Kide Science Learning Philosophy

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The Kide Science Mission Statement

Values of Kide Science

Early childhood is a significant time period for learning basic life skills and forming basic attitudes. In early childhood the basics of interaction skills are learned, the basics of day-to-day skills are practised, the first human relationships are built, and the basics of how the world functions, are grasped.

The child-initiated approach is one of our basic values. Each child is valued as they are, and all learning should develop from the starting point of the child. We educate the children with an approach they find natural: through play and stories. It is important that a child is educated by means of playing, inspiring, and wondering together because a child has the right for a childhood.

The child-initiated learning approach is one of the principles of early childhood education in Finland (Agency for Education 2014, 15). Kide Science also adheres to this.

Our values are based on the stance that especially early-childhood learning should be **fun and meaningful**. That is why in our educational operation, prior experiences are used as a motivation to learn, or the purpose for learning is created using a narrative context. In a small child's world 'density', for example, doesn't play a role in a theoretical sense, but if Hoseli, living in Supraland, can be helped to float in a pond with a floating device, there is a unique motivator in the situation for learning.

Both the producing and utilizing scientific research as part of developing our educational method are important values of Kide Science**.** Our founding member, Jenni Vartiainen, has written her doctoral dissertation for the University of Helsinki on the science education of young children, and she is now working there as a researcher.

Our operation is based on Vartiainen's thesis (https://helda.helsinki.fi/handle/10138/168314) and it follows the latest research on the science education of 3–8 year-olds. Vartiainen is responsible for the pedagogy at Kide Science.

Our founder, Jenni Vartiainen, is a researcher who has worked with the science education of young children since 2006.

In our operations, we emphasize **doing together**. Learning is a social process that can't happen effectively without interaction with others. Interaction is important both with peers and with those on a higher cognitive level. In addition to the Kide operations, meaningful interaction can be created between the child and the caretaker.

The Learning Theory of Kide Science

Part of our learning theory is **to see the child as an active thinker and agent.** A young child is naturally very curious and asks plenty of questions concerning day-to-day phenomena. The child experiences themselves as part of the surrounding world for the first time and practises engaging in it by experimenting and wondering. We want to support the all-encompassing development of a child's thinking processes, as well as encourage the experience of their own agency because these positively reinforce both a child's self-esteem and self-image. The development of 3–8-year-olds is happening at such a rapid pace that they should, therefore, be provided with a safe and positive learning environment.

Our perception is also that a child is an active **information consumer and producer.** This idea is based on constructivist principles concerning a person actively and spontaneously cultivating the perception of themselves and the surrounding world. We support a child's information-producing skills by focusing the educational operations to practise science process skills. A person's knowledge and experience base are built on prior experiences and perceptions, thus it's extremely important in Kide Science's educational operations to provide a child with the experiences of enthusiasm and success. This is possible by providing the child with fun and educational experiences with science that correspond with the child's development level.

Another aspect of our learning theory is that **a young child learns by playing.** Play is the normal state of being and learning for a child, and play-based learning supports the agency of a child and the activeness in the learning process. By translating the language of science education into the language of play, we attain a more child-initiated learning method and a way of enjoying the natural sciences.

The Societal Impact of Kide Science

One of the central missions of Kide Science is **to impact the way in which members of the society perceive their surrounding nature and its meaning.** Science and technology have a special role in impacting how and in which direction the world develops (Sjøberg, 2015). To be able to meet the challenges affecting humankind as a whole in the future, such as climate change, we need science and technology, and especially we need the innovative new experts working in these fields (Henriksen, 2015). In order to effectively have an impact on attitudes, early science education should be provided already before the age the children attend school.

Globally, there is growing concern that young people are not gravitating towards the fields of science and technology. For this reason, the basis of the Kide Science operational model is to **encourage everybody in the field of natural sciences.** This is why it is important for us that besides being a non-formal hobby, we are, through our training of teachers, part of the day-to-day life of the schools and kindergartens. Our goal in the future is to also be a part of the operations of schools and kindergartens more extensively.

Teachers in science-education training.

With Kide Science education we aim for the development of critical thinking. Critical thinking provides citizens with the capacity to comprehensively take part in societal actions and to form decisions based on research-based knowledge. In addition, science education aims to teach the skills needed for critical thinking. Critical thinking does not refer to negative thinking, but rather to the capacity to inspect things from different angles and to ponder the pros and cons.

One part of the effectiveness of science education is **the popularization of science**. Popularization refers to three things here:

1. Scientific concepts and language are translated into a language that doesn't require special skills or knowledge.

2. Science is presented in a way that inspires people to participate in the science culture.

3. Science is made visible as part of everyday life.

Kide Science aims for the popularization of science in the following ways:

1. The concepts and phenomena of the natural sciences are brought out in our educational activities in a way **that recognizes the individuality of a child and that is suitable for the age group the child belongs to**. Adults are also encouraged to communicate with the children about the phenomena of the natural sciences, marvelling and pondering together without forcing in the scientific concepts.

2. Within the Kide Science educational operations, the natural sciences are presented as something anyone can learn and practise. **Every adult and child is involved in the process of producing information** and they are encouraged to take part as information producers through role-playing.

3. Kide-pedagogy is made accessible to the public by **sharing scientific research material** about our educational operations for public use and by discussing our pedagogy in the public media. Content following Kide Science's pedagogy is available, for example, on the Finnish state media in the form of a children's science education show.

The two founders of Kide Science, Jenni Vartiainen and Aino Kuronen, are working as the pedagogical experts on the children's show 'Tiedonjyvä' on the Finnish state TV channel. The show is produced by YLE.

Kide Science's Theory of Knowledge

What is Science?

Typically science is understood in terms of the information it produces, such as 'water boils at 100 degrees Celsius' and 'a rainbow is formed when a drop of water acts like a prism and separates the white light into the whole spectrum of colours'. Science is also other things. Part of the nature of science is how information is produced and used in society. In the science education of young children, how information is produced is more important than the information itself.

The operations of Kide Science follow the idea that the nature of science consists of three parts:

1. the information produced by science
2. the process used for producing the information
3. the utilization of the science-produced information in society

Information produced by science means the information that has been produced by making scientific research and that has been approved by the scientific community. In the science education of young children, the objective is not to teach information, because according to the previous research children are quick to forget fact-based information, and, at the same time, it has been proven that the information-based approach is reducing interest in the natural sciences.

The scientific process means the method of producing scientific data. This includes the idea that information is not constant. No fact is absolutely true. When research methods develop and more information is gained, scientific data is also subject to change. This has been noticed several times in the history of science. It is a part of practising the scientific process to practise the science process skills in a social environment and to critically evaluate the information produced. Kide Science's pedagogy is primarily based on practising the scientific process and thinking skills.

The utilization of scientific data in the decision-making process of society and individual life is just one dimension of the nature of science. With children, different research results can also be pondered in light of how they affect day-to-day life and possible future decisions.

Sharing scientific data is an important part of professional research. One of the main tasks of university researchers is societal interaction. This means that each researcher is supposed to communicate with the society about the results of their research. Kide Science is one example of the materialization of scientific-research results in society.

Why Do We Teach Science to Young Children?

The Finnish Ministry of Education and Culture defines science education as follows: Science education is reinforcing scientific know-how. Scientific know-how means the basic skills from the knowledge and capacities gained by education. It is also the capacity and interest to collect, process, and evaluate new information and to follow scientific development. The knowledge of the sciences is essential as well as thinking and learning skills. It is through science education that the important capacity to understand the processes of science and research is ensured for the know-how of a society.

It has been proven by studies that science education has a number of benefits for a child. Education during early childhood has a long-lasting effect on a child when studying learning and educational achievements (Karila, 2016). Also, a child's attitudes to the natural sciences are formed already in early childhood (Kermani & Aldemir, 2015). Young children have an intrinsic motivation to explore the surrounding world (Brown, 1997; French, 2004). It is especially important to support a child's enthusiasm and interest in the natural sciences while the child is still naturally interested in the day-to-day phenomena related to the natural sciences. According to studies, it has been noticed that a child's interest decreases significantly as the child grows older (e.g. Gottfried, Fleming & Gottfried, 2001). Currently, children have, in general, very few opportunities to participate in science education during early childhood education (Saçkes, Trundle, Bell & O'Connell, 2011; Tu, 2006) and the methods available are not very effective (Greenfield et al., 2009; Saçkes et al., 2011).

According to common definitions, science education is not solely related to the natural sciences, yet according to scientific research, the research and thinking skills typical to science education can best be taught through an inquiry-based approach (Sackes, 2013, Greenfield et al.,2009).

Through the natural sciences, it is easy to practise science process skills because a child can concretely see the impact of their own actions.

Kide Science's Operating Culture

The Principles of the Operating Culture

Operating Culture in this context means the operations that support the organization of education in every possible way. The operating culture of the organizers of the education has enormous significance in determining the form the learning environments are taking and the kind of education that is organized for the children.

Mutual **respect** is one of the principles of Kide Science's operating culture. Each individual taking part in the operating culture deserves to be respected, regardless of their social background, gender, age, religion, race, or other comparable factors. Kide Science does not approve of discrimination in any of its operations.

Another important factor of the Kide operating culture is a **respectful conversation.** This means that every member of the Kide Science teacher community has the possibility to participate in the conversation and open up about their ideas considering Kide Science's teaching and education practices. To enable this conversation Kide Science opens up physical and digital channels for teachers to share their experiences, ask questions, and participate in developing Kide Science's pedagogy.

In all of our operations, the **parity and equality** of the participants of the community and our clients are applied. Each adult and child who is active in the sphere of Kide Science deserves to be treated equally. We strive to ensure equality through our operating culture of conversing among our community and the equal treatment of the customers. We also aim for this by avoiding gendered and race-based conventions and by providing visual material presenting a variety of types of people and characters as scientists.

The Kide Science cartoon characters: Mrs NobleGas, Kelvin, Esther, Hoseli, and Pi.

In our cartoon material, we try to introduce a variety of people of different ages and appearances to allow for as many of the children as possible to have someone to identify with. To make the characters identifiable they are depicted with different hairstyles, eye and skin colours, clothing colours, and personalities. We aim at keeping our visual materials up-to-date.

The last principle of our operating culture is **basing decision-making on collected feedback and research.** Kide Science aims to take into account customer feedback, the opinions of the children and all voices in the decision-making process. Kide Science continually gathers feedback related to its education operations, materials, and operating principles. All educational practices are based on fresh studies of the science education of young children. Kide Science is devoted to developing its operations based on collected feedback and justifiable arguments.

Learning Community

Here, learning community, means a community basing its operations on dialogue, participatory experiences, and developing together. In the learning community, the decision-making process is based primarily on the collected data and the conversations based on this data.

The principles of the Kide Science learning community consist of providing the necessary training and feedback for each member of the teacher community, and for them to be able to develop themselves, their operations, and the operating culture of Kide Science, which they are participating in.

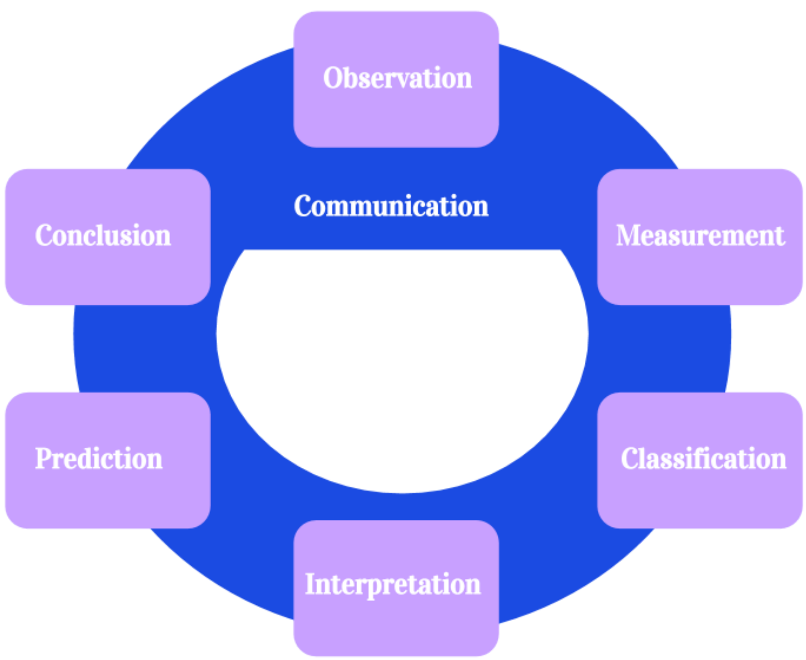
Kide Science provides basic and advanced training in organizing science education and encourages the participation of everybody in the conversation by opening up channels for feedback and natural communication. Due to physical distance, many of the communication channels are on digital platforms, but we also aim to open up opportunities for physical meetings, for example, during our training sessions.

Operating the learning society is based on dialogue, participation, and developing together.

The Foundation Pillars of Kide Science's Pedagogy

Science Process Skills at the Core of the Pedagogy

Science process skills refer to the fundamental skills needed for learning how to produce scientific data. With the help of these skills, research problems are set, data is collected, data is evaluated, and the data collected during the research process is reported. All research operations are connected through communication. There are seven basic science process skills addressed in Kide Science's pedagogy: observation, interpretation, prediction, classification, measuring, communication and conclusion.



Observation: Observations are made by using all senses. By using our senses we collect information about the object of observation. The adult should support the child in verbalizing their observations.

Interpretation: Interpretation happens when the child explains or interprets a phenomenon, event, or thing. For example, if we look out of a closed window and observe with our sense of sight that the trees are swaying, we make the interpretation that it is windy outside. An interpretation can never be 'right or wrong' because it is always a subjective view on the situation. It is possible, for example, that someone might be outside swaying the tree.

Measurement: Measuring can be done using either standardized units (centimetres, grams, or minutes) or with non-standardized units (the length of a finger or a pen). Measuring can also be counting (three spoonfuls or ten leaves).

Classification: Things can be classified in three ways. Single-level classification: dividing objects into categories based on one quality, for example, colour (green building blocks in one category, yellow ones in a second, and red ones in a third). Multi-level classification: classifying into sub-categories based on some other quality, for example, size (the green building-block category is further divided into one-unit, two-unit, and three-unit sized blocks). Serial classification: arranging the objects in an order based on an increasing quality (a block tower from lowest to highest).

Prediction: A prediction is an educated guess on what is soon going to happen or will be observed. A prediction is made using previously learned information or previous experiences. Therefore, in a situation where, for example, a child experiments for the first time to see if a grape will float, and is asked before the experiment what they think will happen, this is not a prediction but merely a guess. Instead, when a child has once observed that the grape sinks and they are asked what they think will happen when trying with half a grape, this is a prediction. Making predictions is a skill developed by the child around the age of four.

Communication: Communication, for example, asking questions and wondering, should be encouraged in all research activities. The adult can encourage the child to verbalize, for example, their own observations by asking defining questions and by listening and appreciating the child's views on the situation.

Conclusion: By conclusion, we refer to the skill of summarising the information gathered during the research process. The concept of conclusion is often used interchangeably with interpretation. The difference between these two concepts is that conclusion often answers the “bigger” research question (e.g. “How could Hoseli blow 100 balloons without using lungs”?) and includes the use of other science process skills, such as interpretation, during the process, while interpretation refers to “smaller” processes. Many interpretations are done during the process to reach a final conclusion of the research question.

An example: To answer the research problem about filling the 100 balloons, we can observe and make interpretations about the reaction between baking soda and vinegar: “What happens in the reaction between baking soda and vinegar?” The interpretation could be: gas is formed! After this interpretation, we could try to find ways to help Hoseli with this knowledge. In the end, the conclusion could be: “We should seal the gas formed in the reaction inside a balloon so that Hoseli could fill balloons without using lungs!” Therefore, we use the science process skills to gather data and answer the research question by making a conclusion.

In all Kide Science operations, we aim to encourage the practising of science process skills. The symbols of the science process skills are often present in all of our educational operations as visual cues to support the training and vocalizing of the specific science process skill.

Inquiry-Based Learning

The objective of Kide Science is to promote inquiry-based learning and education for critical thinking.

Our pedagogy is based on research data on inquiry-based learning. Inquiry-based learning began with the learning theories of Piaget, Vygotsky, Dewey, and Ausubel, which have been combined together as the constructivist philosophy of learning (Cakir, 2008). The learning approaches that make the learner take on an active role to pose questions, plan the research, collect data, make conclusions, and communicate the results, support a child’s learning of the natural sciences (Minner, 2010) and learning of science process skills (Bunterm et al., 2014). Inquiry-based learning is a recommended approach to study the natural sciences at every age level and especially in the natural science studies of young children (Samarapungavan et al., 2011; Peterson & French, 2008).

There are certain basic components in inquiry-based learning that are repeated. This is not to say, however, that it is a path of fixed steps, but rather it is an interactive process that repeatedly takes the learner back to the various steps along the path.

The following phases are part of inquiry-based learning:

- Introducing the context and motivating
- Setting the problem or the objective
- The plan for meeting the objectives
- Conducting the research
- Evaluating critically
- Assessing the need for further information from the research
- Sharing the information

Play-Based Learning and Stories

Play-based learning is an integral part of the Kide Science educational model. Play-based pedagogy is present throughout all educational operations as indispensable, whether it is about the physical science club, a lesson, or a session conducted with a digital device.

According to our perspective, play-based science education benefits the child in the following ways:

- **Play-based learning supports the child's participatory role in the learning process.** A child is an active learner and agent – and play is the language of the child. By using play in our science education, we attract the child to participate in the learning process of natural science, which has previously been considered primarily as a task for older children, or even only for adults.

- **Play supports the child's communication.** Through play, communication during the science education is translated into a natural form for the children to take part in.

- **Play supports the child's sense of community and communication skills.** Play makes it possible to engage together in mutual detective play and to converse about mutual experiences.

- **Play dispels the novelty factor's impact.** When a child encounters a previously unfamiliar context, the new situation can cause heightened emotional experiences, which can disturb the actual task. Adding a familiar element, such as play or a story, to the context of the natural sciences can dispel any tension caused by the new situation.

- **Play evokes positive emotional experiences.** Play enables both joy and action, which are natural for children, in the learning process of natural sciences.

> Learning should definitely not happen in a strict and tense way but should be accompanied by positive emotional experiences.

A large part of play-based learning in Kide Science is created through narration. The possibilities for stories in natural science education have been acknowledged amongst the researchers (Mutonyi, 2016; Solomon, 2002). Narrative, or story-based thinking, is considered to be the most central and primal way of thinking, which can already be noticed in the way a very young child structures their thinking (Bruner 1996; Bruner 1990; Tolska 2002.) Narration centeredness is apparent, for example, in how people from the very beginning have shared information by telling stories.

Narration-based learning can thus work as a bridge between a child's day-to-day and natural science thinking.

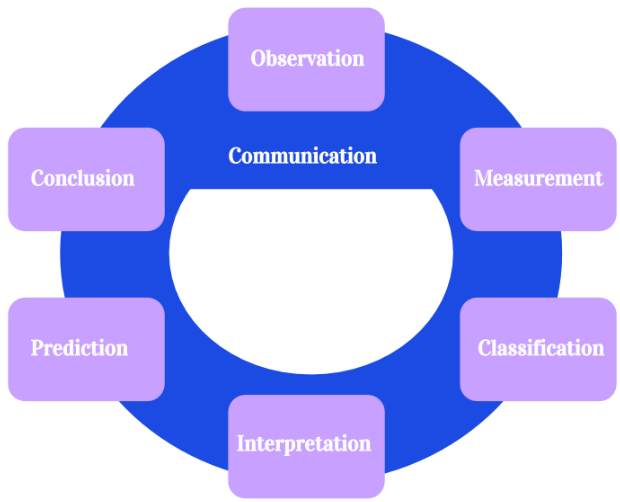
In Kide Science educational operations one gets to explore mystical Supraland. Supraland is in another time dimension which is entered through a wormhole.

Play-based learning is also carried out during our science lessons using drama and role-playing. In the role-play the adults are acting as research assistants and the children as the actual researchers or scientists. Role-playing supports the child's active role and brings humour into the situation.

Committing to the role-play happens by making a drama agreement. The drama agreement benefits the child in many ways. The person participating in the role-play knows after making the drama agreement exactly what they can expect during the session. Thus, each adult participant in the science session is also aware of their own role as the learning instructor and supporter. The drama agreement also works as a transition that helps to clarify that there is an upcoming science adventure and that the play is a part of that adventure.

Objectives in Kide Education

Science Process Skills as Objectives of Learning



The goals of learning in Kide Science are related to science process skills. There is a lot of research concerning the learning and teaching of natural sciences to children. Previous research has found unanimously that a child will especially benefit from inquiry-based science education and the early learning of science process skills (e.g. Saçkes, 2013; Greenfield et al., 2009). It is suggested that the objectives for small children in science education should be to study learning and thinking skills (Kuhn et al., 2000) in a play-based (Bulunuz, 2013) and inquiry-based (Samarapungavan et al., 2011) learning environment.

Science process skills are the fundamental skills that are required in all research. In addition, they are indispensable for the development of scientific thinking.

Scientists at Level 1

It is most beneficial for the youngest children is to start from the basics of science: making observations. With young scientists, you start with the skill of making observations and by practising the verbalization of observations: What colour do you see? What kind of sound do you hear? How does the substance smell? More challenging science process skills, such as interpretation and prediction, can be practised considering the individual abilities of a child.

A young child's vocabulary develops rapidly. Especially in Level 1, it is important to support communication at all stages of the research. The role of an adult is to help a child verbalize their experiences during a science lesson. With young scientists, you should also use other forms of communications alongside verbal communication, such as pictures, videos, motions, and sounds. Scientists of all ages, however, benefit from multimodal means of supporting communication.

The early emotional experiences of practising science are extremely important for developing positive attitudes towards the natural sciences. Play, stories, and humour are especially important for a young child whose memory isn't developed to a stage where they can form long-term memories. It is the positive emotional experiences during a science lesson that a small child might remember. The best results in attitudes towards the natural sciences can be gained through positive emotions.

When working with the youngest scientists there are practical needs that arise. Children need adult help, for example, in fine motor skills and in focusing their attention. Enthusiasm and curiosity, however, are often even stronger!

Scientists at Level 2

Older scientists can focus on the more challenging science process skills: making interpretations, predictions and conclusions. While interpreting a phenomenon, you might want to emphasize the questions which children can observe right in front of themselves. Such questions include: What is this substance? Which of these objects float in water? Answering these questions is possible based on the observations made during the science lesson.

The more abstract thinking is required to answer a question, the more challenging it is. Individual differences in the children's abilities at abstract thinking are, however, big. The difficulty of a question should at a level where the child has the potential to answer the question. Questions that are too demanding can cause frustration.

Questions about the relationship between cause and effect often require quite a lot of preliminary information on the phenomenon and advanced reasoning skills. For example, the question about why does an unpeeled mandarin float requires prior information about the floating effect of air between the peel and the fruit. With these types of questions, however, it will help if it is possible to associate the phenomenon with the child's everyday observations. A floating mandarin, for example, can be associated with observations on swimming with swimming floaters.

Making predictions is one of the skills of the highest level required in the research process. The difficulty of making a prediction is due to the fact that predictions require prior information about the situation. This kind of prior information cannot always be obtained during a science lesson. With children at this level, it is worth trying to make predictions, especially when the children are actually able to do all the observations needed to make the prediction during the science lesson. At this point, the prediction has a close connection to concrete observations and interpretations.

At this level, children can usually verbalize their experiences a bit better than when they are 3–4-years of age. The vocabulary also develops rapidly at this point, and the use of scientific language linked to everyday phenomena is useful for the development of a child's language.

Scientists at Level 3

At Level 3 it is good to emphasize extensive verbalization of the whole scientific process, present follow-up questions, and pay attention to the accuracy of reporting. Making predictions is appropriate, as typically at this age the children's memory has developed to such a level that it is possible to use past observations and interpretations as the basis for making predictions. More experienced scientists can have experiences of previous experiments – this can be seen as an opportunity to make more accurate predictions in situations that cannot be directly observed during the science lessons.

When making interpretations, the most abstract questions about cause and effect may still be challenging. Individual abilities should be taken into account. Discussing these kinds of questions in small groups can offer a good learning experience for the children. During the discussions, the children have the possibility to receive peer support. It should be noted, however, that some abstract questions about natural phenomena can be challenging for even adults to understand. With the skill of measuring it is possible to move towards the use of standardized units of measurement. This should be done without forgetting the importance of using non-standardized units of measurement.

The conceptual ability to discuss more challenging phenomena has typically evolved forward. More in-depth explanations for the causes of phenomena may be in order if the children are longing for the challenge. However, it should be noted that the purpose is to teach science process skills, rather than to learn the scientific explanations of phenomena. The objective is that children are able to combine certain scientific concepts with everyday phenomena.

Objectives and Criteria

Like all teaching operations, Kide Science's operations are guided by objectives. However, while pursuing these objectives, you must always take into account the individual's abilities and needs. When setting objectives in Kide Science we follow the following guidelines:

- Always familiarize yourself with an individual's abilities. A child may need more support in some area and be at a higher level than the other children in another area.

- A young child blossoms when they are allowed to work in a safe and playful environment.

- Creating a too competitive and test-based learning environment can change the atmosphere of science education. In these situations you should be aware of why the testing is done and what the objectives of the testing are.

Group	The general objectives	The objectives in science process skills	The criteria of fulfilled objectives
Level 1 	The child is motivated towards inquiry-based activities. The child's vocabulary expands. The child becomes familiar with science process skills. The child uses vocabulary related to science process skills. The child feels the learning environment is safe and gets positive emotional experiences related to science activities.	Observation Verbalizing observations of the phenomena under study. Interpretation Preliminary practising of scientific interpretations. Classification Practising single-level categorization and verbalizing of categories. Measurement Measuring using non-standardized measurement units. Preliminary use of sequential skills. Predicting Getting to know the principles and contexts of making predictions. Communication Verbalization of experiences during scientific activities. Conclusion Connecting the acquired results to the story.	Observation The child is able to verbalize their findings when asked. Interpretation The child has the courage to try making scientific interpretations. Classification The child is able to form groups when supported. Measuring The child is able to use non-standardized measurement units, like the length of a finger. Predicting The child gets basic information about making predictions and in which context they are used. Communication The child can verbalize about inquiry-based activities. They communicate using different modalities, e.g. using body movement, words, or pictures during science activities. Conclusion The child can recall the question or the mystery in the story and can connect the acquired results to it.

Group	The general objectives	The objectives in science process skills	The criteria of fulfilled objectives
Level 2 	The child's motivation towards inquiry-based activities deepens. The child acts spontaneously during the activities. The child has preliminary understanding about the meaning of the concepts of science process skills. The child enjoys inquiry-based activities. The child shows cooperation skills with their peers.	**Observation** Extensive verbalizing of the observations made of the phenomena under study. **Interpretation** Making interpretations of observable scientific phenomena. Aiming to distinguish observation from interpretation. **Classification** Designing and applying single-level classification. Getting to know multi-level classification. **Measurement** Measurement with non-standardized measurement units and becoming more familiar with standardized measurement units. Using sequential skills to measure objects. **Predicting** Practising making predictions. **Communicating** Extensive verbalizing of experiences during scientific activities. Reporting in form of words, motion, photographs, or other modalities. The child communicates increasingly about scientific topics with peers. **Conclusion** Noticing the connection between the acquired results and the mystery in the story. Making a conclusion based on the gathered information.	**Observation** The child verbalizes their observations spontaneously and when asked. Observations are related to the phenomenon under research. **Interpretation** The child's interpretations are related to the observations made. The child is able to discuss the consistency of the made interpretations. **Classification** The child generates ideas and executes classifications. The child becomes acquainted with the complex classification of things and is able to form multi-level classifications with the support of peers and the teacher. **Measuring** The child measures with non-standardized measurement units. The child gets more familiar with standardized units of measurement, such as centimeters. **Predicting** The child is practising making predictions when the predictions are related to observations made during the science activities. **Communicating** The child participates in the conversation with both the adults and their peers during the science lesson and reports on their studies. **Conclusion** After doing the experiments the child proposes solutions to the mystery in the story.

Group	The general objectives	The objectives in science process skills	The criteria of fulfilled objectives
Level 3 	The child's motivation deepens into inner motivation. The child is motivated about inquiry-based activities. The child understands the basic concepts of science process skills at least on a superficial level. Concepts related to natural phenomena are included in the child's vocabulary. The natural curiosity about the science of everyday life remains throughout the life of this child. The child thinks positively of themselves as a learner (of the natural sciences). The child is able to cooperate with peers while planning and carrying out research activities with adult support.	**Observation** Observations are shared spontaneously and extensively. Observations are more and more relevant to the phenomenon being studied. **Interpretation** The interpretations are based on previous observations. The difference between interpretation and observation is clear. Learning to critically evaluate interpretations. **Classification** Getting to know serial classification. Ability to do multi-level classifications and application of classes. **Measurement** Measuring with non-standardized and standard measurement units. More fluent sequential skills. **Predicting** Ability to make predictions when the prediction is related to situations that have occurred during the science lesson. Exercising the kind of predictions that are linked to previous experiences of everyday life. **Communication** Fluency of communication at all stages of the research process. Reporting using multimodal means and in written form. The child communicates actively with peers and instructors **Conclusion** Using the science process skills to gather data and answering the research question based on their findings.	**Observation** The child can talk about observations with other scientists and is able to negotiate observations with peers. **Interpretation** The child uses observations as the basis of making interpretations. The child is able to justify their interpretation through various previous observations. The child is able to separate interpretation from making observations. **Classification** The child is able to apply the formed multi-level classes and spontaneously communicate the specific features of the class. The child understands the principles of serial classification. **Measuring** The child uses measuring instruments such as a thermometer or a ruler. The child uses standardized units of measurement, such as centimeters. The child can move back and forth in a number sequence. **Predicting** The child is able to make predictions. The child strives to make predictions by incorporating observations about their previous studies and daily life experiences. **Communication** The child experiences the sharing of experiences as a natural part of the investigative activity. They will also report in writing during the science lessons. **Conclusion** The child answers the research question after doing the experiments and connects the results to the story.

Sources

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