



# SCIENCE EDUCATION DURING PRESCHOOL YEARS A CULTURAL-HISTORICAL APPROACH

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# Introduction

- ⦿ Education has immediate connection with science and culture not as “accomplished”, “finished” products of the past, but as processes of continuous evolution and interaction.
- ⦿ Concepts are considered as a cultural-historical product of the wider community, transmitted to the subject by instruction.
- ⦿ The learners’ actions can be understood in terms of a concept acquired by the subject which makes sense of a whole system of their actions.

# Introduction

- ⦿ Vygotsky considered concepts as units of a culture and claimed that the level of development of scientific concepts forms a zone of proximal possibilities for the development of everyday concepts.
- ⦿ There is a complexity within the social (societal-political) practice that can appear even at education in the early years. In bringing the dialectic of agency, passivity, resources, schemas to educational context, tensions may arise in the form of contradictions that need to be resolved.

# Concepts & Scientific concepts (Blunden, 2013)

- ⦿ 'A concept is a form of action organized around a word acting as a sign for it, which is the basic unit of a culture or project and a unit of the consciousness'.
- ⦿ An actual concept matures gradually through practical life experience. This idea of 'concept', as a line of development includes both mature forms and abstract, immature and undeveloped forms and is consistent with dialectical logic and with his own genetic method.

## CONCEPTS OF CHAT SESSION

# The development of Concepts during childhood

A concept is a form of

Concepts are formed to  
solve some problem.

Concepts formed in childhood  
are generally not *true* concepts.



# Concepts & Scientific concepts (Blunden, 2013)

- ◎ Conceptual knowledge develops through the philosophical concepts of Abstract and Concrete. The contrast between abstract and concrete does not mean the contrast between a theoretical idea and practical reality, but both words may have seemingly opposite meanings in different contexts.
- ◎ Thus the abstract concept of the whole (in terms of theoretical conceptions) becomes more and more concrete in the development of concepts into a practical and scientific theory – “a reproduction of the concrete by way of thought.”

# Concepts & Scientific concepts (Blunden, 2013)

- ⦿ For Vygotsky, words are the most important mediators:

“Fundamental to the process of concept formation is the individual’s mastery of his own mental processes through the functional use of the word or sign” (Vygotsky, 1987, p. 132)

# Concepts & Scientific concepts (Blunden, 2013)

- ① The child or young person's actions can be understood in terms of a concept acquired by the subject which makes sense of a whole system of their actions.
- ① A concept is a form of activity. Although Activity Theory, was only founded by A. N. Leontyev only after Vygotsky's death, Vygotsky's concept of concept played the same role in his psychology: - that which provides the motivation for actions and allows the observer to make sense of a subject's actions.
- ① A concept is a cultural-historical product of the wider community, transmitted to the subject by instruction.
- ① Vygotsky further supports this proposal by means of occasional observations about the cultural and historical development of concepts. Concepts are in the first place units of a culture, from which they may be acquired by an individual.

## CONCEPTS OF CHAT (A. BLUNDEN)

# The development of Concepts during childhood

- Syncretic concepts
- Complexes
- Pseudoconcepts
- 
- Potential concepts
- Pre-concepts



# Concepts & Scientific concepts (Blunden, 2013)

- ⦿ Artificial concepts are concepts “that are formed under experimental conditions” (Vygotsky, 1934, p. 51).
- ⦿ The types of concepts whose formation can be created under laboratory conditions are potential concepts, syncretic concepts, complexes (chain complexes, diffuse complexes, collection complexes and pseudoconcepts) and pre-concepts.
- ⦿ Complexes are the simplest form of ‘concept’ in which a subject abstracts empirical features from objects or situations and connects them with features abstracted from other objects or situations. Vygotsky developed the concept of complexes, or ‘complexive thinking’ by use of the method of dual stimulation applied in Leonid Sakharov’s experimental study of concept development, described in Chapter 5 of Thinking and Speech.

# CONCEPTS OF CHAT (A. BLUNDEN)

## Syncretic concepts

Isolate object from background and name it.

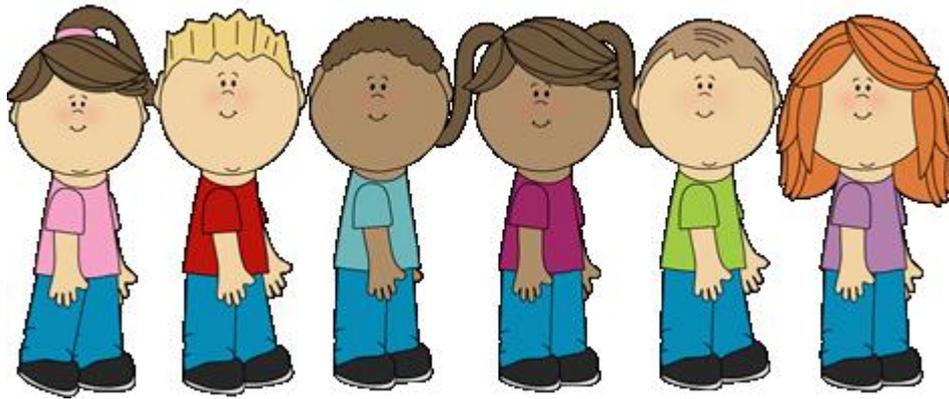


- Incoherent Heap
- Subjective series
- “Those there”

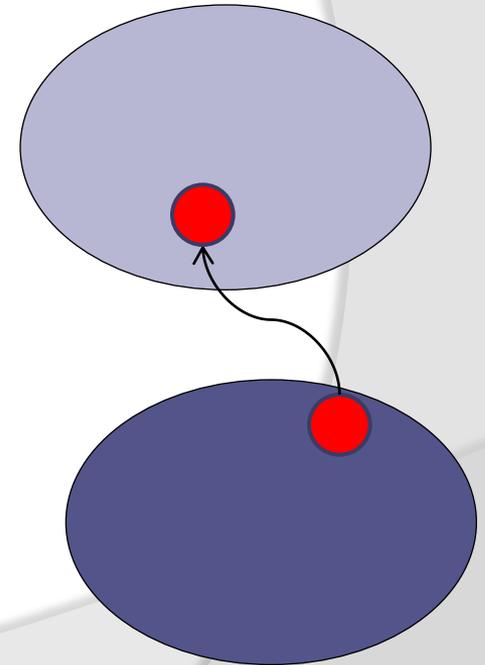
# CONCEPTS OF CHAT (A. BLUNDEN)

## Complexes

*Abstract a feature and group objects according to the same feature.*



- Chain complex
- Associative complex
- Collection complex
- Diffuse complex



# CONCEPTS OF CHAT (A. BLUNDEN)



## Pseudoconcepts

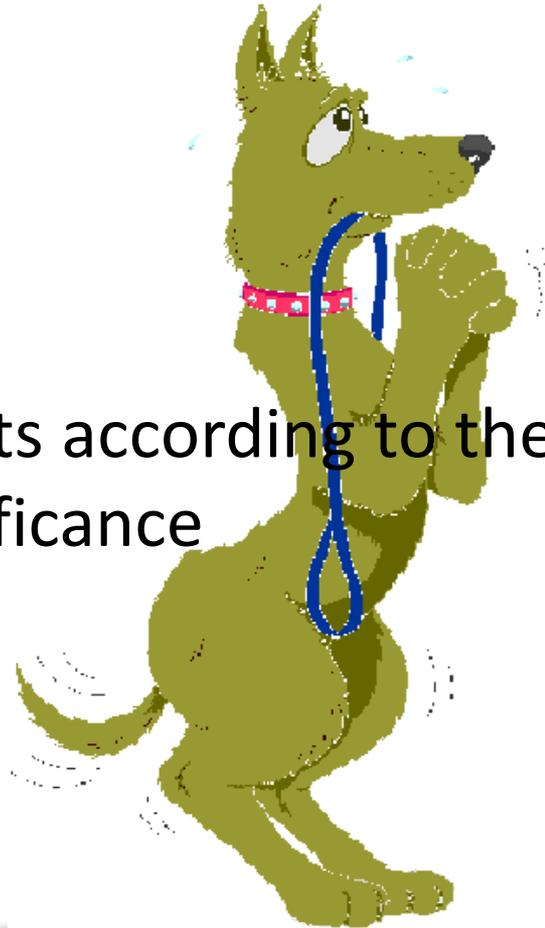


to form complex under guidance of others' word use.

# CONCEPTS OF CHAT (A. BLUNDEN)

## Potential concepts

to isolate objects according to their functional significance



# CONCEPTS OF CHAT (A. BLUNDEN)

## Pre-concepts



to reason within a finite set of objects according to rules

# Concepts & Scientific concepts (Blunden, 2013)

- ◎ Vygotsky (1987) is known for his analysis of the interplay between everyday and scientific concepts and for his account of development from collections to complexes and eventually to formal concepts. However, with regard to the mechanism of concept formation, Vygotsky's idea of double stimulation is of central importance. In the theory of double stimulation, the initial stimulus situation involves a conflict of motives. The conflict is resolved by invoking a neutral artifact as a second or auxiliary stimulus, which is turned into a mediating sign by investing it with meaning.

## CONCEPTS OF CHAT (A. BLUNDEN)

### Spontaneous, True and Actual Concepts



Ideal lines of development,  
not types of concept



# Concepts & Scientific concepts

## Roth, Goulard, Plakitsi, 2013

- ⊙ The development of concepts and categories is dialectically connected with moments of change
- ⊙ The concepts and categories embody change as an inner element and as a result, they reflect difference. Thus, cannot be self-identical, they are always different.

# Scientific concepts within a cultural historical frame

Cross-disciplinary approach in the early years curricula of Science Education

Physics

Biology

Chemistry

Environmental  
Education

Education for  
Sustainable  
Development

# Scientific concepts within a cultural historical frame

Concepts are approached within the five learning frames:

1. Games
2. Routines
3. everyday life situations
4. explorations
5. organized learning activities

All units are dealt through a horizontal linking and not as independent fields of study and furthermore, they are connected with society and culture.

# Development of scientific concepts in the early years curriculum

- ① Science curriculum in early childhood education gives children the opportunity to understand their surroundings, which in fact are their lifeworlds.
- ① By observing the movement of the leaves in the trees, the children have a material object as a resource that provides the opportunity to:
  1. talk about their experience, which is something that they cannot directly see (e.g., air/wind), but which is present, and they can prove it and provide evidence of its presence
  2. explain the phenomenon (air/wind) and contrast it with another way of seeing the world
  3. perceive and comprehend the phenomenon, that is, now they have more resources for talking about the natural phenomenon that is part of their studying.

## Development of scientific concepts in the early years curriculum

- ⦿ As a next step, emerging topics have to be studied in depth, which means that children will be involved in structured activities mediated by artifacts.
- ⦿ Artifacts provide resources to structure activities, mediate conversations, prepare and set up scenarios in which actions and conversations about scientific concepts may unfold.

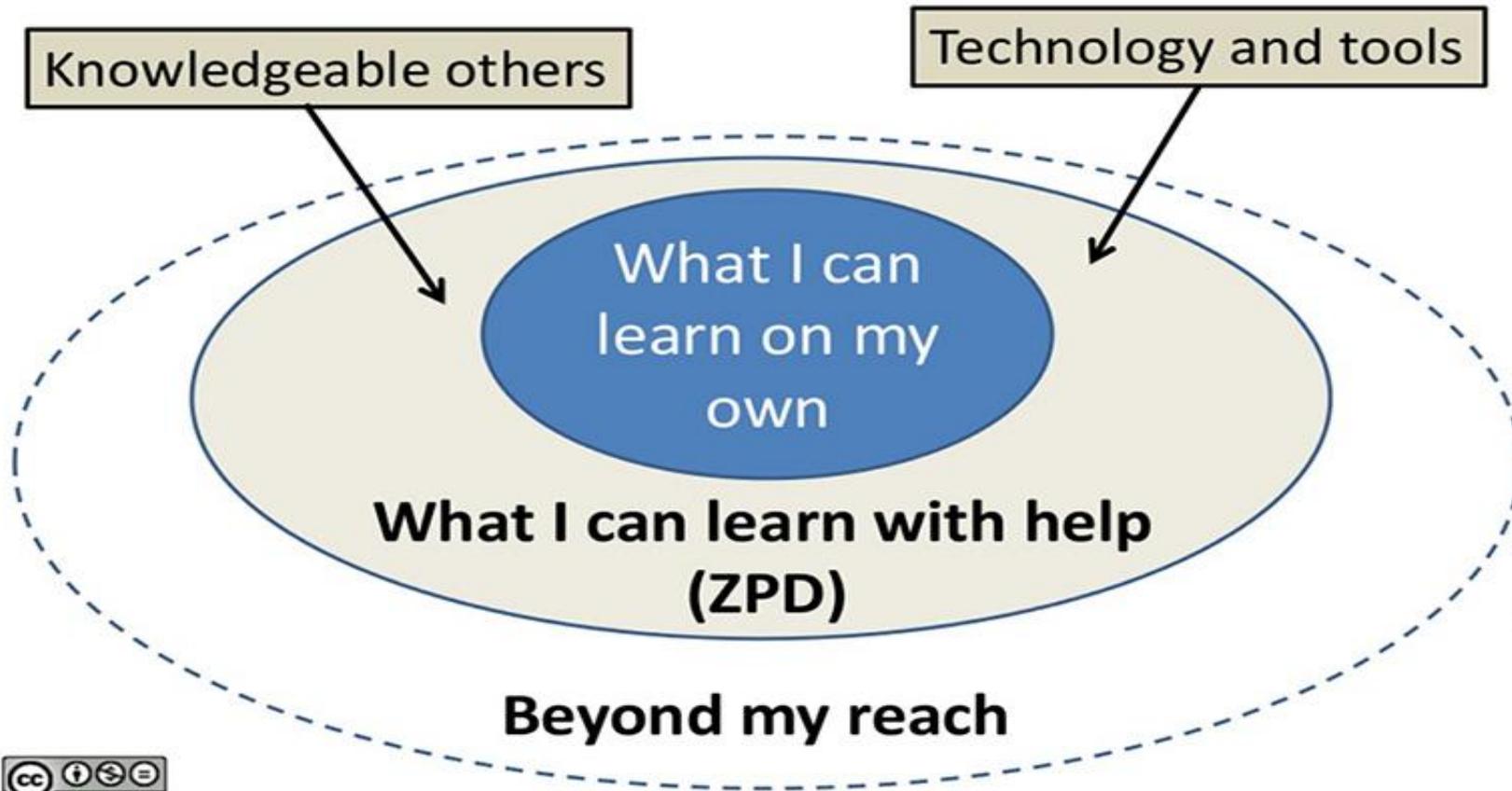
# Development of scientific concepts in the early years curriculum

## **The teacher:**

- ⦿ engages in an authentic dialogue with the students
- ⦿ gives students the opportunity to experience scientific concepts through investigation
- ⦿ encourages students to share their questioning, activates their curiosity about the world while offering them space for investigating these topics together
- ⦿ looks for resources that enable teachers to improve their pedagogical practices
- ⦿ takes into account the students' point of view, that is, the way they perceive their environments
- ⦿ reinforces students' ideas as well as participative thinking

# Zone of Proximal Development

## ZPD and scaffolding



# Cultural Historical Activity Theory framework in Science Education

- Cultural Historical Activity Theory (CHAT) focuses on the connection of school instruction with everyday life and provides artifacts and approaches for analyzing collective activity, interactions within a community of practice and structural change and development
- The unit of analysis is the activity which includes the person or group who is acting towards an object, following certain rules and the dynamic relationships that develop within the activity system
- Contradictions that occur include the possibility of changing the learners' opinions and consist of important issues in the process of the collective learning

# SCOPES: A methodological tool for Science Education

SCOPES includes the key research terms that have been used by the @fise research group for a decade in a series of research studies:

- ⦿ Systems of activity
- ⦿ Contradictions
- ⦿ Outcomes
- ⦿ Praxis
- ⦿ Expansive learning
- ⦿ Science education.

Within this frame, scientific learning in the early years is developed in expansive learning cycles, involves object-oriented activities that seek for an outcome, combines theory and praxis and finally focuses on the analysis of contradictions in the activity systems. Scientific knowledge is considered a result of human actions connected with real life situations and affecting the contemporary world in which learners live.

# SCOPES: A methodological tool for Science Education

- The SCOPES framework can serve as a tool for designing and analyzing formative interventions

**Researchers**

- whose interests are: science education, formal, non-formal or informal, and intend to design an appropriate intervention in order to measure qualitative results

**Practitioners**

- making their science teaching meaningful to their audience and providing means for the design and evaluation of their interventions

**Policy makers  
Curriculum  
developers**

- transcend from the persistent focus on the acquisition of knowledge expecting cognitive outcomes to a more dialectical approach of an object-oriented activity leading through mediation, participation and interaction to learning outcomes considering both the individual as well as the social

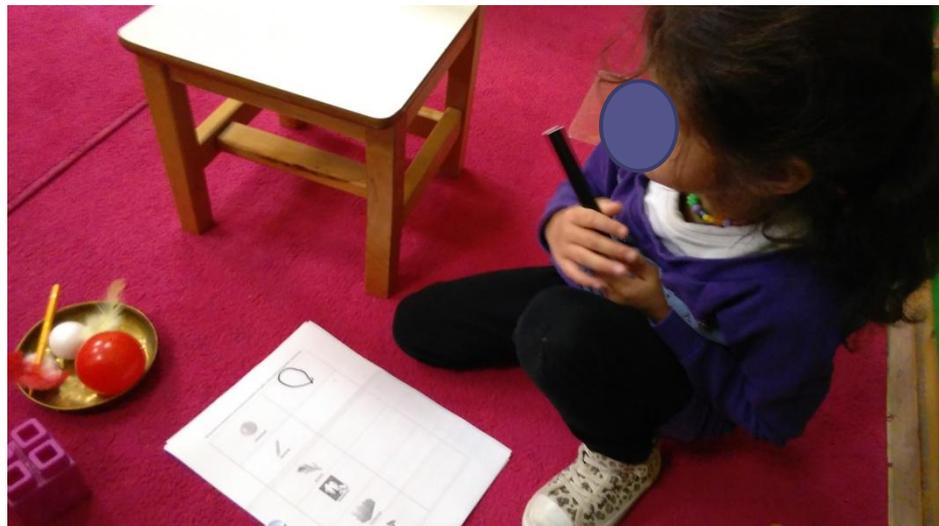
# Scientific concepts within a cultural historical frame





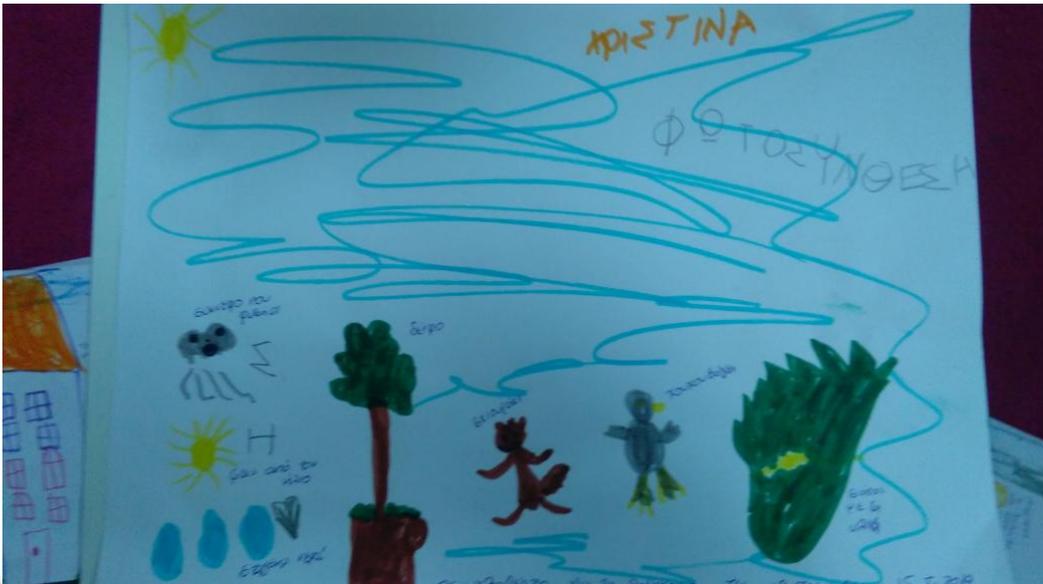
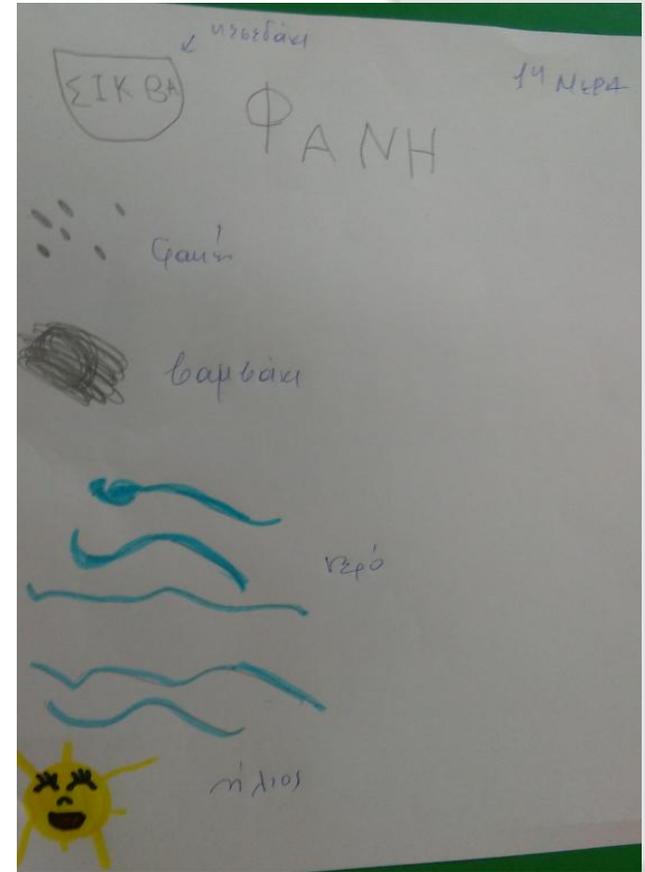


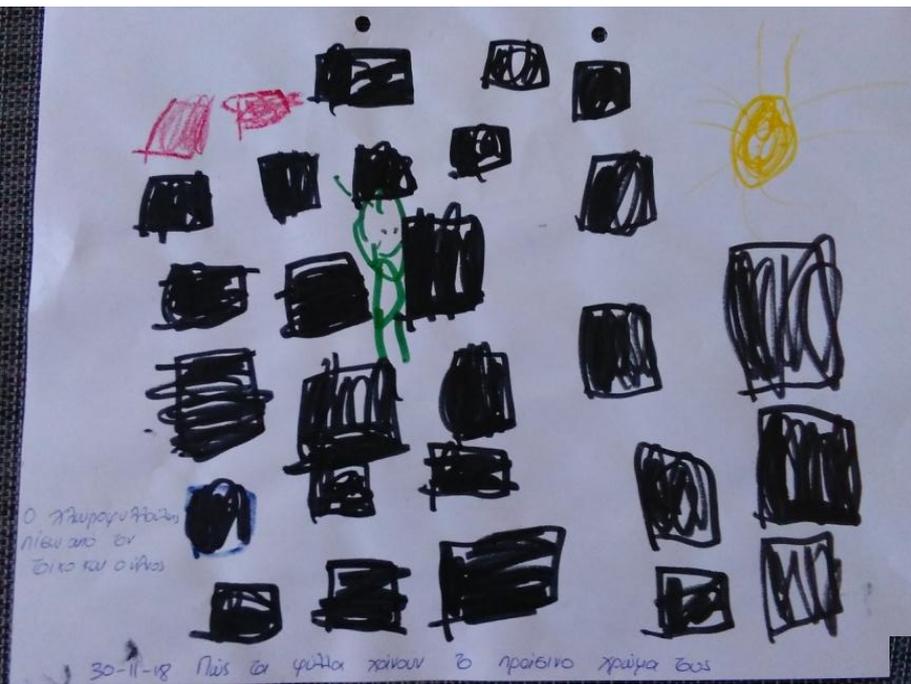








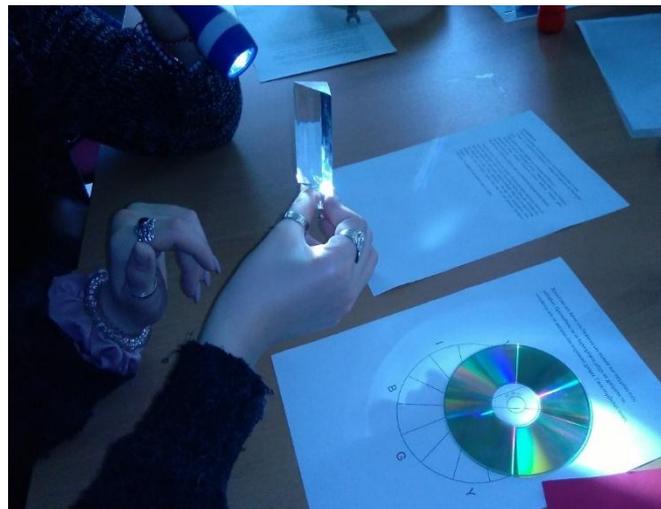


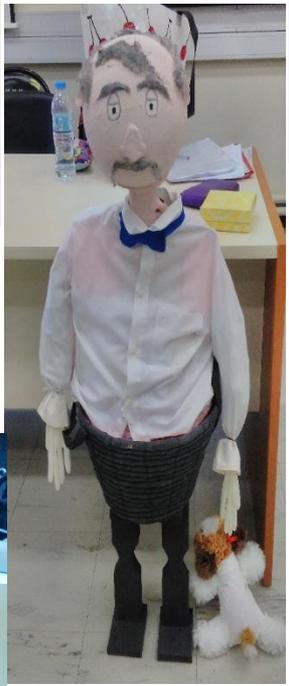






# UOI Lab lessons and Internship







# Expanding the learning community

Όμα: Έξυπνα - Παρασκευή Π/σπα

Όνομασία βοτάνου	Λεβάντα
Περιγραφή	Η λεβάντα είναι ένα δικοτύλο φυτό που ανήκει στο γένος <i>Lavandula</i> το οποίο περιλαμβάνει 28 είδη φυτών. Είναι φυτό αειθαλή και ιδιαιτέρως αρωματικό. Έχει αβρροειδή διατάξη των άνθη της ενώ η κορυφή της βλάστησής είναι θριαμβική. Η ανθοφορία ξεκινάει τον εαρινό μήνα και συνεχίζεται μέχρι τον Σεπτέμβριο.
Το συναντάμε	Τη συναντάμε στη Μεσόγειο σε βραχώδεις και αβρροειδείς περιοχές. Επίσης εκτιμάται στη Βόρεια Αφρική, την Ευρώπη και την Δυτική Ασία.
Χρησιμότητα	Η χρήση της είναι καλλυπτική και φαρμακευτική. Έχει δραστική επίδραση στην εντερική οδού, η οποία εκζέται, προκαλώντας διάρροια, φάρμακα πικρία.
Ζωγραφίζω το βότανο	



Αναγνωρίστε στοιχεία αρχιτεκτονικής ενός τοπικού σπιτιού της περιοχής



Τοποθετήστε τα παρακάτω αρχιτεκτονικά στοιχεία στο κατάλληλο σημείο της εικόνας:

1. Ξύλινη πόρτα με στέγη	6. Ξυλοδεσιά
2. Φαλτσογωνιά	7. Λακωνάρια
3. Πέτρινος ανλόγωνος	8. Πεζούλα
4. Κεραμοκρή επιγραφή	9. Ανακουφιστικό τόξο
5. Στέγη με οριζοστάσια	10. Καλντερίμι

# Discussion

- ④ Early childhood education involves a complexity of a social (societal-political) practice that is possible even with the youngest of children. Motivation includes challenge in order to satisfy the need for achievement, choice and independence in students' learning, expansion of learning community through out of school activities as well as support and encouragement by the family, the peer group and the teachers.
- ④ The modern learning environments constitute multicultural learning communities, in which learners are asked to work effectively within different groups – learning communities. This process emphasizes on the importance of the cultural behavior of tools, being supported by the analysis of human activities

## Discussion on early years Science Education within a cultural-historical frame

- ⦿ What is required for the teacher and the students to expand the activity of learning in Science Education?
- ⦿ How does a teacher consciously and unconsciously conduct her/himself in and toward this trajectory?
- ⦿ What are the conditions that permit the emergence of a curriculum based on scientific concepts connected with the socio-cultural background of the learner?
- ⦿ If we consider concept formation as crucially dependent on cultural mediation what is the role of cultural artifacts, including signs?

Благодарю вас за внимание!  
Thank you for your attention!  
Ευχαριστώ για την προσοχή σας!

