EDUCATIONAL APPROACH

OF THE “Little Scientists” INITIATIVE

EDUCATORS’ GUIDEBOOK: IDEAS FOR EDUCATORS IN SCIENCE, MATHEMATICS AND TECHNOLOGY

A not-for-profit initiative of the Malta Council for Science and Technology and the “Little Scientists’ House” Foundation in Germany.

"A child is not a vessel wishing to be filled,
but a fire waiting to be ignited."

François Rabelais

Contents

4 The “Little Scientists” initiative
5 Introductory message

PART A

How do children learn?

7 New insights into early learning and the educational domains of Science, Mathematics and Technology
8 Principles of child development and learning

PART B

Educational approach of the “Little Scientists” initiative

17 How we view children
18 Our educational principles
20 Our educational aims and objectives

PART C

Practical information for implementation

27 Discovering together – Researching together
29 The “Research cycle” method
36 Learning experiences, suitable questions and working with explanations
39 Literature

The “Little Scientists” Initiative

The German “Little Scientists’ House” Foundation is the largest qualifying initiative in the field of early education in natural sciences, mathematics and technology. More than 1 Million children all over Germany already benefit from the foundation’s program. The major goal of the initiative is to provide all preschool and primary school children with hands on access to scientific, mathematical and technical learning experiences on a daily basis.

The foundation partners in Germany are the Helmholtz Association, Siemens Foundation, Dietmar Hopp Foundation, Deutsche Telekom Foundation and Autostadt GmbH. The Federal German Ministry of Education and Research has been promoting the initiative since 2008.

Children need to have early opportunities to discover this exciting field in a fun-filled setting. This can happen largely as the “Little Scientists” initiative helps educators to integrate science, mathematics and technology into their setting on a daily basis and provide ongoing training to support the learning process in a targeted manner.

The core aspect of this approach is the learning and research undertaken by the children, with the adults involved as learning coaches. Integrating the “Little Scientists” activities and material into the children’s daily activities has many benefits. In addition to enhancing the pure joy of learning per se, it will boost the children’s self-confidence and their mathematical, technical and scientific understanding. Furthermore, it will foster the verbal, social and learning skills of children between three and ten years of age. The initiative’s activities and materials can improve preschool and primary school educational opportunities, helping to secure the long-term supply of scientists, engineers, mathematicians and technicians in the country.

The development of workshops and materials by the “Little Scientists” initiative is in line with the specifications outlined in the National Curriculum Framework For All (NCF) and A Vision for Science Education. It also draws on current knowledge in Developmental Psychology, learning research, early education and didactics. In addition, the Foundation has incorporated numerous empirical findings and content-based recommendations accumulated during trainer workshops, regular preschool and primary school visits and observations made in the “Little Scientists’ House” Foundation networks in Germany over the last seven years.

The “Little Scientists’ House” Foundation makes the experience gained available to interested players abroad and is happy to support the Malta Council for Science and Technology in implementing the programme.

Introductory Message

Dear educators,

We are very pleased that you have taken the opportunity to participate in one of our workshops and we welcome you warmly to the "Little Scientists" initiative by the Malta Council for Science and Technology in collaboration with the "Little Scientists' House Foundation" in Germany.

The aim of this initiative is that children, especially those in kindergarten and primary levels, engage themselves in researching and experimenting. This not only means additional educational opportunities for each individual child but also huge benefits when it comes to the development of skills and knowledge. Science is important and it is through research that we are able to improve our quality of life. We need to increase the amount of scientific research and engagement in science related activities for the sake of our national economy and competitiveness. To do so we need to start at a young age and to have children researching and discovering together in schools. MCST is investing in this initiative as we are convinced that Malta's long-term research standing will improve as the foundations for a person's interests and talents are laid in childhood.

By attending our workshops, you are demonstrating your desire to work on integrating Science, Mathematics and Technology in an active manner. In doing so, you are providing the children in your care with an opportunity to playfully address the many exciting questions that arise within their experiential world. This underpins not only the joy of conducting research, but also helps to nurture the ability to deal positively with problems and challenges, resulting in a positive self-image overall. We want children to experience the "I can do it!" feeling. Science in the early years and primary sector needs to be given much more importance and become a core subject as stated in the "National Curriculum Framework For All" (NCF) and "A Vision for Science Education". Whatever your background in science, we would like to support you in integrating science and technology into the curriculum by providing you with our materials, handouts and ideas.

This booklet is divided into three sections. In Part A we invite you to take a brief look at the most current research findings in Developmental Psychology. In Part B we present the educational approach and the philosophy behind the "Little Scientists" initiative. In Part C – using a concrete example involving the subject of "Water" – we demonstrate how you can integrate educational activities in Science, Mathematics and Technology in cooperation with the children on a daily basis.

We look forward to receiving your comments and suggestions so that this initiative is as fruitful as possible to our educational system. Come and talk to us, send us an email or just give us a call! We hope that you have a lot of fun and enjoy great success in your research and discovery activities with the children in your care!

Dr. Jeffrey Pullicino Orlando
Chairman, MCST

Elton Micallef
Project Leader, Little Scientists

PART A

How Do Children Learn?

New insights into early learning and the learning areas of science, mathematics and technology

Our understanding of early learning and its significance has changed dramatically in recent years. Early childhood is the most intensive period in the process of lifelong learning for us all. Developmental psychologists have shown that even at a very early age children explore their world inquisitively, knowledgeably and in a focused manner. Recent brain research has confirmed not only this eagerness to learn, but has also demonstrated the immense importance of having fun during the learning process right from the beginning[1].

Comparative research studies such as TIMSS[2] and PISA[3] have highlighted some weaknesses in our education system. Businesses also continue to lament the increasing shortage of highly trained professionals, especially in the fields of Science and Technology. These multiple insights have resulted not only in various educational institutions reconsidering their approaches, but have also prompted society to review its obligations to support and foster the interests and strengths of our children from their earliest years. The role of elementary education is vital in educating and supporting all children.

Our society's role in promoting equality of opportunity for every single child in all areas of education has been addressed not only in the "Vision for Science Education", but also in the "National Curriculum Framework For All" (NCF). Both include principles and practices aimed at ensuring the development of basic competencies for sustained lifelong learning, with particular emphasis on scientific, mathematical and technical education content.

Early childhood educators are taking on new responsibilities, not only in terms of subject matter content, but also in terms of methods of delivery. They require resources and assistance in order to recognise the strengths of each individual child and to guide them on their path in life. In addition to parents, they are the most important facilitators of learning. They are the people who recognise the interests and aptitudes of the children and who are able to support them in their long-term development.

The "Little Scientists" initiative wishes to support educators in their educational responsibilities. Consequently, we have developed further education and training opportunities for Science, Mathematics and Technology.

1 Cf. Kiefer, M., Schuch, S., Schenk, W., Fiedler, K. (2007)
2 "Trends in International Mathematics and Science Study (TIMSS)" is an international study comparing scholastic performance in those subject areas. Further information can be found at www.acer.edu.au/timss
3 The PISA studies undertaken by the OECD since 2000 involve international research into scholastic performance with the aim of measuring the general and vocationally relevant knowledge and skills of 15-year-old students. Further information can be found at www.acer.edu.au/ozpisa

Principles of child development and learning

It is not only important to know something, but to understand the process involved in acquiring this knowledge.

Educators have devoted innumerable hours to studying the question of how children learn and develop mentally. In recent years Developmental Psychology has made great advances in understanding children's cognitive development and the processes involved in how they learn. Scientists now know so much about learning that they can predict fairly accurately what will help a child's development and its acquisition of knowledge.

But what does education in Science, Mathematics and Technology actually mean in a preschool setting? The primary focus of the "Little Scientists" initiative is on the joy of learning and competency in solving problems. The initiative's activities are largely aimed at guiding children[4] on their journey of discovery and knowledge acquisition using a style based on the scientific approach (see Part C "The 'research cycle' method").

EXAMPLE

A child fills a small wading pool in the garden with water using the garden hose. When it is almost full, the child gets in and notices that the water level rises considerably, causing water to spill out over the edge. The child quickly gets out of the wading pool to turn the tap off, but the water level is now much lower than before! It thinks about getting the hose again, but hops into the wading pool one more time. When it sits down the water splashes out over the side yet again.
The child is fascinated by its observation and ***asks*** *itself why it is so. It seems that there is a connection between things that go into the water and the water level.*
The child tests its ***hypothesis*** *by means of an* ***experiment:*** *it stands up in the water and sits down again repeatedly. When it stands up the water level drops and when it sits down in the water the level rises again.*
It also sees what happens to the water level if it pushes a large beach ball under the water – and observes that the water level doesn't rise quite as high as it does with its own body. The child comes to the ***realisation*** *that the size of the object must play a role when it is immersed in the water.*

In the example given the reason why the water level changes is not of major concern. The exciting thing initially is that it does it at all. In terms of the scientific comprehension process it is the way in which the children arrive at this understanding and how they are supported during this process that are crucial.

[4] The target group encompasses children aged from 3 to 6 years in education and care services such as long day care, outside school hours care, vacation care, family day care, occasional care etc.

Are children able to think scientifically at their age?

Recent findings in Developmental Psychology confirm that important components of scientific thinking and behaviour develop at a very early age. Preschool children are already capable of displaying central aspects of research behaviour. They can make predictions, conduct experiments and draw basic conclusions. Primary school children are in a position to make discoveries and to undertake research systematically as long as they are prepared initially by a suitable learning coach. The children can then make a considered choice from the various options available to them, justifying their decision and explaining their findings. Part C of this booklet provides ideas for suitable stimuli designed to encourage children to work systematically on their research and discoveries.

NOTE

Over time, preschool children develop the ability to reflect on their own thought processes (meta-cognition). Primary school children make huge advances in their ability to reflect upon their learning processes and communicate with each other about this. The development of meta-cognitive competencies is further enhanced if the trained educators talk to the children about their learning experiences on a regular basis.

The learning processes to be achieved in preschool differ from those in primary school in terms of the degree of the children's depth of understanding. The decisive factors in preschool are the initial basic experiences involving scientific phenomena and mathematical or technical problems, as well as the formulation of simple "if-then" or "the more, the..." relationships, i.e. recognition of conditions and connections.

For example, preschoolers can investigate which objects float on water and which sink. Later on, based on their earlier findings primary school children can research the individual factors involved in floating, e.g. weight and size, as well as systematically comparing the depth of immersion of floating objects and correlating these factors and outcomes with each other.

Developmental Psychology of children [5]

Small children are able to understand causal "if-then" principles and start to apply these in their thinking and behaviour. They look for causes and display early insight into connections between events, e.g. the interesting effect generated by the chain reaction of falling dominoes. From the beginning, small children embed their knowledge in naive theories about natural phenomena. They already have content-related knowledge in the biological and physical domains that resembles the knowledge of adults in many respects. Their recognition memory is already well developed.

Even babies can think scientifically. Studies have shown that six-month-old babies reflect on cause and effect sequences. Furthermore, babies are born with specific knowledge, so-called core knowledge, in various domains such as Physics, Mathematics, Psychology and language. They know for example that non-living objects only change their position if subjected to an external force, while living things can move of their own accord. This core knowledge that children have constitutes a launching pad for further learning.

[5] Cf. Pauen, S., Pahnke, J. (2009); Oerter, R., Montada, L. (Eds.) (2008); Sander, E. (2011)

Preschool children already possess major prerequisites for thinking scientifically. They understand basic connections between cause and effect and apply this causal understanding correctly when they think about events (e.g. when they try and find out what factors are involved in whether or not a cake rises in the oven). They can recognise incorrect beliefs when they compare their assumptions and predictions with actual observations. In addition, preschoolers become increasingly confident in their knowledge about their own knowledge (meta-cognition), i.e. knowing that they know something and how they know it.

Primary school children have good language and memory capabilities, plus increasing cognitive flexibility. Thanks to improvements in their abstract thinking it becomes easier and easier to organise their learning experiences cognitively, to link events meaningfully and express these verbally. Primary school children are developing an increasing ability to structure and plan their cognitive processes and start experimenting systematically. With the aid of trained educators they can test which condition is decisive for an event by changing only one variable and maintaining all the others. Furthermore, children of this age are increasingly concerned with their peer relationships. Self-awareness within this group is a decisive developmental step that leads to enhanced self-perception and personal efficacy.

How can we support children in their development?

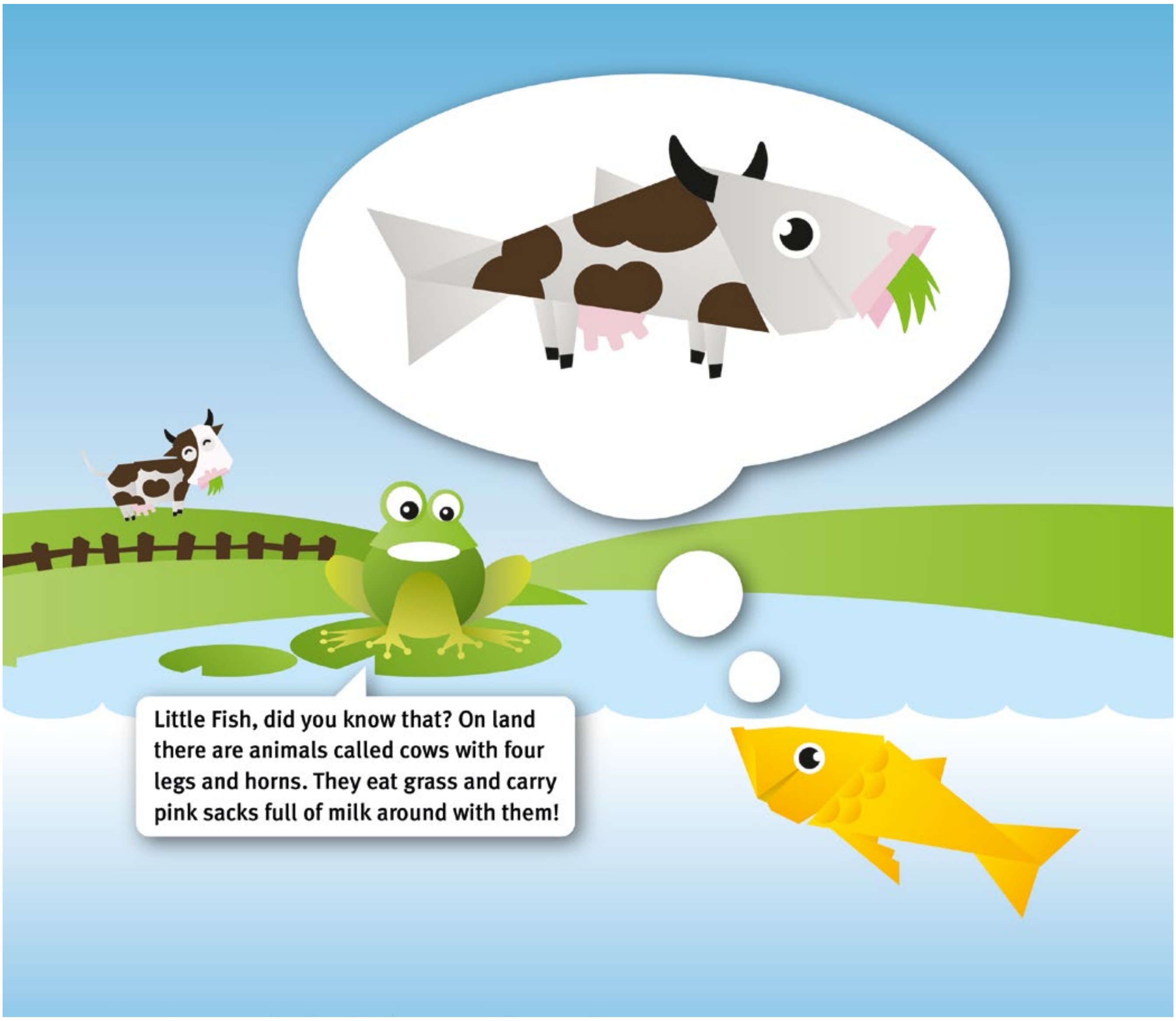
Preschool and primary school children are already quite competent, not only in terms of research-oriented cognition, but also with respect to knowledge about Science, Mathematics and Technology. At the same time, they are open-minded, inquisitive and thirsty for knowledge about the many and diverse areas of the world they experience around them. Consequently, early learning stimulation melds with the basic prerequisites. In many cases, this means that educators can and should utilise the children's pre-existing basic knowledge and understanding. This is quite important as new knowledge needs to be anchored on prior knowledge in order for it to be stored in long-term memory.

In addition to the typical general knowledge for their specific age, each child has their own prior knowledge and therefore requires their own individual approaches. Consequently, educators should assist each child as far as possible to have those learning experiences that allow them to understand yet another piece of the world.

It is important that each child has its own personal experiences in order to construct its world concept. As the story about the frog and the fish in Figure 1 illustrates, a world concept remains limited if it develops on the basis of third party accounts instead of one's own experience:

Figure 1

The story of the frog and the fish (based on an idea by Leo Lionni, 2005)



The frog's story fascinates the little fish as it has previously only known its own underwater world. The small fish can only imagine what the frog is telling him by adding the information to his own prior knowledge. So he develops his own mental picture of a fishcow. If the small fish and the cow were to meet one day face to face, the small fish would have another opportunity to understand what a cow really is.

According to the Russian pedagogue Lev Vygotsky, there exists something known as the "Zone of proximal development" based on a child's current stage of development (see Fig. 2)[6]. This zone constitutes the entire range of developmental possibilities a child has at a specific point in time with the support of a more knowledgeable other. The role of this educator is to recognise the (next) potentially attainable developmental stage and to provide the appropriate support for the child to make its way through this zone.

Figure 2
Zone of proximal development, based freely on Lev Vygotsky

6 Cf. Vygotsky, L. S. (1964)

NOTE

Role of the more knowledgeable other (i.e. educator):
Educators should recognise each child's current stage of development and the right learning opportunities to best facilitate them taking their next step on their own.

Consequently, educators have the following specific responsibilities:

Always connect with the children's pre-existing knowledge!
Educators will get an idea of the children's prior experience and thought processes if they listen very carefully, observe them and ask them about their predictions.

Talk to the children!
Educators can support children in taking their next cognitive developmental step by talking to them. Explain less and enquire more!

Motivate the children to reflect!
If children employ what appear to be incorrect concepts, e.g. "The wind comes from the trees", then this provides a good indication of where they are right now. The task is to point out to the children at an opportune moment that there is also wind in places where there are no trees. In this way, educators encourage children to develop their own new theory.

PART B

Educational Approach Of The "Little Scientists" Initiative

How we view children

The pedagogical concept promoted by the “Little Scientists” initiative is based on a specific conception of children. This view constitutes the basis for educational activity and encompasses our own concept of how children learn and discover the world.

Children already have considerable prior knowledge and competencies
The main focus of the educator’s work is on the strengths, competencies and developmental potential of the children, rather than on possible deficits. The resource-oriented approach of “building upon strengths” is of major significance here.

Children intrinsically want to learn
Children do not need to be encouraged or forced to learn. They have an intrinsic interest in exploring and understanding their world.

Children actively shape their education and development
Education and development always involve social interaction. Children actively construct their own knowledge and their conception of the world as part of this process. Therefore, it makes sense to utilise the interests of the children as the starting point for your educational activities.

Each child has its own personality
Children explore topics from different entry points and they require individual activity options. As “the” child does not exist, neither does “the” method or “the” activity.
The interests, abilities and approaches of the individual children are diverse, providing enrichment for all. Consequently, it is vital for each individual’s educational process that educators have an inclusive yet differentiated view of the children.

Children have rights
Human rights are of course also children’s rights. These include for example the right to education and personal development. Whenever possible, children must be involved in the decision-making processes that impact them (participation).

SIGNPOST

Every child is different
If you vary your methods and activities in the educational areas of Science, Mathematics and Technology, you will note that individual children respond differently. Some children display their urge to do research or their creativity best in a very open framework. In contrast, others initially require instruction, a model or some other form of guidance to develop their own enquiries and ideas on the basis of this. The materials prepared by the “Little Scientists” initiative and our workshops are deliberately designed to be multifaceted in order to cater to the different needs and to expand the educators’ repertoire of methods for Science, Mathematics and Technology.

Our educational principles

Children and adults shape the learning process together (co-construction)

Each child forges its own knowledge about the world. This occurs during interaction with others, although knowledge is not simply transferred from one person to the other on a one-to-one basis. Learning is a social process that occurs when doing things together and talking about them. For instance, addressing a question and seeking answers with others consolidates the children's learning processes. This means that the knowledge is "constructed" by the children and their mentors together. In this situation "the focus [...] on the issue of how the interactive processes need to be structured in order for them to have a positive impact on development and competency."[7]

Pre-requisites for co-constructive learning processes

Co-constructive learning processes demand great sensitivity and empathy on the part of educators in terms of the plethora of thoughts and ideas of not only the group as a whole, but of the individual children as well. The success of the learning process is largely dependent on the ability of the educator to "pick up the child where it stands" with its own individual prior experiences.

It is the task of educators to identify the prior knowledge of the children and in particular their ideas about the world and then to act accordingly, for instance through guided participation[8]. In order to do this, precise observations and documentation of a child's behaviour and responses are vital, in addition to knowledge of age-typical developmental steps. The children should always have the feeling that their questions and explanations are valued highly.

Educators should have recognised and embodied the concept of the child as an active shaper of knowledge and culture. To do so, they must be very willing to communicate with the children and enter into a dialogue, possess an inquisitive and reflective approach to their own learning processes and those of the child, and have the courage to share their own unanswered questions during the process[9].

Co-constructive education processes make it possible to:

- exchange ideas,
- generate new content together,
- become acquainted with different perspectives,
- solve problems together with others and
- expand the current horizon of comprehension.

Children become aware of the fact that they are learning something (meta-cognition)

A special relationship exists between educational processes and the children's development of learning and reflective competencies. In a society subject to continuous change it is no longer beneficial to simply have static knowledge acquired at some time in the past. It is

7 Fthenakis, W. E., Wendell, A., Eitel, A., Daut, M., Schmitt, A. (2009, S. 21)
8 Guided participation: "a process whereby informed individuals (experts) construct situations in such a way that people with lesser knowledge and skills are able to learn something." (Rogoff, B., 1990, quoted from Siegler, R., DeLoache, J., & Eisenberg, N., 2008, p. 225).
9 Cf. Kramer, F., Rabe-Kleberg, U. (2011)

much more important to be competent at repeatedly acquiring new knowledge, reflecting upon one's own learning and being able to develop one's own learning and problem solving strategies – "learning how to learn". While the learning processes are being shaped together, you can talk to the children about the fact that they are learning, what they are learning and how they are learning. This occurs when we explore our own cognitive processes (thoughts, opinions, attitudes), i.e. the knowledge a learning person has about their previous knowledge, their newly acquired knowledge and their journey to get to this point.

Talking about learning – meta-cognitive dialogues
Language plays a special role in the construction of knowledge. Expressing their own behaviour, thoughts and insights in words is particularly helpful to the children when they are reflecting on their actions, thinking and learning and when constructing a concept of how the world functions. That is precisely what reflecting on learning is about: Phases of reflection are indispensable for raising the children's awareness of learning processes. That is why conversations and discussions between the children and with the educators are so important. The reflection process can be supported and facilitated by the educators' use of suitable questions and input.

The ability of the children to engage in meta-cognition can be actively supported by exploring scientific, mathematical and technical topics using a research-oriented approach. In doing so, the following principles should apply:

Principles for structuring learning processes

- The launching pad for considering scientific, mathematical and technical topics must be the world the children experience around them.
- Educators facilitate and support not only the specific research activities undertaken by the children, but also the learning process per se.
- Documenting the activities promotes the children's learning process and improves their awareness of their own problem-solving and learning strategies.

SIGNPOST

When is a good time to reflect?
Pay attention to the correct moments for reflective phases. Children often concentrate very intently during experiments. They are so focused on their own actions and observations that it can be difficult during the experiment itself to ask them to verbalise their individual perceptions and thoughts at the same time. Interruptions may even disrupt the children in what they are doing. Therefore, it is better to use the time before and after experiments for in-depth discussions about what the children have experienced.

Part C of this booklet provides further information and recommendations, for example on how to initiate meta-cognitive learning processes with the children through the use of appropriate questions.

Our educational aims and objectives

Objectives at the level of the children

The "Little Scientists" initiative pursues the following aims (see Figure 3) at the level of the children and their development:

Develop enthusiasm, curiosity and interest in research
The "Little Scientists" initiative sees enthusiasm, curiosity and interest as the key elements to entering the world of Science, Mathematics and Technology. As a rule children tend to have a perspective that is characterised by curiosity and the initial total lack of bias. From this point the children can also develop an understanding of basic scientific, mathematical or technical relationships in addition to an interest in the phenomena. Brain research also indicates that positive feelings aid concentration[10]. Therefore, enthusiasm and curiosity support learning.

Practice research-based approach and expand problem-solving competencies
A research-based approach for example includes the ability to deliberately experience and perceive phenomena, to observe and describe them, and to compare events. The children can then use this to derive expectations and predictions that they can then check by trying things and conducting experiments. Their own experiences contribute to an understanding of basic scientific, mathematical and technical relationships and initiate further considerations (in this respect see Part C "The 'research cycle' method"). The cyclical approach to research expands the children's methodological competence and problem-solving abilities; they learn to find answers to their questions themselves.

Comprehend basic scientific, mathematical and technical concepts
The research process allows children to accrue fundamental experience of natural phenomena. Over time they discover relationships, acquire individual knowledge about scientific, mathematical and technical phenomena and comprehend fundamental concepts in these topic areas. They identify for example that liquid water and ice are two different states of one and the same substance. When it is very cold, water freezes to solid ice. On the other hand, when it is warm solid ice melts and turns into liquid water.

Experience self-efficacy[11] and personal competence – Children experience "I can do that!"
Over time children find themselves becoming more confident in their research, communication, answering their own questions and solving problems that can arise on the way. In their exploratory activities with Science, Mathematics and Technology they experience the feeling: "I can do that!". This strengthening of the children's own feelings of competence and self-confidence is a core objective of the "Little Scientists" initiative. This boost to their self-confidence and inner strength is very important in terms of responding flexibly to the challenges of changing situations and mastering difficult and / or continuously changing life situations, e.g. the transition from day care and preschool to primary school.

Current research confirms that self-confident and strong children are more resilient in response to change and the challenges of everyday life than children who lack this self belief in their own competency[12].

10 Cf. Kiefer, M., Schuch, S., Schenk, W., Fiedler, K. (2007)
11 Self-efficacy expectations describe a person's belief in their own ability to be able to master challenges (cf. Bandura, A. 1997)
12 Cf. Rutter, M. (2000); Werner, E. E. (2000)

In addition, tackling questions and searching for answers together enhances a number of general competencies that the children need in life:

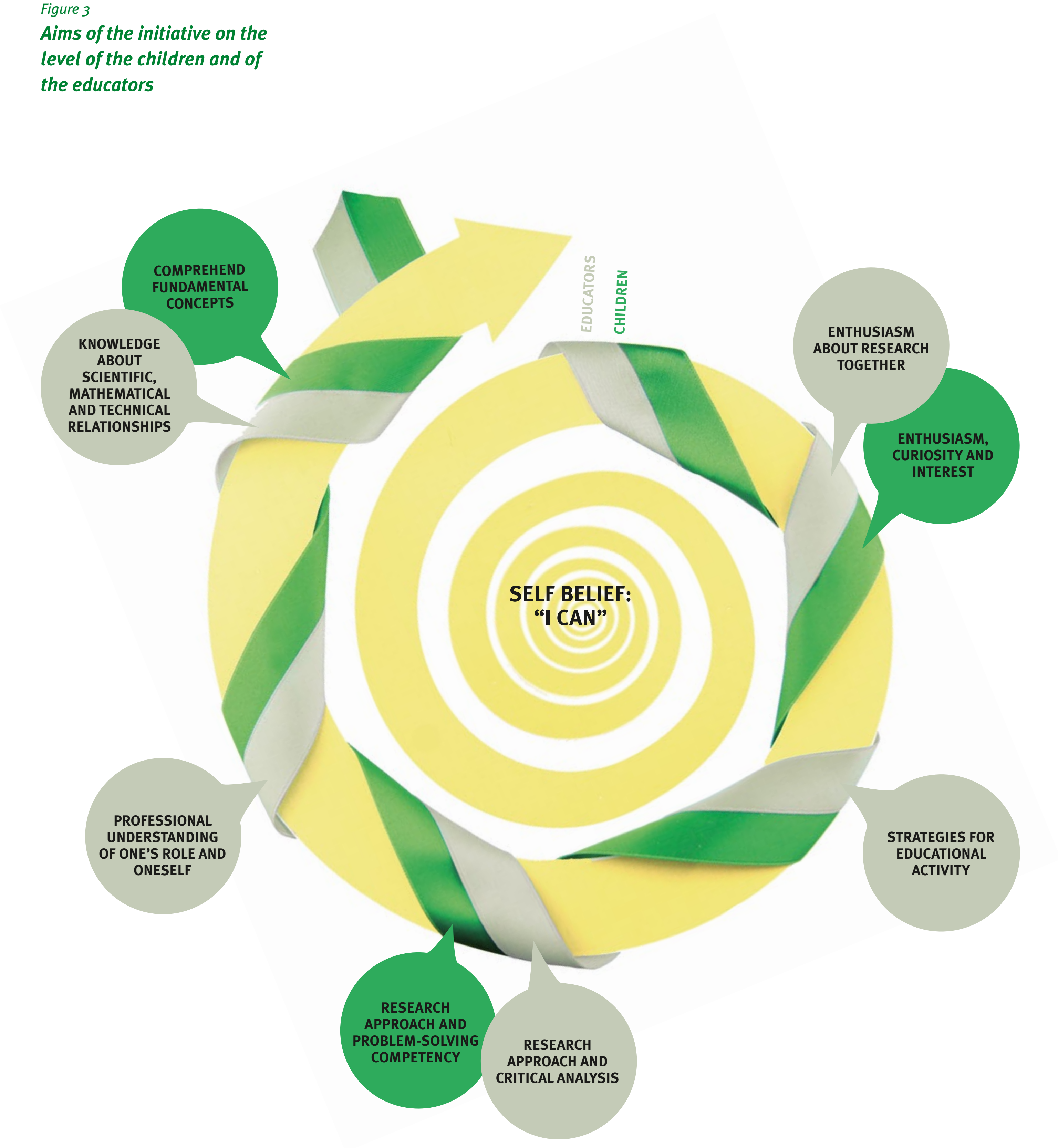
Learning and learning methodologies
The sheer volume of information available and the speed at which it changes in today’s society make it impossible for a person to accrue this information as a pool of knowledge in its entirety. Consequently, learning means not only an increase in knowledge, but above all, strategies that children can use to solve problems and accrue knowledge. The reflection phase during the research process is of major significance. It involves questions (e.g. “How did you find that out?”) that initiate reflection about the learning process (meta-cognition).

Social competence
Social competence is required in order to be able to interact successfully with other people. Among other things, it encompasses that a person is able to assume responsibility for themselves and their actions. Social competence can be enhanced through research and experiments, for instance when children negotiate how they will proceed, exchange ideas or develop rules together.

Language competence
Language is an essential pre-requisite for successful education and involvement in society. The verbal dialogue constitutes an elementary component of the reflective phases of scientific research and discovery in particular. Language learning can occur during research particularly when children are explicitly encouraged to express their predictions, describe their observations, name the materials used and formulate their own explanations.

Figure 3

Aims of the initiative on the level of the children and of the educators



Children and educators continue to develop their competencies in different areas when they undertake research together.

Objectives at the level of the educators

The initiative pursues the following objectives with respect to the educators:

Develop enthusiasm about researching together
It is not uncommon for adults to have partially or even totally lost their enthusiasm and curiosity with respect to scientific topics at some time during their educational journey. Together with the “Little Scientists” initiative, educators are setting off on the road to integrate Science, Mathematics and Technology into daily life at their preschool. In doing so, it is very important to be open-minded. Consequently, a core objective of the workshop run by the initiative is to facilitate a positive initial entry point for participants right from the outset.

Apply a research approach and critical analysis
Educators use a research-based approach in their own actions and critical analysis when they explore scientific, mathematical and technical phenomena and employ a procedural, cyclical mode of operation. The educators compare and evaluate experiences, develop predictions, speculate, try out ideas, experiment and reflect on their observations. The “Research Cycle” method (Part C) is intended to encourage children as well as adults to discover relationships through their own activity and research methods and expand their scientific understanding.

Deepen knowledge about scientific, mathematical and technical relationships
In order to support the children in comprehending scientific, mathematical and technical relationships, educators require basic subject matter knowledge of the content area being examined. This makes them feel more secure about the topic and they can give the children tips and hints while they are conducting the research and making discoveries together. The activities offered by the initiative support the educators in their endeavour to expand their own background knowledge of scientific, mathematical and technical relationships. Consequently, the thematic booklets published by the initiative also always have a section with background information on the specific subject matter.

Expand range of educational classroom strategies
Educators assume an active role in the co-constructive organisation of the educational processes. In the workshops run by the initiative, educators are introduced to specific pedagogical approaches for supporting the children’s learning processes. These also involve the role of typical naive conceptions held by children regarding certain phenomena as well as designing suitable learning environments for the children.

Self-confidence as a learning coach
Educators gain self-confidence in guiding the children through scientific, mathematical and technical learning processes as a result of the professional development sessions and conducting research activities together with the children. The educators’ self efficacy expectations with respect to structuring scientific learning processes grow in line with their expanding knowledge of basic subject matter interrelationships, scientific approaches and ever increasing numbers of pedagogical strategies for the classroom. Educators feel competent. This can also boost one’s confidence in one’s own abilities in general.

Enhance appreciation of one's professional role and self concept
In order for preschool educators to be able to master the increasingly diverse range of challenges it is important that they critically and constructively explore their role in the overall educational and individual teacher-student process, pedagogical concepts and their own pedagogical activity. Their attitude to doing research with children generally plus cooperation between educators themselves also play a vital role.

Developing one's own professionalism is a lifelong process that depends on one's willingness to undertake further education and training and update one's own specialised knowledge and skills. The regular workshops organised by the "Little Scientists" initiative provide support to educators in their efforts to do so.

In summary, the following pedagogical principles regarding scientific education and support can be identified, based generally on the "Flensburg declaration on promoting Science in early childhood"[13]:

- Encountering scientific, mathematical and technical matters promotes curiosity and enthusiasm for these subject areas.
- Children have the opportunity to devote themselves autonomously to scientific, mathematical and technical topics.
- Conducting experiments requires sensitive guidance and individual support for the children.
- Children learn together and exchange ideas.
- Educators and children address not only the subject matter content and activities, but also the learning process per se.
- Science, Mathematics and Technology are not offered as separate spheres of education in each preschool, but are embedded in complex contextual relationships and enmeshed with other activities if possible.
- Documenting and reflecting upon activities supports the children's learning process.
- There is a regular exchange of ideas between educators that serves to enhance their self reflection and produces new ideas for their own work.

[13] A white paper was prepared by the research and project groups at the conclusion of the Conference "Learning from phenomena. Promoting Science in elementary school" at the University of Flensburg in March 2009. The declaration is intended to heighten awareness of the extraordinary significance of early scientific education, formulating pedagogical principles and demands. (Cf. Flensburger Erklärung, 2010)

Using the educational material provided by the initiative

The educational material developed by the initiative, such as thematic booklets and the discovery / research cards constitute a font of ideas, stimuli and tips on how to integrate scientific, mathematical and technical topics into general daily activities together with the children.

Discovery cards provide an invitation to address a topic; the stimuli on them are intended to help the children compile a range of previous basic experiences in the subject area. As far as possible it is best to engage with the phenomena in everyday settings first. This provides an important springboard for more complex questions, which can in turn be explored using the “Research Cycle” method.

The example **research cards** show more advanced learning experiences for a specific topic, which are designed to assist educators launch the research process together with the children. The children should always have the opportunity to share their ideas with the group and check their predictions in an experiment. Experience shows that children very quickly start to test their ideas on their own.

The **thematic booklets** prepared by the initiative offer practical research ideas for application with the children in different content areas. In addition to the many practical recommendations, e.g. for project work, the booklets highlight how the topic is anchored in the educational frameworks and curricula and provide guidelines regarding the level of psychological development required and specialist background information for each subject matter area. With increasing experience, it is assumed that you will require the materials less frequently as you will have the basic knowledge and ideas as well as the self-confidence to pursue these of your own accord.

This is similar to cooking. When preparing a dish for the first time most people stick closely to the recipe in order to ensure its success. However, the more frequently their efforts are successful and they gain more experience, the more confident they will feel in the kitchen. Recipes are perfected and the cookbook can stay on the shelf.

WATER

Discover the phenomenon: **Aggregate states**

A STONE MADE OF WATER

LITTLE SCIENTISTS Science and Technology for Kids

Where do we encounter this in everyday life?

Water ice blocks are lovely and refreshing in summer. In cold parts of Australia kids can see frost on the ground and frozen puddles in Winter. The puddles are as smooth as glass and just as transparent. In some parts of Australia you can even see icicles and snow. On some mornings dew can freeze on car windows. How does ice form?

What it's about

The children hold ice in various forms, perceive it with all their senses and investigate its characteristics. They discover that ice turns slowly to water in their hands and in a warm room. The boys and girls experience how water turns to ice on frosty winter nights, the same as in a freezer and how frozen water takes up more space than liquid water.

You will need

- Freezer
- Water
- Ice cubes
- Pre-prepared blocks of ice: Put small items (such as buttons, stones, action figures) in a yoghurt tub filled with water and freeze them.
- Liquid ice blocks in sleeves
- Flat dish
- Different tools:
- Spoons, forks, small hammers
- Hand towels, kitchen paper
- Magnifying glasses
- Salt, sand

06/2013

Fig. 1: Ice cubes are like stones made of water

Fig. 2: Ice cubes melting in the hand

Fig. 3: How do you get the dinosaur out of the ice?

ICEY TIMES (SETTING THE SCENE)

Have an ice cream all together or a drink with ice cubes to provide an opportunity to start talking to the children about when and where they come across ice in their daily lives. The girls and boys can then report their own learning experiences related to ice, for example frost, snow, pictures of icy places or movies set in such locations. Ask the children what ice actually is and how they recognise it.

The children can try and find different examples of ice. If you live in a very cold place, make use of your local environment in winter. Examine these places in greater detail and describe what you notice.

A STONE MADE OF WATER

Place a block of ice containing small surprises (such as buttons, crêpe paper, stones or even small plastic toys frozen inside) on a flat plastic dish in the middle of the group. The children examine the ice closely, with and without the magnifying glass. What does the surface look like? They touch the ice and listen to it. How ever did the little surprises get into the ice? Challenge the boys and girls to get them out of the ice. The children will first attempt to free the toys from the ice with various tools such as spoons, forks or even hammers as well. They will notice that ice is a solid material and that it is not only tools that can alter ice: Their warm hands and the warmth in the room will melt the ice. But they can see that this takes quite a long time. What possibilities are there to accelerate the process?

Look at this:

Ice is a cold solid - as smooth as glass, it can be white, but also transparent. Ice melts in your hand and becomes a liquid. The warmer your hand is, the faster that happens.

WATER

Discover the phenomenon: **Saturating sugar using water**

HOW MUCH SUGAR CAN BE DISSOLVED IN WATER?

LITTLE SCIENTISTS Science and Technology for Kids

ASK QUESTIONS ABOUT THE NATURAL ENVIRONMENT

People put sugar in their tea to sweeten it.

But how much sugar can you dissolve in a cup of tea?

Is there a limit?

06/2013

COLLECT IDEAS AND HYPOTHESES

Together with the children, think about what happens to the sugar when it dissolves in water. Where does it go? Has it disappeared or is it just invisible? Can you keep dissolving sugar forever or is there a limit to the amount of sugar that can fit in the water?

Each child places the quantity of sugar cubes in front of themselves that they think will still dissolve in the water. The girls and boys write down or draw the number of sugar cubes. Will it make a difference if you put them all in together at once or one after the other?

Together with the children think about what will happen when the sugar no longer dissolves. Will it sink to the bottom or float in the water? Will the water look different? Will it remain liquid or will the sugar make it hard?

TRY THINGS OUT AND CONDUCT EXPERIMENTS

The children put their estimated amount of sugar into jars with the same amount of water and observe exactly what happens.

Let the children decide by themselves whether they want to put the sugar cubes in all together or one by one. Would the boys and girls just like to watch the process or accelerate it for example by stirring?

Once the quantity of sugar has dissolved in the jar, the children can estimate and test again how many more sugar cubes can still be dissolved in the water now. They repeat the process until no more sugar dissolves in the water.

PART C

Practical Information For Implementation

Discovering together – researching together

Entry to scientific, mathematical and technical topics is largely shaped by one's own actions and observations. It starts with almost casual discoveries in everyday life that can fascinate not only children but also adults. Sand running through your fingers, raindrops that either stick on windows or run down in snake-like patterns, or sugar that dissolves in tea and seems to disappear – the surprise and enthusiasm triggered by such discoveries drive one to explore one's own observations further.

Discovery is a phase of exploration in which the children try out and repeat as many different things as possible. This phase can be difficult to endure for educators providing support, especially when the intended learning experience is actually a deep and systematic exploration of the phenomena involved. However, comprehensive basic experiences with phenomena and materials are essential for children. They must do this before they can develop specific questions and predictions and focus on their own specific topics in a targeted way.

Practical assistance for employing this approach is demonstrated using an example from the subject area of Water below.

RESEARCH WITH WATER

Discovering water

We encounter water in many different places. Plants and animals need water to live as much as we do. We come into contact with water all the time, whether swimming or showering, cooking or washing up. Children are fascinated by this damp element from an early age and love splashing in water. They wash their hands with warm water and drink cold water to refresh themselves. Children watch how steam rises from pots on the stove. Bath water is sometimes too hot to get in right away. Children develop a concept of water and its characteristic features on the basis of the experiences they have: Water is wet. Water is sometimes hot, sometimes cold. If water is heated above 100°C it generates steam. If water is cooled below 0°C solid ice forms – and much more.

Ask the children to go on a "voyage of discovery" about water. Ask them when and where they encounter water during the day. When is it hot, when is it cold? Let the children tell their stories: How lovely it feels when you let the soft, warm water run on your skin when you wash your hands or how cold seawater tickles your feet but feels more pleasant the longer you leave them in the water.

RESEARCH WITH WATER

Together with the children, collect photos showing water with a range of different images: the ocean in summer and winter, warm summer rain, a fountain, a simple glass of water, the lake from a recent excursion, a puddle in front of a house etc. Looking at the pictures, is it possible to guess how the water feels in each case? Is it warm and soft or cold and prickly on your skin? How do you know that? Have the children lay the pictures in a sequence from cold to hot.

Then test your own temperature sensitivity together with the children. Fill three or four bowls with water of different temperatures. The children can dip their hands into the bowls one after the other. Which water temperature feels the most pleasant? Do all the children share the same opinion? As the next step, have the children lay both hands in the bowl with warm water. Then they can put one hand into a bowl with cold water and finally back into the first bowl. How do both hands feel now? Can the children feel the difference?

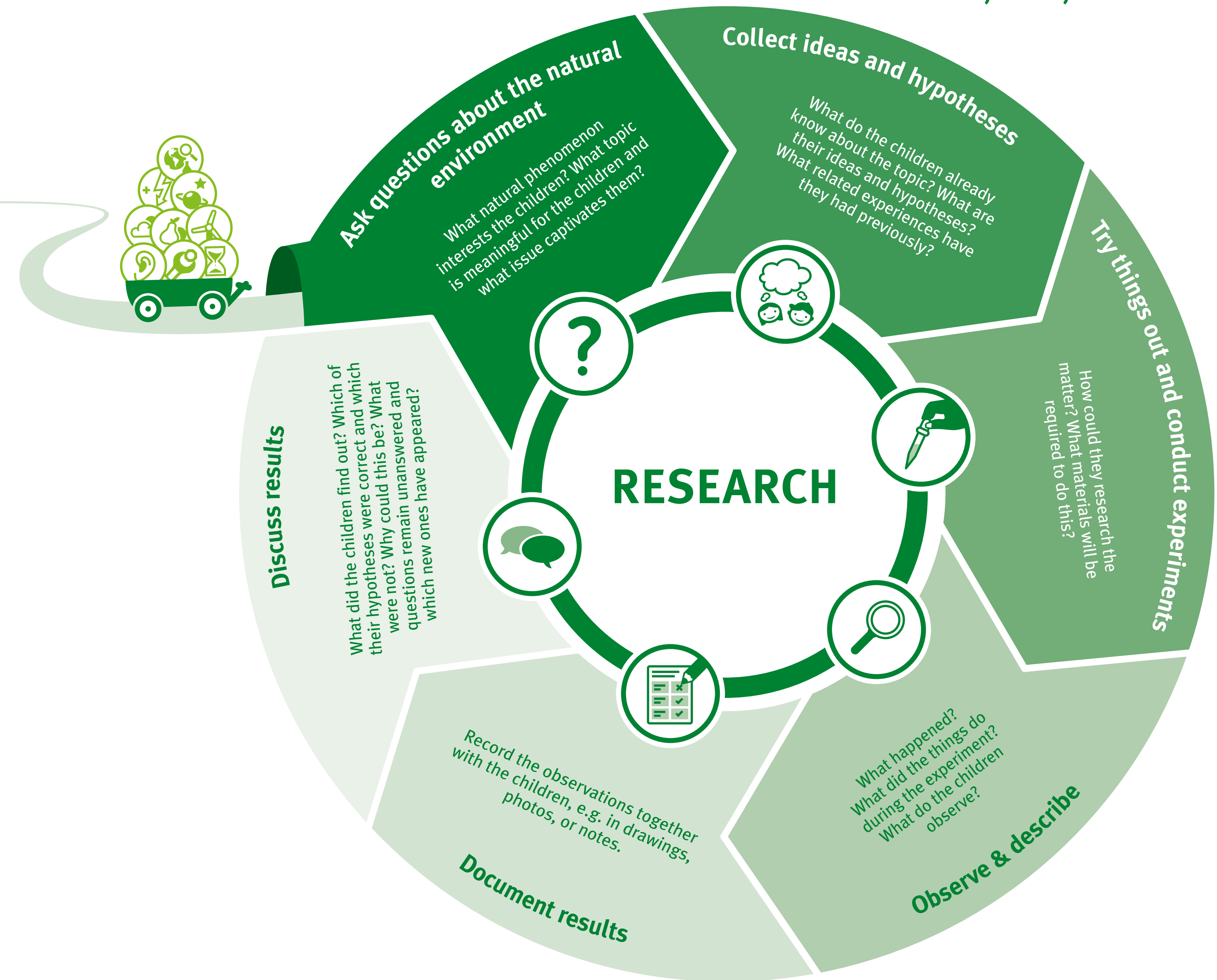
Focused research begins when a child no longer tries things randomly, but comes across something that it wishes to investigate in greater detail. Does the water cool down as quickly as it can be heated? How can the water be transported? Can rain or water drops adhere to materials other than glass? Are there other foods that simply “disappear” when they are stirred into water? Such questions provide the stimulation to devise and conduct their own experiments, evaluate their results and discuss them together.

The educators shape the learning process for discovery and experimentation together with the children. In the ideal case, they head off on the search for an answer together and talk to each other about how they view the situation. The role of educators is also to encourage the children to gather information, data and descriptions of their observations, to describe their perceptions, ask other children about their ideas, record the knowledge generated and to repeat it. The learning stimuli provided by the educators are always linked directly to the ideas and the experiential world of the children so that the children are able to develop scientific knowledge themselves and reflect upon it. The children are encouraged to generate their own ideas and to discuss these with others.

The “Research Cycle” method

The research process can be divided into different phases involving thinking and doing that typically occur in a repetitive cycle. This process of accruing knowledge can be summarised in the form of a research cycle. Individual phases of this method will be introduced in detail below and illustrated with reference to a specific example from the subject area of water.

Figure 4
The research cycle describes a method of scientific action.



Ask questions about the natural environment

Natural phenomena constitute part of a child's experiential world. Children are strongly and intrinsically motivated to understand their world, to grasp it in both senses of the word and to find out more about phenomena and relationships in the natural environment. There are many opportunities available in the daily lives of children that can be used as a starting point for educational work. The questions posed by the children themselves should always play a central role in research and discovery.

What you can do: Find an entry point for the research process by picking up on either a question or an observation made by the children that can be investigated further or by suggesting a phenomenon or a question – ideally related to an observation made by the children. Remind the children about where they have already been able to observe a certain phenomenon themselves. Always create a link to the world in which the children live.

RESEARCH WITH WATER

The excessively hot bath water or the freshly made hot chocolate that is still too hot to drink both offer a good entry point into the research process. Almost every child has experienced this and asked themselves: "How can I cool the hot chocolate down so that I can drink it faster?" Make yourself a cup of tea and describe your dilemma to the children – freshly brewed tea that is too hot to drink. Put your tea in the middle of the group and let the children observe it first. They see the steam rising, which abates after a little while. Hold the teacup firmly and allow the children to touch it carefully. They pull their fingers back quickly. What can we do to cool the tea down?

Collect ideas and hypotheses

Sometimes the children make numerous predictions and assumptions and also often have specific ideas about what they want to find out. But there will also be children who are unable to formulate their ideas precisely or do not wish to do so. You can often decipher their thoughts on the basis of their actions. In your role as the learning coach you can then speak to the children directly about what they are doing.

What you can do: Take notice of the children's predictions and assumptions and show the children that you take these valuable ideas seriously. Ask questions in response that motivate the children to think more about the issues.

RESEARCH WITH WATER

Together with the children, think about what they know about hot liquids. What do the children normally do with hot drinks or hot bath water? What ways can they think of to lower the temperature? What happens if you don't do anything? Do the children have an idea what one could do to be able to drink the tea sooner? Collect all the children's ideas (e.g. stir the tea, pour the tea back and forwards between two jars, put the jar in a cold bowl of water or in the refrigerator etc). Ask the children to give reasons for their ideas. Why do they think that their particular method will work?

And where do they think the heat goes when the tea cools down? Encourage the children to draw or write down their ideas. Once they have noted down all ideas you can encourage them to start preparing the practical activity.

Try things out and conduct experiments

The next step involves examining the ideas and predictions collected earlier. Suitable methods must now be found to test their own ideas. This phase tends to require a lot of time and the children often feel the need to repeat certain experiments numerous times.

What you can do: Work out an experimental plan together with the children. This confirms to the children that they are really allowed to pursue their own ideas. Alternatively, you can offer suitable materials and suggestions for experiments. Ask the children specific questions: "What do we want to know? How can we find it out? What material can we consider using?" Once these questions have been resolved together, you can remain more in the background during the experimental phase. Give the children uninterrupted time to conduct the experiment and collect their own results.

RESEARCH WITH WATER

Together with the children, go through and work out which ideas are going to be tested: Do nothing to the tea, blow on it, stir it, put it into a cold water bath, add ice cubes etc. Talk to the group about the possible number of ice cubes required and whether the material the stirring spoon is made of will play a role.

How can one tell how hot the tea is? Some children might already know about thermometers and may already have even used one themselves. Look at different thermometers together with the children and try these out.

Together with the children think about: "How can we compare which method cools the tea fastest?" For example, the children can note down the temperature of the tea at particular time intervals (after 1 min, after 2 min, etc.).

In order to allow the children to do this themselves, please use only temperatures that will not scald the children (40°C maximum). Start the experiment by pouring the hot tea in a glass jar and then start measuring the time. The clock should be visible to all. One child can be responsible for ensuring that the temperature of the tea is measured at the agreed times.

NOTE

When doing research it is often impossible to avoid dirt, grime and slop. Doing experiments is just like painting with watercolours when it comes to making a mess – sometimes minor or even major mishaps occur. A glass of salt water that is knocked over can provide an invitation to further research rather than leading to condemnation. Maybe we don't need to wipe up the puddle because the water will evaporate, won't it? Will the cloth soak up the salt as well? Of course not all incidents can be used as springboards for research, but a relaxed approach to a lack of cleanliness encourages the children to experiment freely.

Observe and describe

The children generally make numerous observations and discuss these with each other and with the guiding adults. In addition to these first spontaneous exchanges it is very important for the learning process that the children are actively aware of these experiences.

What you can do: Ask the children to observe closely and describe what is happening very carefully: What has happened exactly? What did the children see? What did the things do during the experiment? Targeted follow-up questions and hints from you can also make the children aware of other distinctive aspects.

Some educators have used hand puppets quite successfully. In addition to introducing a research question, the puppet also leads the discussion about the children's explanations. However, during the actual experiment time the puppet tends to fall asleep (with the children waiting expectantly for this to happen). As soon as the children have finished, it jumps up from its nap very excitedly, asking the children what has happened and what they saw. Experience has shown that the children prefer talking to the puppet and report their impressions to it more willingly than to the educator. The latter was obviously awake the whole time and must know what has happened. Because the puppet is sometimes a bit slow on the uptake, the children have to explain and describe things in great detail, something that helps them to verbalise their actions and thoughts as clearly as possible.

RESEARCH WITH WATER

Encourage the children to not only note the visual changes, but point out to them that they can also make note of odours, sounds and above all tactile feelings during the experiment. The children can initially feel the change in temperature with their hands on the glass. After an arranged period of time they can then carefully put a finger into the tea. Do they notice a difference? What do the children notice when using the thermometer? What happens to the ice cubes in the hot tea? Does anything change in or on the cold water bath in which the hot tea is standing?

Document results

The documentation of educational processes plays an important part in meta-cognitive learning processes. Documentation is not only important in order to demonstrate the diversity of activities in each centre to third parties (for example parents), but also helps the children to remember certain events and to reflect on their own learning processes.

What you can do: Prepare posters, drawings, photos, films or portfolios together with the children. You can also photograph the experimental sequence and then have the children put the printed photos in the right order. In this way, experiments that have been conducted can be reflected upon in discussions with the children, repeated "in their heads", methods and chosen solutions recapitulated, and suggestions regarding key situations offered again. Note down the children's exact words and commentary.

RESEARCH WITH WATER

The temperature of the tea is measured and felt through the glass jar for each idea after 1 minute, 2 minutes etc. Older children can record the temperature in a table as well. Children who are not yet able to read or write can mark different coloured lines on a drawing of a thermometer (e.g. blue for cold, orange for luke warm, red for hot). At the end of the experiment the poster thermometer shows many lines that illustrate a trend from hot to cold. You can also make a large poster together, showing all the experiments and all of their temperatures at a particular measurement time (e.g. after 3 min). Pictures or photos of their "own" glass jars with tea help the children to remember the experiment and reflect on it. In order to compare the different methods of cooling, the children sort the photos on the basis of the temperatures reached in the jars filled with tea.

Discuss results

When discussing the results of the experiment the main point is to discuss whether the initial question has been answered, which original predictions were correct and which were not, which questions remain unanswered and what new questions have arisen. In doing so, it is important not only to discuss what they found out, but also to recapitulate on how these results were achieved.

What you can do: Discuss the results together with the children. What was observed? What worked well? What did not? What did the children do? How did they manage any difficulties that arose? Did they do what they originally planned to or did they change the question during their research activities? If yes, how did that happen?

RESEARCH WITH WATER

Look at the sequence of pictures on the poster together with the children. Compare the different cooling methods and talk to each other about how this sequence came about. Why did the hot tea cool down using one method more quickly than using another? Could one also use two methods together at the same time and would the result be better, i.e. would this approach result in the tea cooling more quickly? Together with the children, consider whether their initial question, i.e. "What can one do to cool down the freshly made tea more quickly?" has now been answered. It is possible that new questions arise: What happens, for example if one uses a completely different container for the tea? Will it cool more quickly in a ceramic cup then in a glass jar? And what about porcelain? Does double the quantity of hot tea also take twice as long to cool down? What is the lowest temperature that the tea will reach when it cools?

Background knowledge for interested adults
Water is a relatively poor thermal conductor. A considerable amount of energy is required to heat it. Once water is hot it only releases this heat into the surrounding environment very slowly. That is why oceans and lakes need a long time to heat up to a pleasant temperature for swimming in summer, i.e. long after the weather has warmed up. This heat exchange process is known as thermal equalisation: If two substances with different temperatures meet, then the temperatures level out so that they no longer differ from each other. In this process the warmer substance gives up energy and becomes colder, while the other substance takes it up and becomes warmer. The hot tea gives up its warmth to the immediate environment, i.e. to the cup and the air. If the cup is standing in a cold water bath, the heat will also dissipate into the surrounding water, which warms up as a result.

The research process does not generally end with the final phase. The additional questions that have arisen lead to new ideas and speculations that demand to be examined in greater detail. In this way, the research cycle is continuously revisited until the children have found satisfactory answers to their questions.

The individual phases of the research cycle presented are not temporally defined in any way. They can take minutes, hours, days, weeks or even months. And of course research and discovery are always very individual processes. Therefore, the responsibility of learning coaches lies not only in supporting the group of researching children during these generally identifiable phases, but also to recognise and take into account the individual characteristics of each of the children.

SIGNPOST

The research cycle can be seen as a model or tool that shows you how you can conduct experiments together with the children. It provides opportunities to enter into a dialogue with the children about scientific phenomena[14]*. The research cycle is a method that provides a degree of orientation and reference points for flexible research with the children. With more advanced cognitive development, primary school children are then in a position to reflect autonomously on the research cycle method and apply this in a deliberate manner.*

Learning experiences, appropriate questions and working with explanations

In order for the educators to provide targeted support to the children before researching begins, it can be advantageous to consider one or more possible learning experiences that the children might be able to engage in that relate to the particular topic. For instance, what can the children observe? What fundamental relationships are they meant to recognise? With this objective in the back of their minds, educators can facilitate the research process using suitable questions and advice as required, helping the children to discover answers to their own questions themselves.

It should be noted that the type and / or formulation of questions always generates certain types of answers. Questions should be asked in such a way that the children are able to answer them. Meaningful research questions are event-oriented questions (e.g. “What happens to ice in the room?”). Action-oriented questions (e.g. “What happens if you...?”) prompt children to find the answer by doing something themselves, for instance with an experiment. Questions that require observation and description (“What can

14 Cf. Ramseger, J. (2010)

you see? What happened?") generally have an effect that promotes language. After the experiment the educator asks questions reflecting the learning process, thereby supporting meta-cognitive competencies ("What do you think about it now and what did you think before? How did you find that out?").

At workshops held by the "Little Scientists" initiative educators often express the need to have child-friendly explanations for the phenomena observed. This desire must definitely be taken seriously. However, in this context the question is how we should define "explanations" and / or meaningful learning experiences in preschools. When a child asks "Why" it does not necessarily want an explanation involving scientific background information. What children mean when they ask a question and what adults think they mean is not always the same thing.

EXAMPLE

A preschool child asks: "Why does it rain?" The educator goes to great lengths and makes several attempts to give the child an explanation for the phenomenon of rain. Together they find out for example that water evaporates from a saucer over time or that steam condenses again on a mirror held over a pot of boiling water. They have a series of discussions about the water cycle, the clouds and the sun. The child is still dissatisfied and asks: "But why is it raining now?" The educator is at a loss as to how to help the child find an explanation. One afternoon the child runs excitedly over to her and reports with a big grin on its face: "I know why it rains: So that the plants get something to drink!" In this case the child's question had a more philosophical background.

Autonomously identifying elementary relationships with respect to a specific phenomenon make it easier for children to develop a deeper understanding about it later. That is why some of the material available from the "Little Scientists" initiative includes suggestions for games or visualisations that can support children in identifying certain conditions. The extent to which you seek further explanations with the children will depend on the individual group of children and on each individual child.

EXAMPLE

When researching the topic "Carbon dioxide" it doesn't matter why two particular substances react together and why another substance is formed. What is important is to investigate together which substances react with each other at all. For instance, it is only when children experiment with bicarbonate of soda and discover that carbon dioxide is formed when an acidic liquid such as vinegar or lemon juice is added – i.e. water is not sufficient by itself – that a valuable learning experience results.

Educators should always be asking themselves what each individual child's interest is in this knowledge and at what point the explanation has reached the child's individual limits. They should definitely not feel pressured to be able to answer all the children's question immediately. Instead, educators and children should set off in search of an answer together. Therefore, it is incredibly important to have an understanding of what the children think about the phenomenon involved. This dialogue enhances the learning ability and self-confidence of the children. Examples of potential paths include researching together on the Internet, in a book, in a conversation with an expert or obtaining information from knowledgeable parents. In this way many facilities have found a mentor who can provide support on a permanent and regular basis with respect to specific activities or questions. Children can therefore learn about different ways and sources of acquiring information.

SIGNPOST

In order to motivate the children to undertake research at home with their parents, you can also introduce little "research boxes". The research box can be a small box or a nicely decorated shoebox. One child in the group takes this research box home with them over the weekend, considers a research question together with their parents and thinks about a possible experiment for it. The child brings the research box back at the beginning of the week together with the material for the experiment and presents their question and the chosen path for answering it to the other children. Experience has shown that children are very proud of their own presentation and the opportunity to motivate other children to think about the same question.

The "Little Scientists" initiative wishes you all the best and a lot of fun in your research and discovery activities together!

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