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Contemporary teaching methods and science content knowledge in preschool education: searching for connections

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Curriculum implementation

Distance between the official curriculum of preschool education and the applied curriculum (Kallery & Psilos, 2002)

Some of the components responsible for the poor teaching of science concepts in preschool education:

- insufficient content knowledge or alternative ideas (Lawrenz, 1986; Kruger & Summers, 1988; Kallery, 2004, etc.)
- lack of confidence (Harlen & Holroyd, 1997; Yoon & Onchwari, 2006)
- doubt about the benefits of science teaching (Eshach & Fried, 2005)

Greek Curriculum

- 1989 – 2003: “Activities manual for the Kindergarten – teachers’ guide”
  - Piagetian theory
  - 5 units of child development (knowledge fragmentation)
- 2003 – present: “Cross-thematic curriculum framework for kindergarten”
  - Interdisciplinary pedagogy
  - Holistic approach of the knowledge
  - Emphasis on procedure

«Science» in the curriculum

- In the unit “Nature and Interaction”
- Description of two indicative themes (“Water” and “My neighborhood”)
- Possible activities under the theme “Water” pertain to Science teaching

Sinking/Floating and Evaporation:

Only two introductory questions

» Put some snow in a cooking pot. What do you observe?

» Put a pebble and a rubber toy in a basin with water. Do they float or sink?

The study

Focus

- Teachers' methodological choices to teach Sinking/Floating and Evaporation
- Teachers' content knowledge on Sinking/Floating and Evaporation

Aim

To investigate:

- the teaching strategies teachers use to Sinking/floating and Evaporation, and
- the influence of the content knowledge on the teaching strategies

Method

Sample

20 preschool teachers in public schools, in Attica, Greece.

Procedure

- Semi-structured interviews (av. duration = 18 min.)
  - relation with science teaching
  - feelings about their sufficiency on this subject
  - detailed description of the usual approach of Sinking/floating and Evaporation
- Questionnaire
  - 14 questions concerning the content knowledge; simple science issues that can be approached with young children in a preschool classroom

1. Sample

- 20 women, 2 - 29 years of working experience (mean = 11.4).
- Studies: 16 have graduated from Pedagogical Departments (4 years) and 4 from a 2-year Pedagogical Academy
- Familiar curriculum: 7 with the current curriculum; 13 with both.

Results

2. General aspects on science teaching

- Helpful University Science Education courses: **None**
  [Personal inquiry and exchange of ideas is what helps most.]
- Insecurity when dealing with science concepts: **6**
- Difficult for the children to understand: **5**

  It depends on the way they "teach" each concept and its appropriateness: **15**
- They **all** approach science concepts in their classrooms:
  - water cycle (20)
  - melting/freezing (18)
  - sinking/floating (18)
  - evaporation (18)
- According to the current curriculum: **20**

  Still using the old curriculum: **6**

3. Teaching Sinking/Floating

Each year: **13**, only once: **5** (4 to 6 years), never: **2** (4 and 8 years)

- Emerges by the children: **3**
- Part of a theme: **15**
  - Theme: “Summer” (7), “Water and water cycle” (5), “Planting seeds” (2), it can stem from different events and more than once during the school year (4).

Begin the approach

- Questions to incite children’s interest: **17**
- Narration: **8**

Procedure

- Children put different materials in a basin with water: **15**
- The teacher puts different materials: **3**

Discussion

- which materials sink and which float

Table to classify the materials they used during the experimentation.

4. Teaching Evaporation

Each year: **18**, not yet: **1** (4 years), never: **1** (3 years)

- Part of the theme “Rain and water cycle”: **18** (always connected with the rainfall season)

Begin the approach

- Questions to incite children’s interest: **19**
- Predictions: **6**

Procedure

- The teacher performs the experiment that uses a cooking pot, something to warm the water and a plate to help the steam condense into water again: **18**

Discussion

- Only after the observation of the experiment: **12**

Paint the “water cycle”.

- Combine evaporation with melting/freezing, treating them as one concept, the concept “water”: **5**

5. Analyzing teaching strategies

Two basic categories that describe the teaching strategies:

"Empirical" approach

- Information through the senses
- Simplified knowledge
- Experiment = demonstration
- No systematic observation and reasonable conclusions
- Inappropriate questions (that reveal alternative conceptions)
- Teacher *transfers* knowledge and interprets the results.
- References to the piagetian theory (materials, reasoning skills and previous children's ideas).

5. Analyzing teaching strategies

"Contemporary" approach

- Children's predictions
- Systematic experiment and observation
- Test of children's predictions ⇢ conclusions
- Teacher facilitates investigations
- Appropriate equipment
- Processes that facilitate learning (cooperative learning, symbolic representations, language etc.)

5. Analyzing teaching strategies

Concept	**“Empirical”**	**“Contemporary”**
Sinking/Floating	63	10
Evaporation	34	8
Total	97	18

Table 1. References to the two categories from the descriptions of the approach of the two science concepts

Results

6. Content Knowledge (score: 5.02)

Sinking/Floating Score: 4.17

	"Empirical" (number of references)	"Contemporary" (number of references)	Content knowledge (scale 1-10)
1	4		5.7
2	5	1	7.1
3			7.1
4	3	2	2.8
5	4	1	1.4
6	4		2.8
7	6		2.8
8	1		10
9	2		4.2
10	1	2	2.8
11	1		1.4
12	4		7.1
13			0
14	5	1	7.1
15	3	2	2.8
16	4	1	1.4
17	4		2.8
18	6		2.8
19	2		4.2
20	4		7.1

Results

6. Content Knowledge (score: 5.02)

Evaporation Score: 6.02

	"Empirical" (number of references)	"Contemporary" (number of references)	Content knowledge (scale 1-10)
1			2.8
2	2	1	4.2
3	2		7.1
4	2		4.2
5	3		8.5
6	2		7.1
7	1	2	7.1
8	2		10
9	2		2.8
10	1		4.2
11	3		2.8
12	1		10
13		2	5.7
14	2	1	4.2
15	2		4.2
16	3		8.5
17	2		7.1
18	1	2	7.1
19	2		2.8
20	1		10

Discussion

on science teaching

- Recognize the importance of teacher's role to design appropriate activities
- Have not discarded the "old" curriculum
- Neglect children's predictions
- Extended use of narration
- Stereotype procedure
- Non-systematic experiment process
- Combination/confusion of different concepts

Discussion

on content knowledge impact

- Not an immediate connection between the teaching strategies and the content knowledge
- The teaching practice is so well established, that it is not significantly affected by the content knowledge
  - One must examine all the components that are reflected on the teaching practice (teachers' attitudes, beliefs and perceptions which can all lead to inappropriate teaching choices)

Next step:

Collect data through observation

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Thank you for your attention!

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