

Creativity, Arts and Science in Primary Education



Training Material

Learning Science Through Puppetry

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Speel je Wijs

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The CASE Project and Inquiry based science education

In CASE, primary teachers are agents of change.

CASE aims to empower teachers' profession with skills and competencies which will enable them to widen their teaching capabilities by strengthening creativity in the classroom. Our approach to creativity lies at the intersection of science and art in education.

Inquiry Based Science Education (IBSE) is a method of teaching and learning that focuses on use of questions, problems, and educational scenarios used to engage students in concepts of science and support their acquisition of scientific knowledge and skills. This is achieved through their **active participation** in activities that make sense to the students, chiefly due to the fact that they are largely initiated by those students. Students understand in-depth the scientific concepts through their own perception of the world that surrounds them and through their own experiences and reflective processes.

In CASE, science and the arts are intertwined. The interaction between these fields within IBSE requires creative solutions on the part of both students and teachers, and enables new ways of thinking about the science curriculum, as shown below.

Various approaches have been developed for IBSE implementation. In CASE, a core cycle of query, evidence collection, analysis, explanation, connection, communication and reflection (see Figure 1) is adopted, based on previous initiatives in the field (e.g. the CREATIONS project¹).

¹ www.creations-project.eu / H2020-EU Project reference: 665917



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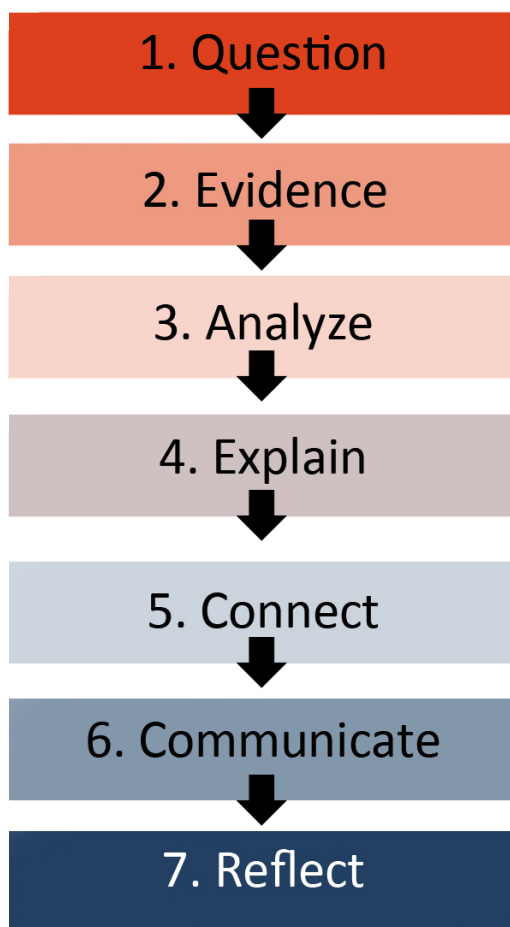


Figure 1: Phases of IBSE

This cycle emphasizes the need for students to engage in creative processes, through which they will act as young scientists and communicate science.

In Figure 2, actions that students perform in each IBSE phase are briefly shown.

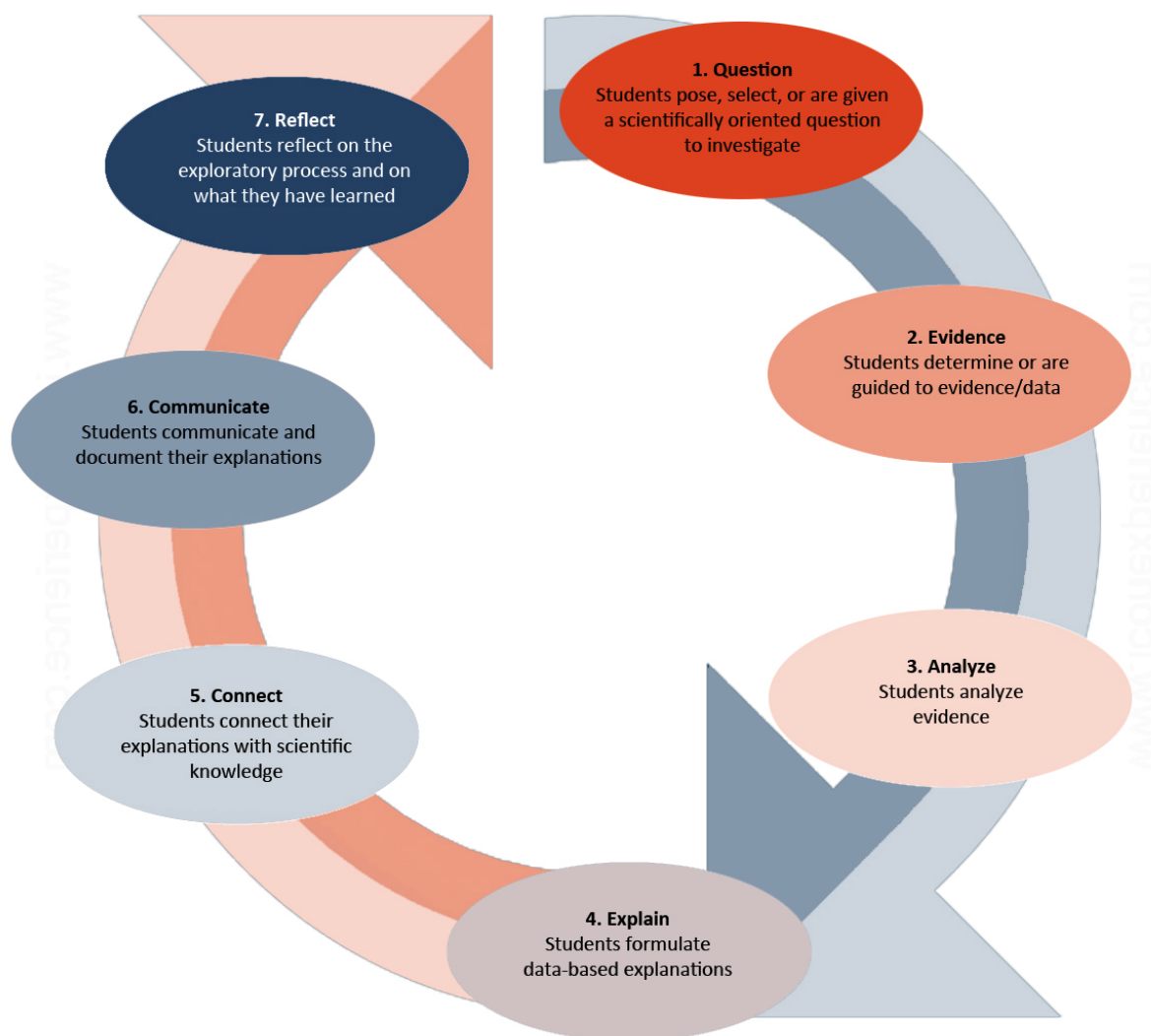


Figure 2: Student actions at each stage of IBSE

“Learning Science Through Puppetry”

“The greatest scientists are always artists as well.” Albert Einstein



About the puppetry activities

Children must be given the opportunity to play and develop, and we want them to enjoy themselves in the process. Puppetry inspires young children in creative approaches to achieving that goal, while building a bridge to the world as they experience it.

Science and technology are the ideal disciplines through which to stimulate the natural inquisitive behaviour of children. Puppet play leads the children in fantasy adventures. The hand puppets excite children's curiosity because they have a question or need help, which instantly motivates children to go on to discover and create. Children learn from and with each other, and are allowed plenty of space to develop their talents in their own way. They love to share their experiences with the puppets. Often children with Special Needs also enjoy the combination of science and puppetry.

Implementation phases

Below you find a description of the implementation phases of the Science and Puppetry activities. Sometimes, the phases will overlap or can be combined.

PHASE 1. QUESTION



KEY CHARACTERISTICS

Children are given a scientifically oriented question by the hand-puppet(s) to investigate.



EDUCATORS' ACTIONS

The teacher chooses a scientific subject from the curriculum or a scientific topic which fits with a theme the class is working on. It can also be a science experiment the teacher likes to introduce. She/he then starts with a puppet play in which the imaginary world of the puppet will connect science with the real world as young children experience it. One or two puppets are chosen for this. The teacher can play with the puppet standing in front of the children or sitting on a chair, no theatre is needed.

The puppets play a short story, introduce the topic by giving some information, asking questions and sometimes showing something. At the end of this phase the hand puppet will ask the children for help with solving a problem or the puppet has a scientific question the children can help discover.



CHILDREN'S ACTIONS

At this stage the children will observe, listen and if they like, ask the puppet questions. The children will be encouraged and their motivation to explore or learn more will be triggered.



EXAMPLE

'Making the wind sing'

Material you need for this activity:

- *Hand-puppet of a Big Bear*
- *A bowl with water for every two children and*
- *For every couple a bigger stone, a middle-sized stone and a small stone (all fitting in this bowl) They can go outside to find these*
- *An example of a 'Bull Roar'*



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To make this you need:

- A yardstick
- Scissors
- A yard or twine
- A piece of cardboard which is quite thick, approximately 35 cm long and 10 cm wide
- A knife to cut this in the right shape
- Paint and brushes
- *Making instructions:*
 - Cut the cardboard in the right shape (search for examples on the internet using 'bullroarer', 'rhombus', 'turndun' or 'snorrepot'. Young kids might need help or pre-cut versions.)
 - Make a hole at the end of the shape.
 - Pull the yard through the hole.
 - Create your own design and paint it on both sides.
- *If you like, you can make this from wood, pewter, clay or stone.*
- *Playing instructions:*
 - Go outside and find a safe place where nothing and no one is in your way.
 - Turn the bullroarer around and enjoy the sounds!



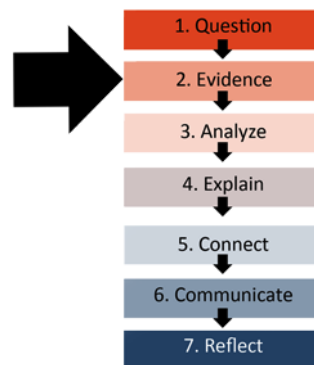
Phase 1: Big Bear is grumpy, he walks from one side to the other and you can tell he is not happy at all. "I don't like to hear all these sounds surrounding me, I cannot concentrate at all. I hear the sounds of cars, the sirens of ambulances and police cars, the terrible noise of the printing machine, the coffee machine, I cannot concentrate at all." He keeps walking and complaining (use the sounds which you can hear in your neighbourhood or in your school.)

Big Bear asks to the children about sounds he hears at this right moment: "You see? This high tone ... What is it? And this beeping, do you know what that is?" (Try to make Big Bear focussing on sounds you can hear at this moment.)

"Children, do you recognize this? Are you sometimes annoyed with certain sounds as well?" Big Bear asks the children to give some examples.

Then he asks the children if they know how we can hear sounds. Maybe some children know, otherwise Big Bear explains (in Phase 2).

PHASE 2. EVIDENCE



KEY CHARACTERISTICS

At this stage, the teacher helps children find evidence by using the puppets to ask questions, show examples and give information.



EDUCATORS' ACTIONS

The teacher keeps playing with the puppet(s). In this phase, the puppet asks more questions, shows examples and gives some information to explain more about the scientific question. The teacher and puppet(s) help children search and collect information and materials. If there are (picture) books or useful internet sources available, these can be used. If there are specialists who can be visited or invited, this is another interesting way to explore evidence.

The teacher uses materials and adds playful activities in this phase. If there are things to see, touch, smell, hear, taste and do, this will encourage children more.



CHILDREN'S ACTIONS

The children decide upon the scientifically oriented question of the puppet(s) what they wish to explore. They ask questions and gather information about this question/topic. This happens in dialogue with the puppet(s) and the teacher. If they need to use materials, they can collect these now.



EXAMPLE

Big Bear asks the children to help him and put the bowl closer. "What do you think will happen when we drop a stone in this water? What would we see?" He asks children to come up with several answers (hypothesis).

Then he invites one child to take the stone and drop it. "What do you see? What happens? Was that what you expected? Were you surprised? Who was surprised as well? Why are there waves in the water?"

If you like, you can repeat this dropping of the stone several times. And if you think your children

can go a step further, you could also vary with bigger stones and smaller stones to discover that the waves are different.

Then Big Bear starts explaining the connection between sound and what happens in the water: "Imagine this water is the air surrounding us. The air between you and me, the air we breathe in and out and the air which makes the sounds travel to our ears so we are all able to hear." Big Bear sits next to the bowl and asks a child to put its ear at the other side of the bowl. "So, imagine, the bowl with water is the air between me Big Bear and ... (name of the child)." He drops a new stone at his side of the bowl and shows that the waves tremble and that the trembling water reaches the ear of the child. This is exactly how it works with sounds.

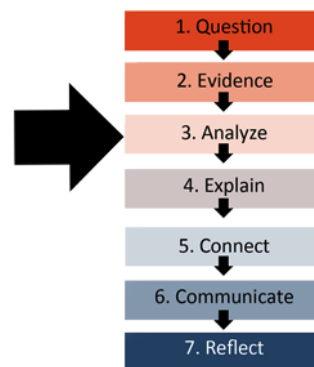
Sounds make the air tremble and your ears recognize this trembling of the air as sound.

Then Big Bear listens to the current sounds again, says what he is hearing and suddenly realises that he could also decide to listen to the sounds as if it were music. He gives it a try, he shares the noise he hears, listens with all his attention and then starts humming a little bit with it.

This inspires Big Bear to think of making musical instruments which 'sing with the wind'. He asks the children to close their eyes or turn around and listen to what they hear. He sweeps the Bull Roar (see instruction in Phase 1) in the air and hides it after he did that. "What did you hear? What do you think made this sound?" Then he shows what he did. The children can make the same sound.



PHASE 3. ANALYSIS



KEY CHARACTERISTICS

This phase will be an active and inter-disciplinarily part in which children will design, investigate, discover and at the same time analyse and categorize data in a playful way. The children might work part of this phase individually and at the same time will need to cooperate since teamwork plays important roles in finding and gathering necessary information about the main inquiry question that has been asked by the puppet.



EDUCATORS' ACTIONS

The teacher functions more as a facilitator, and coordinates discussions among children about the things they design and the outcomes they discover during playing. Again, the teacher can use the puppet(s) to ask questions and give suggestions to the children if this is needed. She/he encourages and coordinates the children to improvise, create, try, fail, make changes, improve, re-try and discover as much as they can.



CHILDREN'S ACTIONS

At this stage, children play, discover and observe, using their senses. Creativity plays an essential role as children can come up with different solutions using several materials and skills. They sometimes work individually and sometimes collectively, exchanging key findings and information they have collected. How much time this takes, will depend on the child so this will vary.



EXAMPLE



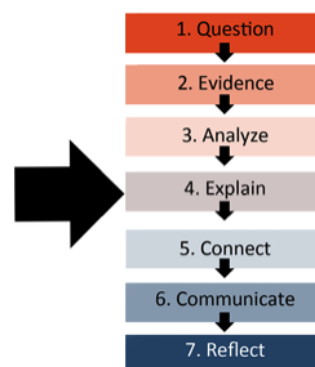
In this phase, the children build their own bull roar or any other instrument which 'sing with the wind'. (The official name for this is 'Aero phone'.) They can try out bigger or smaller objects, turn the rope fast or slow and investigate the differences. Background: The bullroarers were used in ancient times in several cultures. For example, in North America by the Native Americans, in Australia by the Aborigines and in the Netherlands by the Native Inhabitants (named 'Snorrepot').



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PHASE 4. EXPLAIN



KEY CHARACTERISTICS

A key feature of this phase is the dialogue between children. That dialogue is needed in order to discuss possible explanations, designs and answers for the scientific question. This phase is often combined with phase 5.



EDUCATORS' ACTIONS

The teacher acts as facilitator and process coordinator while identifying and correcting possible misconceptions of children about the interpretation of data. She/he uses the puppet(s) to interview the children or lead the conversations. This can be done in several ways, with pairs, smaller groups or the entire group at once. The teacher makes sure all children will be involved and have the chance to share something.



CHILDREN'S ACTIONS

Children collaborate and discuss decisions about the basic explanations to answer the scientific question(s) or solve the scientific problem. They can use their designs and materials to demonstrate and explain what they have discovered.



EXAMPLE

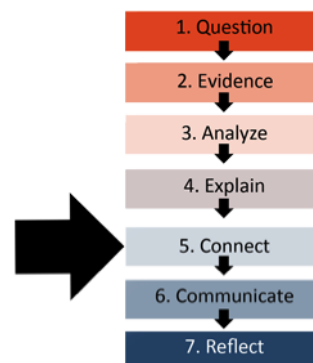
After the children had time to play and explore, Big Bear asks them to sit in a circle and he asks questions. "Who likes to show what he or she made?" "What did you discover?" "Did you hear differences in sounds? Which differences?" "What went well? Why?" "What was hard or went wrong? Why?" "What did this failure teach you?" (Getting used to fail and keep trying is very important.) "What was the best mistake you made? Why?" "Can you improve the sound? How?" "What are the differences between the bigger versions and the smaller once?" "Is there a difference when you use a longer twine? Why?" "What would happen if ...". Some questions can be answered by all children, they can for example talk with the one sitting next to them and then some of the children can share their answer with the group and Big Bear.



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PHASE 5. CONNECT



KEY CHARACTERISTICS

A key feature of this phase is connecting the process and outcomes with scientific knowledge.



EDUCATORS' ACTIONS

The teachers task in this phase is to use the puppet(s) to guide the conversation between children and ask the right questions in order to make children understand the scientific part.



CHILDREN'S ACTIONS

The children share more about the subject or experiment, in this phase focussed on the scientific part. They continue showing each other what they have explored, discovered and learned and answer questions of classmates, the teacher and the puppets.



EXAMPLE

Big Bear keeps asking questions, now more connected to the scientific part. "So, you did hear different sounds. How do you think this is possible, when was the sound louder and when was it softer? What was the difference? Which are the differences between the bigger versions and the smaller once?" "Is there a difference when you use a longer twine? Why?" "What would happen if ..."

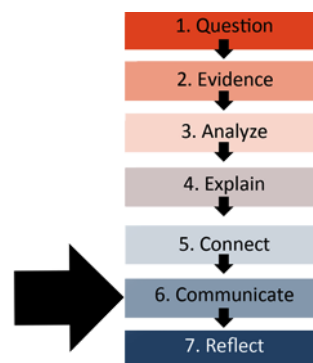
He takes the bowl with water again and a bigger bullroarer and a smaller one. "Who can tell something about the connection between the big stone and one of these bullroarers?" If needed, Big Bear explains.



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PHASE 6. COMMUNICATION



KEY CHARACTERISTICS

The main feature of this phase is the dimension of children's communication, both with their classmates and with the puppet(s) and teacher. In addition, communication also involves the expression of scientific concepts and findings by children through showing their answers, outcomes and designs.



EDUCATORS' ACTIONS

The teacher encourages children to connect the things they have learned and discovered. This can be done in several playful and creative ways. They can make a poster, write a diary, a poem, make a mindmap or wordweb, diagram, make a painting or drawing, an act or living statue, or use puppets to explain. If there is a specialist available, the teacher connects the children with this specialist again and they can share with the specialist. The puppet could also function as a specialist it selves.



CHILDREN'S ACTIONS

The children can reflect on what they have discovered in a creative way. They can use a variety of art forms mentioned above. Sometime the teacher might choose in which way, other times children can think of their own way and maybe choose a variety of ways for this phase, working in smaller groups.



EXAMPLE



Big Bear likes to make drawings or stick on pictures of different bullroarers on a poster to explain and remember differences and scientific content. (A bigger bullroarer makes lower sounds, turning faster make louder sounds, etc.) Which children like to help him? "How can we organise this so other people who see this will understand it as well?"



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PHASE 7. REFLECT



KEY CHARACTERISTICS

The main feature of this phase is reflection on the process and learning.



EDUCATORS' ACTIONS

During this last stage, the teacher plays the puppet to discuss with the children about their reflections regarding what they experienced during the process and about the outcomes, products, solutions or designs. The questions can focus on both artistic and creative skills and scientific outcomes. The things that may be improved or further questions, next challenges or ideas and plans can also be discussed. At the end of the reflection, the puppet play finishes, so the teacher thinks of an end of the story and the puppet goes 'home' again or leaves the classroom.



CHILDREN'S ACTIONS

At this stage, children will evaluate different parts of the activity, chosen by themselves and/or the teacher.



EXAMPLE

Big Bear gives every child a post-it. On this post-it they draw an emoticon of their feeling of this activity. Children who write, can write some feedback. Or the teacher can help them. Big Bear can give the first part of a sentence. For example:

I was surprised that ... because ...

What I liked most was ... because ...

I found it hard to ... because ...

I discovered that ...

If I could change something I would change ... because ...

I am proud of ...

The mistake I learned most of was ...

Stick them all on one big paper and if you like, stick pictures of the children with their designs with it.

Big Bear loves listening to all the Bull Roars. He asks the children to go outside and all play at the same time. Now he isn't annoyed by the other noises anymore. He even starts humming again!



Photo credits and more information about Science and Puppetry (Dutch language):

www.lilaland.nl