Stone & Jacquette, 1982). Most children under 7 cannot distinguish between objects/materials that are or are not attracted by magnets; they have difficulties in
explaining magnetic attraction and attribute it to some kind of ‘glue’ possibly existing behind the magnet, or to the magnet’s ‘magical’ qualities (Barrow, 1987; Finley, 1986; Harlan & Rivkin, 2000; Ravanis, 1994; Wenham, 1995). Older children (up to 10 years) refer to ‘forces’, or ‘currents’ which pull or push. They continue to draw their explanations from everyday life and ascribe magnetic attraction to ‘some kind of electricity’, ‘air pressure’, or ‘some kind of gravity’ (Barrow, 1987).

Even after relevant teaching has taken place the children’s level of understanding of magnetic forces may not improve significantly. A possible reason for this is that teaching itself may disorient children from their everyday experiences with magnetic phenomena (Finley, 1986). Therefore it is suggested that teaching activities take into account children’s experiences and focus on hands-on experiments with magnets (Driver, 1989; Driver et al., 1994). Such experimental activities have proved to help children improve their knowledge (Ravanis, 1994) and particularly recognize the kind of material an object is made of as a criterion for its interaction with a magnet (Kakana & Kazela, 2003).

Based on these premises the present study aims at studying and comparing the effectiveness of different approaches for teaching magnetic attraction to preschool children. The different approaches shared the same objectives, namely to facilitate children to a) identify different materials (e.g. wood, plastic, metal, glass, etc.); b) distinguish and classify different objects based on the material they are made of; c) distinguish between different objects based on their attraction (or non-attraction) by a magnet; d) understand that not all metallic objects contain iron and e) distinguish between different metallic objects based on their attraction (or non-attraction) by a magnet.

**Method**

**Sample**

Three classes from urban public Greek nursery schools participated in the study. Two of the classes served as experimental groups (Experimental Group 1, N₁=24 and Experimental Group 2, N₂=25), which comprised 12 girls and 12 boys and 12 girls and 13 boys correspondingly. The third class, which served as a control group (N₃=24), comprised 12 girls and 12 boys. The average age of children in each class was approximately 5.5 years. The children participating in each group had similar socio-economic backgrounds and were cognitively equivalent; this was ensured by the fact that no teaching activities relevant to magnetism had taken place in any of the three classes prior to the study, and verified by the comparable results yielded by the pre-tests, as will become apparent in the Results section.

**Research design**

The research design adopted in this study involved individual semi-structured interviews with the children participating in the three classes prior to (pre-test) and after (post-test) the teaching interventions, in order to evaluate the respective learning outcomes. The interviews in the pre- and post-tests used identical questions in order to elicit the children’s predictions and relevant argumentation about the action (attraction or non-attraction) of a magnet on a variety of familiar
objects made of different materials (e.g. a copper coin, a plastic bottle, an aluminum key, an iron pair of scissors, etc). For this purpose they were given a worksheet with pictures of these objects and were asked to mark the ones they thought would be attracted by a magnet. The children were also asked to explain why they thought the magnet would (or would not) attract each of the objects in question. The interviews were recorded and subsequently transcribed verbatim. For the purposes of the analysis each of the participants was attributed a specific code, consisting of a number and a set of initials distinctive of the group they belonged to (for instance, the code ‘c3EG1’ stands for ‘child #3, participating in Experimental Group 1).

The teaching objectives –already presented in the previous section- were determined based on the results of the pre-test –children’s predictions and argumentation about the interaction of magnets with different objects. Also, in the case of the two experimental classes the children’s responses to the pre-test guided the selection of the material and objects to be provided to the children for experimentation during the teaching sequences. Specifically, as the pre-test revealed inappropriate attributions of magnetic attraction to the size, weight, or color of an object, the children were provided with a range of objects of the same material with varying weights, sizes, and colors and with magnets of different shapes and types and were encouraged to experimentally test their predictions.

Experimental Group 1

For the class serving as Experimental Group 1, a socio-cognitive perspective was adopted, putting an emphasis on children’s alternative conceptions about magnets and magnetic forces as well as on their collaborative experimentation and their interactions within the groups and with their teacher.

The children worked in small, heterogeneous (in respect to gender and ability) groups (Johnson & Johnson, 1985). Five different groups of children (consisting of 5-6 children each) worked at different spots in the classroom, organized so as to provide the required space and materials to be used. The children within each group were arranged in circle in order to facilitate communication.

The children initially participated in activities aiming at familiarizing them with the material of which different everyday objects are made of and at making them aware that not all metallic objects contain iron. They used various kinds of magnets, and a range objects made of wood, plastic, paper, cloth, and different metals, among which the objects used during the pre- and post-test interviews, and were left to freely explore the provided material. Subsequently they were engaged in experimental activities, planned according to their initial conceptions. In the course of these activities the children expressed, exchanged, and compared their views about the possible attraction exerted by a magnet on different objects. They collaborated sharing the material as well as their knowledge and experiences, testing different ideas, and advising their peers on how to proceed with their experiments. Special attention was given to encouraging socio-cognitive conflict, in order to challenge their initial conceptions, attributing magnetic attraction to irrelevant features of the objects and enhance their concentration on the type of material as a criterion for magnetic attraction. Therefore the teacher’s role was to facilitate communication between children and to assist them in testing their predictions based on these conceptions. In the following excerpt of a discussion
the children in one group gradually shift their concentration from the size and color of an object to the material (wood or iron) it is made of.

Example 1
Teacher: *I see that you put a piece of wood close to the magnet. What happens?*

c5EG1: *It doesn’t stick... It’s big.*
c18EG1: *It’s black, it’s not silver!*

Teacher: *Look at these pieces of wood [small, and big, black, red, and ‘silver’]. Try with these and see what happens.*
c11EG1: *The magnet pulls none of these.*
c9EG1: *Look, the magnet sticks onto the clothes-pin! Do you want to see how I made it stick? I put it on the side of the small iron here, because it wouldn’t stick on the wooden side.*
c5EG1: *Give me the clothes-pin! I want to play too!*

Each group also participated in evaluation activities and completed worksheets identifying objects with the material they are made of, or classifying (metallic) objects according to their interaction with magnets. After evaluation, each group presented their activity outcomes to the rest of the classroom.

The instruction was implemented in the course of two 20-minute sequences, which were carried out in two subsequent weeks.

**Experimental Group 2**

The instruction implemented with Experimental Group 2 also took the children’s alternative conceptions into consideration –known by the existing research literature and verified by the children’s responses to the pre-test- and combined accordingly designed activities using storytelling, hands-on experiments, and drama. Two 20-minute sequences were planned according to the objectives and were implemented in the course of a two-week period. Each sequence started with brainstorming for eliciting the relevant children’s conceptions. The teacher recorded these conceptions on a concept map. Subsequently she read a part of an especially devised fantastic story, ‘The little magnet’, with the title-role adventurous hero interacting with different material-friends and exploring his interaction with them.

After listening to the story the children participated in hands-on experimental activities, testing their conceptions about the possible attraction a magnet would exert on different objects in the classroom. In one of the activities each child tried to collect as many objects as possible using a magnet. In another the children classified different metallic objects (jewelry, tin cans, paper clips, etc.) into ‘families’, tried to guess which ‘family’ members would be attracted by the magnet, and tested their predictions. During the experimental activities the teacher played a facilitative role, by making sure that all the children had the opportunity to experiment with the provided material in small groups which worked successively, and by posing questions to be explored. These questions aimed at challenging the children’s inappropriate conceptions as recorded on the concept map.
Subsequently they participated in drama activities during which they incarnated the roles of a magnet and of different objects and interacted accordingly, representing symbolically the experiences previously gained during their experimentations.

Each sequence completed with the children helping the teacher to modify and extend the initial concept map according to the knowledge acquired during the preceding activities, and comparing their prior with their newly acquired knowledge.

In the following excerpts the children discuss while constructing (Example 2) and reconstructing (Example 3) a concept map concerning what objects / materials are attracted by a magnet:

Example 2
Teacher: Where does a magnet stick?
c20EG2: On the fridge...
c12EG2: On the wall...
c19EG2: On a glass...
c5EG2: On metals...
c8EG2: On a sword...

After they had participated in a sequence of relevant storytelling, experimental, and drama activities, the children asked the teacher to go back to the concept map.

Example 3
c4EG2: Can we write some more?
Teacher: Of course we will write. What do you want me to write? Where does a magnet stick onto? What things did you ‘catch’ with your magnets?
c15EG2: Nails...
c3EG2: Metals...
c4EG2: A lamp...
c5EG2: The magnet didn’t pull the lamp!
c4EG2 [referring to the story narrated by the teacher]: And the Little Magnet could play with all the glass things, they didn’t stick onto it!
c18EG2: A pen...
Teacher: Where did the magnet pull the pen from?
c24EG2: From the tip... It had a metal tip...and I lifted it from the front.
Teacher: What were the things you couldn’t ‘catch’ with your magnets made of?
c8EG2: Glass...
c22EG2: Wood...
c3EG2: Plastic...
c8EG2 [referring to the drama activity]: Yeah...when you were a magnet you couldn’t catch the plastic bottle!

It should be noted that while eliciting the children’s initial ideas the teacher consistently used the words and phrasing introduced by the children (e.g. the magnet ‘sticks onto’ other objects). As the teaching sequence proceeded, the teacher gradually introduced more appropriate vocabulary (e.g. the magnet can ‘catch’, or ‘pull’ various objects), which were adopted by the children.
Control Group
The children in the control group participated in a traditional, teacher-centered 30-minute activity about magnetic attraction. The teacher presented magnets as well as different objects to the whole class, posing questions and providing explanations about the interaction of different objects with the magnets. Some of the children had the opportunity to experiment with the material and announce the results of their experimentations to the others, who passively watched—although most of them had explicitly expressed their willingness to engage in the hands-on experimentations themselves. The classroom setting was such (the whole class sitting in a semi-circle) that it sometimes obstructed children from watching what others were doing. The experimentations involved only one object made of each of the different materials. The children were tightly and constantly directed by the teacher who dominated throughout the activity and provided closed questions and channelled their answers (essentially guiding them to repeat answers already provided by her). The questions asked by the teacher addressed either the whole class or individual children, and focused on the action of the magnet on different objects. Only a small number of children participated in the discussion. The final conclusion drawn by the teacher as a rule was that “the magnet only pulls things made of iron, while all other things do not stick onto the magnet”. An evaluation activity followed, during which individual children were asked to classify the objects based on the action of magnets on them (attraction or non-attraction).

Table 1 summarizes the main features of each teaching approach illustrating their differences and commonalities. Symbol ‘●’ indicates a generalized presence of a feature, encompassing all children, while ‘○’ indicates a partial use of a feature.

<table>
<thead>
<tr>
<th>Features of teaching approaches</th>
<th>Experimental Group 1</th>
<th>Experimental Group 2</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consideration of children’s initial ideas in intervention design and implementation</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Small group discussions</td>
<td>●</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Hands-on experiments</td>
<td>●</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Socio-cognitive conflict</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concept mapping</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Story-telling</td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Drama</td>
<td></td>
<td></td>
<td>●</td>
</tr>
</tbody>
</table>

Table 1. The features of the different teaching approaches
Results

The results presented in this section concern the comparative evaluation of the three teaching approaches based on the children’s responses to the pre- and post-test questions regarding the action of a magnet (attraction, or non-attraction) on different objects. These responses are considered as ‘adequate’ in the case they are accurate, or ‘inadequate’ in the case they are inappropriate (for instance “I think that the pencil will stick onto the magnet; it’s small and it’s light”, c12EG2).

The results of the pre- and post-tests implemented with the children in the three different classes are presented in Table 2.

During pre-test, a considerable number of children could not distinguish between objects that are or are not attracted by a magnet based on the material they are made of. Even in cases of correct predictions their justifications were based on inappropriate concentrations (e.g. on the size, color, or shape of objects), as is apparent in the comment of c12EG2 in the previous paragraph. The level of the children’s responses to the pre-test questions was fairly similar in the control and the two experimental groups. Some differentiations appeared in Experimental Group 2, the children of which tended to give inadequate answers more often than the children in the other groups in regards to magnetic attraction on an aluminum key, and a pair of scissors, while they made more accurate predictions concerning a plastic bottle and a sock.

The most important outcomes of the study, however, are related to the evolution of the children’s conceptions as a result of the teaching approaches implemented in the three groups. Specifically, the numbers of adequate answers increased significantly in the case of the two experimental classes, which means that their understanding of magnetic attraction improved extensively as a result of the implementation of the designed activities.

In the following Examples, excerpts of post-test interviews with one girl from Experimental Group 1 and two children (a girl and a boy) from Experimental Group 2 are presented.

Example 4
Researcher: What do you think will happen if you hold the magnet close to the pair of scissors?
c5EG1: The magnet pulls the scissors.
Researcher: Why do you think this will happen?
c5EG1: ’Cause [the pair of scissors] is made of iron.

Example 5
Researcher: Can the magnet pull this ring?
c20EG2: No, because it’s made of gold.
Researcher: And the magnet cannot pull golden things?
c20EG2: No, they’re like the earrings and the ring you are wearing.
<table>
<thead>
<tr>
<th>Materials and objects</th>
<th>Experimental Group 1</th>
<th>Experimental Group 2</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adequate</td>
<td>Inadequate</td>
<td>Adequate</td>
</tr>
<tr>
<td></td>
<td>Pre-test</td>
<td>Post-test</td>
<td>Pre-Test</td>
</tr>
<tr>
<td>1. Metal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>aluminum key</td>
<td>23</td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td>copper coin</td>
<td>12</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>golden ring</td>
<td>11</td>
<td>24</td>
<td>13</td>
</tr>
<tr>
<td>iron scissors</td>
<td>18</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>2. Paper book</td>
<td>10</td>
<td>24</td>
<td>14</td>
</tr>
<tr>
<td>3. Plastic bottle</td>
<td>8</td>
<td>24</td>
<td>16</td>
</tr>
<tr>
<td>4. Wood pencil</td>
<td>8</td>
<td>24</td>
<td>16</td>
</tr>
<tr>
<td>5. Glass light bulb</td>
<td>11</td>
<td>24</td>
<td>13</td>
</tr>
<tr>
<td>6. Cloth sock</td>
<td>17</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>118</td>
<td>216</td>
<td>98</td>
</tr>
</tbody>
</table>

Table 2. Pre- and post-test results corresponding to the three instructional settings
Example 6
Researcher: *So, do you think that the magnet can pull the coin?*

c8EG2: *No, it can’t. Because the Little Magnet couldn’t pull Mrs. Euro, either.*

On the other hand, the frequencies of adequate (and inadequate) answers roughly remained stable in the control group. What is more, some of these children regressed in a number of cases; after the teaching activity they were more likely to give inadequate answers than they were before, predicting that an aluminum key, a copper coin, a golden ring and a sock would be attracted by a magnet, while an iron pair of scissors would not. One of the possible reasons that the children in the control group regressed in their predictions during the post-test is that they adopted a generalized conception considering all metallic objects as ‘iron’, which was based on their observable and characteristic shine.

**Discussion**

In the study presented here three different approaches were described and compared concerning teaching magnetic attraction to pre-school children. Two of them were specifically designed to take into account children’s conceptions based on inappropriate empirical concentrations. The third approach involved traditional teaching common in everyday practice even nowadays.

The experimental classes yielded significant learning outcomes, showing a considerable improvement in children’s conceptions and predictions about the action of magnets on different things. This finding is in support of the argument that preschool children can develop their understanding of aspects of the natural world when engaged in appropriately designed and systematic activities (Eshach & Fried, 2005; Havu-Nuutinen, 2005; Ravanis, 1999; Tytler & Peterson, 2003).

Apart from their accurate predictions, the children in the two experimental groups also developed the quality of their argumentation significantly. Prior to the teaching activities, even correct predictions often revealed alternative conceptions in children’s thinking, since they were based on inappropriate features of the objects, such as their weight or size. After the interventions, however, the vast majority of the children correctly attributed the interaction of the objects with the magnet to the material they are made of (see Examples 4 and 5 in the previous section).

A common feature of the two experimental settings was their hands-on orientation, encouraging all the children in each class to experiment with magnets and real-life, familiar objects like books, wooden pencils, golden or silver jewellery, iron paper clips, coins, etc. Such practical activities took the children’s experiences into consideration and thus set a familiar and recognizable context (Driver et al., 1994; Finley, 1986) that oriented children towards appropriate concentrations and criteria for predicting and explaining magnetic attraction (Kakana & Kazela, 2003) and therefore encouraged conceptual change (Skoumios & Hatzinikita, 2006). During post-test the children based their answers to the
questions on their newly acquired knowledge and justified them on the basis of formal causality and of their experimentations during the teaching activities. A typical example is the justification provided by a child participating in Experimental Group 1: “the pencil will not [be attracted by the magnet] because it is made of wood [...]. I’m sure, I’m telling you, because I’ve done it and I’ve seen it” (c19EG1).

On the other hand, the traditional approach adopted in the control group failed to assist children in developing their understanding and overcome their alternative conceptions; this finding is in accordance with previous research outcomes (e.g. Kang et al., 2004). Therefore, the number of adequate answers did not significantly increase during the post-test, in fact new confusions often arouse, like the identification of all metals with iron. The insignificant learning outcomes of the traditional approach could be attributed to the pervasive role of the teacher who directed the discussion and experimentations without paying attention to the possible difficulties the children faced, or to their inadequate conceptions based on prior experience. Moreover, not all children had the opportunity to engage in hands-on activities with magnets, or to participate in the relevant discussion, which was teacher-dominated and particularly oriented to eliciting the ‘correct’ answers.

Furthermore, apart from the very significant learning outcomes of the two experimental teaching sequences, notable and interesting differences emerged between the corresponding classes. In Experimental Group 1 conceptual change was mainly determined by the interaction, experimentation and collaboration between children in small groups. In order to stimulate socio-cognitive conflict this approach was based on identifying children’s initial conceptions, confronting their predictions with discrepant observations, and encouraging discussions within the groups in order to put contradictory arguments in conflict (Limón, 2001; Skoumios & Hatzinikita, 2005/2006).

In Experimental Group 2 the children’s conceptions and misinterpretations were also taken into account in designing the sequence of activities. The construction and re-construction of a conceptual map before and after the teaching activities correspondingly helped the children not only express their conceptions, but also observe and realize their development. Moreover, the affective dimension seemed to be prevalent in this approach; the motivation created in children through the storytelling and drama activities played an essential role in stimulating children to be involved in the process (Begoray & Stinner, 2005). The story of the Little Magnet provided a context for the children’s subsequent experimentations, by encouraging them to formulate and test their predictions (Hugerat et al., 2005; Yoon & Onchwari, 2006). They represented symbolically the phenomenon of magnetic attraction by using their bodies, which probably materialized and thus strengthened their newly-built knowledge in a lively and personified way. Apparently these features operated as determinant factors for conceptual change (Skoumios & Hatzinikita, 2006).

In conclusion, each of the two experimental approaches has its relevant strengths and qualities, and can yield promising learning outcomes. Besides, a selection and combination of features and activities of the two approaches might
be beneficial according to the specific conditions of a class, such as the preferred teaching styles, or the individual children’s learning profiles. This issue, however, requires further research to determine which parts of each approach would be more favorable under varying circumstances.
References


