



Curriculum Materials

Learning Journey

Floating Boats

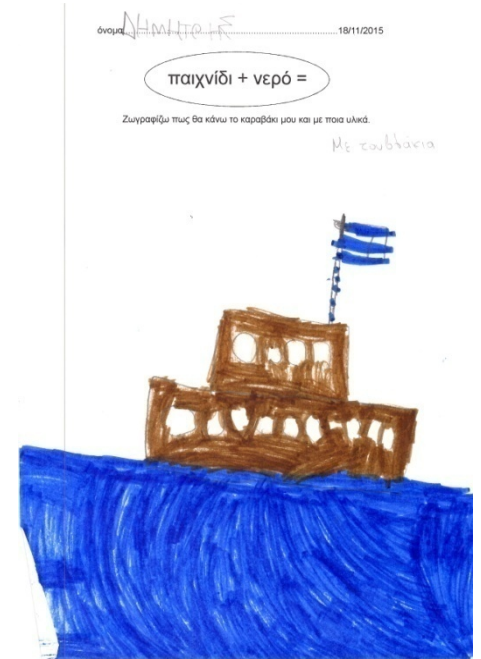


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Learning Journey Floating Boats



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Floating boats

Setting the Scene

Focus

The focus of this project is on children:

- **designing and planning investigations;**
- becoming familiar with and practicing **gathering evidence** with precision;
- developing opportunities for collecting **data** in order to develop **explanations.**

Rationale

The children were familiar with working in groups, but did not know how to **plan and organize an investigation.** Therefore **the motivation** for this new knowledge was intense and I needed to build on their **enthusiasm** for their **explorations** and subsequent **investigations.** I needed to encourage children **to reflect and evaluate** their actions not because I imposed this but because the inquiry procedure itself and its principles promoted it.

The implications for my planning and teaching were to strengthen children's **reflection and reasoning** through new experiential activities. **Observation and recording of data** were catalytic factors designed to give impetus for children's creative thoughts and actions. Children would have opportunities to **evaluate their actions** directly and spontaneously - prompted as a result of the active learning process.

Group cooperation would be fostered through encouraging direct exchange of ideas, sharing observations and interactive control of results. So knowledge and ideas would come naturally and would be unconstrained.

Links to CEYS Framework

Learning activities:

- Designing and planning investigations
- Gathering evidence
- Explaining evidence

Creative dispositions:

Curiosity, Ability to work together

Synergies:

- Assessment for learning
- Reflection and reasoning
- Motivation and affect

Contextual factors: Group work

Background

Age: 5-6 years old

School setting: *It is an urban school with two classes.*

School policy for science: *We follow the official national curriculum.*

Curriculum links :

- Children get to know and utilize scientific methods.
- Children learn to collect, compare data and draw conclusions.
- Children evaluate their thoughts and results of their actions.

Overview of the sequence of activities

Starting points

These first activities are designed to provoke children's interest and elicit their ideas in order to identify main issues and then to proceed to solving problems.

1. **What we know about water.** On the occasion of the visit of an alien in our class we list children's current knowledge about water.
2. **Children set their first goal.** They express their need to play with water and draw what they want to do.
3. **Free exploration with water.** The children play freely outdoors with water. I observe, ask questions and photograph their actions. Then, children draw what they really did.
4. **Children set the second goal.** After negotiation children decide to construct boats.

Learning journey

Children, divided into small groups, start a series of exploratory activities to construct a floatable boat.

1. **Constructing boats:** Children construct boats they assume are floatable. They test them in water, make observations and draw conclusions.
2. **Evaluation:** After discussion and evaluation children decide on the most successful boat model.
3. **How much time should we wait for?** Children ascertain that time is a key variable in the flotation/sinking process of an object. Some objects float initially, but after a short or long time sink. Why?
4. **How to run an inquiry?** Children express views on how to measure/control the time and after my prompting watch a relevant [video animation](#).
5. **Inquiry design:** Children, after reflection, decide to try one by one some objects to see if they sink or float in water, by controlling the key variable of time. They notice that they also have to hold a kind of diary of their observations.
6. **Designing the diary:** Children, with my help design on the computer an observation sheet which takes into consideration the variables of time and kind of object.
7. **Inquiry procedure:** Children, always divided into teams, carry out a series of investigations, record and evaluate their observations. They plan their next moves based on their evaluations.
8. **Compare data and conclude:** Children present their results in plenary, compare them and express final conclusions. They also dramatize them.
9. **Boats construction:** Children based on the conclusions drawn from their inquiry processes, plan and construct floatable boats.

Developing the learning journey: Starting points 1

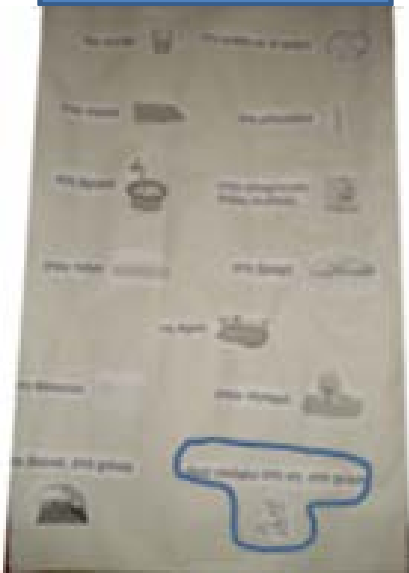
I am Mouts Mouts
and I want to learn
everything about
water.



Activities : What we know about water

An alien-muppet appears and spontaneously children ask him who he is. He says his name and asks them to help him understand what is this element he has landed in. He gives children some clues but not the name because he does not know it. Children figure out that he describes sea and its water. At once children start to tell him everything they know about it.

Where we can
find water



What water does and
what we can do with
water



Rationale: to activate
children's **motivation and
interest** about the subject
of water.

Children's emotional
connection with the
subject activates
their learning
motivation.

Children extend the discussion
into activities they would like to
do with water.

Developing the learning journey:

Starting points 2

Activities: Children set their first goal

Children are talking about games they can do with water. We record their ideas and decide by vote which will be implemented first. Then they draw the game they will do.

Rationale: To encourage children to crystallize their ideas and become more specific in their actions.

Children begin to set goals and to shape the course of their activity.

I realize that when the object of learning has meaning and fun, then the children **express more creative ideas.**

Παιχνίδι = Νερό + παιχνίδι (Είρων)
Νερό + χιονοπόλεμο (Μάρις)
Ένα παιχνίδι που να λιώνουμε το χιόνι (Κατερίνα)
Χιόνι να το ζυγίζουμε με ζυγαριά (Στέλμα)
1. Να βουτάμε την βρύση να τη γεμίζουμε νερό, να ρίξει παιχνίδια και να παίζει (Ανδρέας)
Να γεμίσει με ένα παιχνίδι με νερό για να εινάει (Μάρις) - Νερό + παιχνίδι
Νερό + ζυγαριά: Βάζουμε νερό στη ζυγαριά και τη βάζουμε και να πετάει το νερό (Βαγγελία)
Συμπεριβαίνει: Μια βατσουλά με ζυγαριά και νερό που κρέμεται (Ελευθερία)
Χιονοπόλεμος (Σάνια)
Να ρολοιμίσσει (Σταύρος Φ)
Μπουμπουλί (Ανδρέας) (Είρων) (Μαρία) (Βαγγελία)
2. Νερό + παιχνίδι (Μάρις) + παιχνίδι (Είρων)
Φυσική νερό + παιχνίδι Νερό + παιχνίδι (Βαγγελία)
Νερό + κύβος = αστεράκι (Στέλμα)



What are the games we can do with water?

Draw what "water+game" means to you

They have the **motivation** to design the next activity.

Developing the learning journey: Starting points 3

My paper roll
does not
make
bubbles.



Activities: Free exploration with water
Children choose the materials and implement their chosen activity. I just observe, record and **ask for explanations** if something interesting happens. As an **assessment** they draw their activities.

Rationale: Opportunity for children to play with water. And for me to observe and record their actions to learn about their ideas and interests.

Children's motivation and interest in hands-on activities strengthens. Because of this, they are able to **express** effortlessly **prior knowledge and experiences.**

This is because it has a big opening and the air goes out.



Teacher: What did you do with the bottle here?

A ship.

Teacher: How did you do it?

I close the bottle with a cork not to let it sink.

Teacher: Draw the game you did with water.



Children refine the target of their next activity.

Developing the learning journey: Starting points 4

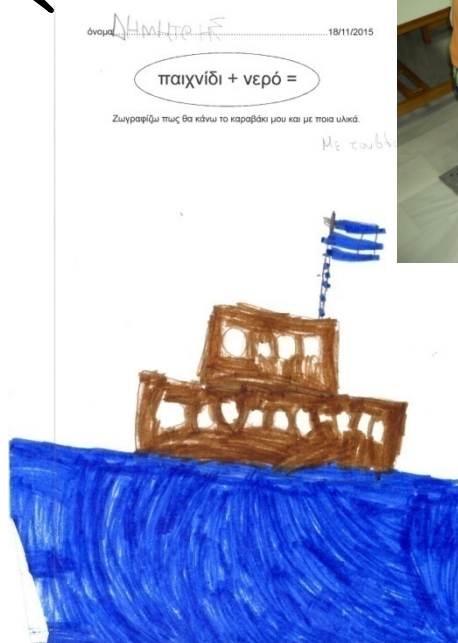
Draw the boat as it will be, using the chosen materials

Activities: Children set their second goal

In the plenary children review the photos we took and **discuss and reflect** on their actions with water. After voting they decide to construct their most favourite play. They draw their ideas and expectations.

Rationale:

Children design and organize an activity to create a floatable boat.



Children present and explain their drawings to each other.

Children realize that their ideas can be implemented through a process of hypothesis and **design and planning.**

Children's previous experiences with the boats in the water lead them to their new design.

Developing the learning journey :

1 Start of investigation

Rationale: Children **work together** to build a common structure , with a specific aim - but recognise that they cannot control their success – they are **testing their hypotheses**.

Activities : Boat construction

Children, in small groups, construct their boats and **make predictions** about their floatability.

I think that it will sink.

Teacher: Why you think so?

Because its base is so narrow.

Teacher: Is it a good boat?

Yes because we put plenty of masking tape and 2 sponges. Sponges float.

Teacher: Why are you so sure?

Because I saw it in my bath.

The next logical extension is to **test the boat** in water to confirm or not their **predictions**.

Children execute their ideas without forgetting their main aim. They give some satisfactory **explanations** about their choices based on their existing knowledge and experiences.



Developing the learning journey :

2 Test and evaluation

Activities: Testing boats

Children test their boats in the water. They observe and describe what happens. Finally they copy, in their opinion, the most successful model.

Rationale

Children **test their hypotheses** and **evaluate the results** of their actions.

I knew that it will sink.

We had to put more and bigger blocks.



Some predictions of groups are semi-correct, but they still have not checked all the variables that lead to the construction of a floatable boat.



No, because after a while it will be dissolved.

As we predicted it floats!!!

Because it is steady and has sponges and paper roll.

Teacher: Will you test it in water?

Teacher: But why?



We leave our boats a long time in water in order to watch what will happen to them.

Developing the learning journey : 3 and 4 Investigating Time

Rationale: To understand that knowledge must be checked and confirmed through investigations.

Activities : How much time should be waiting?
Children ascertain that time is a key variable in the flotation/sinking process of an object. Some objects float initially, but after a short or long time they sink. Why? I took advantage of this conversation and I asked them where we can find answers on how we can proceed. They are familiarized with internet searching so they propose to do so. We watch a relevant video.

For the first time the children express more scientific thoughts. They are talking about time and how this changes the state of an object.

Our boat was ok. The paper roll sipped less water.

Teacher: Why did your paper roll not sip more water?

Because the sponges held it up.



Teacher: I think this video will help us.

But the plastic bowl was ok no matter what.

Not always. If the water comes in, it becomes heavy and sinks.



I remember that the paper roll "crumpled" after a day.

Teacher: Is there another word for crumple?

Yes. It melted.

Yes. It is dissolved.

The motivation for learning is reinforced by a video. They want now to try the scientific methods by themselves.

Developing the learning journey : 5 and 6 Design and plan the investigations

Observation sheet

Name of the team: πράσινη ομάδα

Date: ημερ.

Activities: Planning our investigation: The video not only reinforces the motivation for further investigation but helps the planning of activity. With my help they design a worksheet on the computer to write down their observations. We decide how often we will check and record the results, we find a code for float and another for sink.

Time - Material	Half hour	1 hour	2 hours	1 day

Children are able to **design an investigation** only when they've understood their aim. They **evaluate** results more critically when the investigation arises from their inspiration

Rationale: To design and execute a series of investigations by **controlling all variables.**

We find out that finally our boats sank. We have to check material one by one.

Carry out the investigation!

Developing the learning journey:

7 Carrying out the investigation

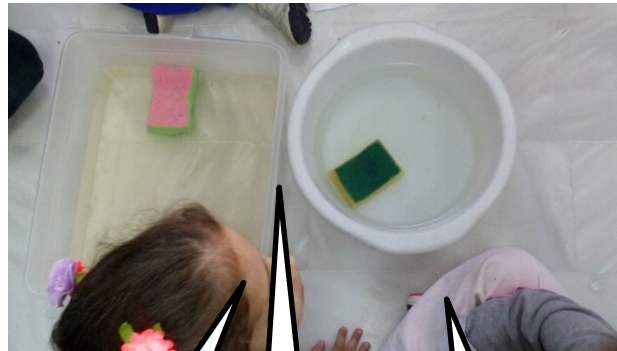
Be careful!
You sank the
plastic cup.

I want to see
what will
happen

Activities: Carrying out the investigations: Children, always divided into teams, carry out a series of investigations, record and evaluate their observations. They plan their next moves based on this evaluation.

Rationale: To carry out investigations in a scientific way.

The scientific structure of the investigation helps children **check** more consciously some **variables**.
Children are more concentrated and observant.



We must not
move the water.
It is better to
place the bowl
somewhere safe.

One sponge
sinks the
other floats

Teacher:
Why did this
happen?

Maybe because
the first has more
holes than the
other. It's older.

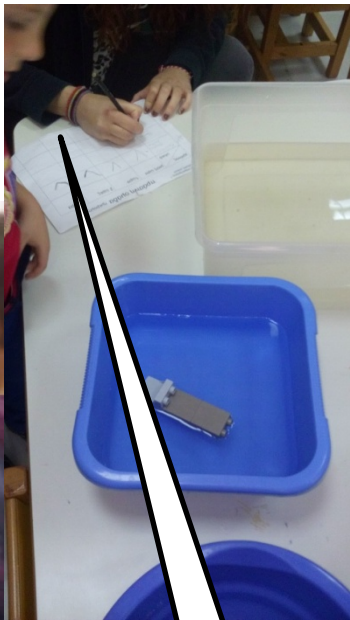
The paper roll
is sinking.

Teacher: Why
you think is this
happening?

Because the paper
has little holes
and the water
comes in. So
becomes heavy.

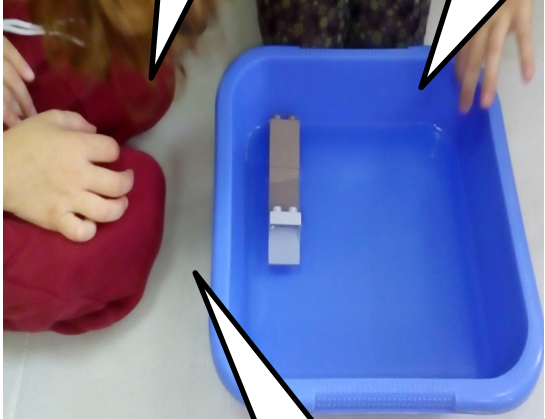
I keep pushing the bowl but goes up when I let it.

Teacher: why do you think this happens?



(After half an hour) But now it half-sinks.

Teacher: Why does it not float as before, after half an hour?



Because it is not "boring" (in Greek boring and heavy have similar letters)

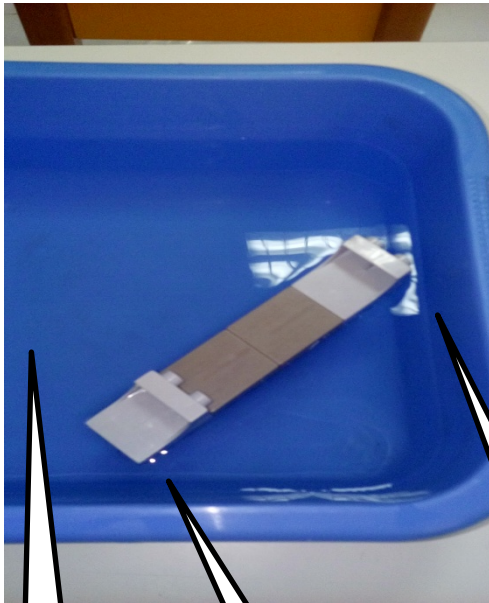
Teacher: When you put force, with which one you fight? The bowl or the water?

I put force and the water lifts the bowl.

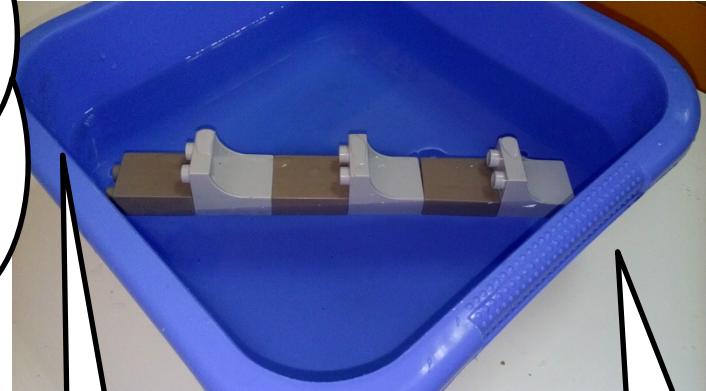
Blocks are floating because they are made of plastic.

Because the light gray brick is heavier than the dark one and sinks from this side.

Children are concerned about the weight of each piece of construction. They want to make new combinations.



The integration of past experience and knowledge enhances children's abilities to evaluate their actions.



We put one more light grey to become the same heavy on both sides.

Can we do a pattern?

Teacher: And how will you do it?

Teacher: Why are the bricks floating now?

Because there is a pattern and it is the same heavy everywhere.

Every time children check their investigations regularly - after half an hour etc.

Effortlessly children reach the end of their learning journey and they feel satisfied. Now they want to review their diary.

Developing the learning journey : 8 Finalising investigations

Activities: Compare data and reach conclusions. Children present their results in a plenary, compare them and discuss final conclusions. They also dramatize them with sound accompaniment. We find a sound for float and one for sink.

They also find a recording code

Rationale: Engage children in **comparing data**, and argumentation leading to **conclusions and explanations based on evidence**.

Φύλλο παρατήρησης 1 επίτευξη υλικών

καφέ ομάδα ημερομηνία

χρόνος	μισή ώρα	1 ώρα	2 ώρες	1 ημέρα
υλικό				
Πλαστικό ποτήρι	✓	✓	✓	✗
Πλαστικό ποτήρι	✓	✓	✓	✗
Πλαστικό ποτήρι	✓	✓	✓	✗

Φύλλο παρατήρησης 1 επίτευξη υλικών

πράσινη ομάδα ημερομηνία

χρόνος	μισή ώρα	1 ώρα	2 ώρες	1 ημέρα
υλικό				
Πλαστικό ποτήρι	✓	✓	✓	✗
Πλαστικό ποτήρι	✓	✓	✓	✗
Πλαστικό ποτήρι	✓	✓	✓	✗

Plastic bowl with wide base is better material to construct a boat.

Φύλλο παρατήρησης 1 επίτευξη υλικών

κόκκινη ομάδα ημερομηνία

χρόνος	μισή ώρα	1 ώρα	2 ώρες	1 ημέρα
υλικό				
Πλαστικό ποτήρι	✗	✗	✗	✗
Πλαστικό ποτήρι	✓	✓	✓	✓
Πλαστικό ποτήρι	✓	✓	✓	✓

Φύλλο παρατήρησης 1 επίτευξη υλικών

μπλε ομάδα ημερομηνία

χρόνος	μισή ώρα	1 ώρα	2 ώρες	1 ημέρα
υλικό				
Πλαστικό ποτήρι	✓	✓	✓	✗
Πλαστικό ποτήρι	✓	✓	✓	✗
Πλαστικό ποτήρι	✓	✓	✓	✗

Teacher: But why?

Because it does not turn over to fill with water.

Children could **evaluate and reason** about their findings. They developed **dialogue** and complemented each other's **explanations**.



I am a plastic bowl and I am floating

Teacher: Why are you moving?

Because the water moves.



I am a paper roll.

Teacher: What is happening to you?

I am in the bottom. I sank and I am starting to soften.

Rationale: For children to express their new knowledge through dramatization.

Children's representations seem simple. But when we ask for further explanations the amount of knowledge gained is highlighted.

Naturally they proceed to the boat's construction.

Developing the learning journey: 9 How to construct a floatable boat

We can put a
Playmobil in it.

Teacher: You
can do that if
you want.

Activities: Boat construction.
Children construct their boats based on the conclusions gained from the planned investigation experimental processes. They construct floatable boats.

Rationale
To **express** their acquired knowledge and experience through hands-on activity.



No! We do
not want it
to be heavy.



Can these
boat sail?

(He blows)
Yes!

Even during the construction of the boat children **continue to argue, to infer, to investigate**. They address new obstacles but they try to **give explanations and solutions**.

Overview of teaching and learning approaches

This project lasted almost 4 months. The following factors were taken into account to facilitate learning and encourage children to creative thinking and hands-on activities:

- collaborative learning and the exchange of ideas;
- sufficient time;
- exposure of children to open-ended questions and counter-questions - *when children asked something I provoked them with another question instead of an answer;*
- step by step sequence of investigations - *as the children decide to go ahead and not as I decided.*

Approaches to assessment

- self-assessment during the activity;
- team assessment after discussion;
- evaluation of data in plenary discussion.

Types of evidence for assessment. The assessment took place through

- dialogue;
- drawing;
- dramatization;
- recording.

Reviewing learning across the project

- The facilitation and control of the learning was done through **discussion, open questions** on my part as the teacher, and children's experiential activities.
- Children's **design and implementation of their investigations** spur their **creative thinking** and, as much as they can, **scientific justification**.
- Finally the children had the necessary **time** to implement and finalize their planning.
- **Evaluation and assessment** was carried out by the students themselves naturally and effortlessly during the investigation and its completion.
- The **motivation for learning** is maintained throughout the investigation because there is rotation and variety of activities, several experiential activities, quick and substantial discussion with audiovisual support.
- There is **not enough variety of materials** but the important thing is that they are familiar to children. So they focus to find their new usage rather than to explore them.



Recording



Present results

Reviewing learning across the project in class



Children's progress



I want to see if the cork softens in water, as the roll paper does.



Our boat floats because it has a large base.



(They notice that one sponge floats and the other sinks)

We must put both sponges dry in water at the same time to see which floats.

Reflections: Children's progress

What progress did the children make related to the aims of the sequence?

- ✓ They had a strong **motivation** for learning and emotionally engaged, because the **reflection** was purely their own inspiration.
- ✓ They learned and applied **scientific procedures**.
- ✓ Their **evaluations and explanations** were as a direct consequence of their thoughts and actions.

Other unexpected outcomes for the children?

- ✓ Fertile **incorporation of children's prior knowledge and experiences** in this learning process and its evaluation.

What did children say about their learning?

- ✓ That they learned to **work as team** having a certain role, sharing their tasks.
- ✓ They recognised **the value of identifying and sharing ideas**. "I have an idea"
- ✓ They realized that **knowledge is built through hands-on activities**, repetition and because of their **personal interest**. "We see.....we try.....we did it before.....we want....."
- ✓ They learned how to **design, plan and carry out an investigation**.

Reflections: Teacher role

1. **Assessment** carried out was more often **formative**. It **was taking place during the activities** and mainly emanated from the children. Firstly I focused on how children drew what they knew or inferred, but later I realized that this was an incomplete way of assessment. So I tried, at first to ask them to remember, to explain and discuss what they think or figure out, both in groups and in plenary. Secondly, I provoked them to read their “notes”, their drawings and to observe the photos we took. I realized that these tactics improved our effort to evaluate and assess.
2. As a conclusion, **through questioning and recording**, I managed to realize the essence of children’s actions and to promote the **genesis and expression of creative dispositions**.
3. Additionally I found that these assessment approaches promoted children’s own **reflection and reasoning** in relation to their actions and acquired knowledge. They better understood the whole learning process and recognized the stages of activity and ultimately the processes of scientific thought.
4. Finally I realized that their **motivation and affect** were enhanced because they recognized the importance of their own role and action in planning the activities. I choose to give children this role following the principles of child-centered and social-cultural theory.

Classroom environment

All dimensions of the *spider diagram* are important factors for the exploration and development of children's creativity. Their balanced development is important. However I would emphasise: **the role of the teacher, grouping, time, aims and objectives and content**.

Further questions for the reader promoted by my reflections

- Is the teacher’s detailed design of an activity an obstacle to children’s creativity?
- Does assessment affect creativity?
- Do democratic classroom processes enhance or suppress individual creative expression?



Only the children know what they
are looking for.

— *Antoine de Saint-Exupéry* —

AZ QUOTES



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University



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