KiDE SCIENCE

Assessment Guide

Kide Science Approach to Assessment

Prologue

It’s the journey, not the destination.

The following is a bit gloomy, but bear with us: Imagine a situation where you are just experiencing your last breaths. You would have all your beloved people around you. And now think, how would you feel if at that point you would get your grades, for the first time, for everything you’ve done during your life. Your significant other gives you 8 out of 10 from partnership and love, your sibling gives you a 7 for sisterhood, and your boss gives you 9 for the work you have done. No-one has ever given you feedback during the years you’ve spent your time with them, now they are giving you grades, and you don’t actually even know where they come from. Wouldn’t that be an unfair situation?

Of course, this is a very provocative example, but it hopefully somehow highlights the noteworthiness of how significant the situations are, where we get assessed. Even though no-one means to do it like this, we sometimes end up assessing our students without them knowing they’re being assessed at all. It’s human.

Sometimes we also end up not explaining the aims of what we are doing. We end up not documenting the processes and the brilliant ideas our students had during the learning situations and end up giving grades from situations that do not actually reflect the skills the children have at all. In the situation described above, this could mean that instead of having feedback from your beloved ones during your lifetime and all the lovely pictures in the family album, you would actually have The Final Test on paper that assesses you from head to toe. How much would this reflect real life, all the emotions you have experienced, all the skills you acquired and all the social situations you’ve encountered?

This is why we are asking, who are we doing the assessment for? And what if we could focus more on assessing the journey, not the end results?

Dear Reader,

The purpose of this handbook is to guide you through the assessment philosophy and practises we at Kide Science believe in. With this guide, we also aim to enlighten and argue the reasons behind our thinking: why do we assess the way we do and why we find these practices important. We are not alone with our thoughts but have a bunch of researchers, education experts and practitioners backing us up. To show this, we have included excerpts from interviews with early education experts around the world, as well as added references to the scientific literature we refer to.

The guide will

- walk you through the main theories behind our thinking
- take a look at assessment from the perspective of learning scientific thinking skills and science process skills, which are at the core of our pedagogy
- shine a light on the basics of evaluation in Finnish early childhood education system.

After these, we will present our Assessment Toolkit for the teachers to help them in their assessment and evaluation processes.

Our leading thought throughout this document is: What could we do to assess the learning process, not just the end result? And how could we harness the assessment to support the learning process?

We are also taking into account what we could do to get the learner (the child) as well as all the instructing and caring adults (also learners), included and active in the learning and assessment and evaluation processes.

We hope this guide will be helpful in your work as a pedagogical pioneer, and along with our Assessment Toolkit, offers you something to grasp on when doing assessment and communicating with homes.

Assessment? Evaluation?

By the way, you may have already noticed that we are talking about two very similar concepts: assessment and evaluation. They are often used synonymously, but we are making a distinction between them here.

When we talk about assessment, we talk about children and their learning. And when we talk about evaluation, we are talking about the teachers and their teaching methods. These two terms have a lot of similarities, but we want to distinguish them since the two practices have quite different viewpoints.

Assessing is looking at the journey the child is having during the learning process and provides a very insightful view on how it is going. For example, the child is attending a lesson where we need to solve the liquid that will quench Hoseli the Robots thirst – he is a robot, and doesn't drink water like us humans. The assessment here could be observing what kind of questions the child is asking, are they enthusiastic about the learning and how they would self-assess their learning after the lesson. The concrete results could be teacher's notes about the child's questions during the lesson, a picture the child has drawn about their experiment and a self-assessment form where they've told about their thoughts.

Evaluation is providing the teachers with insights on how they should make their practices better during this journey. In the previous example, the teacher would look at the situation from their point of view, even though the actions might be quite similar. The teacher could look at the questions the child has asked and think: Did I provide enough space for the child to ask their question? Was the learning situation open enough? They could even look at the child's drawing and think: What kind of feelings can be seen in this picture? Have I encouraged the child? Have I made the situation safe?

We acknowledge that assessment has a more strict and knowledge-based connotation in English that might refer to doing summative tests. This is quite the opposite of what we mean when we are talking about assessing children. **We are all about the journey, formative assessment and collecting knowledge about the path through various methods, so we can actually help the child.**

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1. Assessment Theory – Why We Assess Learning Instead of Knowledge

Assessment has gained a lot of attention in the past years in the field of research and curriculum development (e.g. Black & Wiliam, 2009; Corrigan, Buntting, Jones & Gunstone, 2013). One challenge of assessment arises from the notion of how **we can assess not only outcomes of learning but also the process.** When we talk about assessment, we should first of all clarify what we aim to assess. In general, we can assess either learning outcomes or learning processes. In the field of early childhood education, the direction has been for assessment to focus on the learning process and making the learning process visible (Buldu, 2009) rather than paying attention to academic learning outcomes.

The theories of learning that we are leaning on define which assessment style should play a bigger role. For example, empiristic learning theory (Galtung, 1972), which was dominant in the early 1900s, understood that knowledge is static, and learning can be identified by repeating the knowledge served by a teacher. If we leaned on this theory, it would be reasonable to assess learning by tests that measure memorizing the facts. Still, the contemporary understanding of learning is very much different from that.

1.1 Learning is a process

Contemporary view on how learning happens is based on sociocultural learning theories (Vygotsky, 1978; John-Steiner & Mahn, 1996). In a nutshell, that means we understand **learning is a process in which learners construct their knowledge in interaction with other learners, teachers, environment and tools**. Pedagogies that rely on sociocultural learning theory put an emphasis on supporting children's thinking skills and problem-solving skills. **Rather than delivering knowledge, the teacher aims to trigger children's curiosity and questions.** At the same time, they guide children to acquire and produce knowledge and to apply that knowledge to build understanding. It is clear that this kind of learning philosophy requires very different assessment methods.

1.2 Assessment benefits both the child and the teacher

Assessing the learning process is crucial to sociocultural learning theory. **Teachers need continuous feedback on how children are progressing** in their knowledge-building process because that provides **information on what kind of support each child might need.** Further, knowledge about a learning process is not only valuable for the teacher but the child as well. If we are able to receive continuous information about the children's learning process, we can adjust the teaching methods according to their needs and hence help them reach the aims that were set for learning. It is also worth noting that assessment steers learning: you pay attention to what you are given feedback about.

1.3 Assessment should be done while the child is learning

Formative assessment, done properly, shows the teacher where the student needs support while the learning is ongoing. This, of course, affords both the student and teacher greater agency over the learning process, when compared to post-learning evaluation.

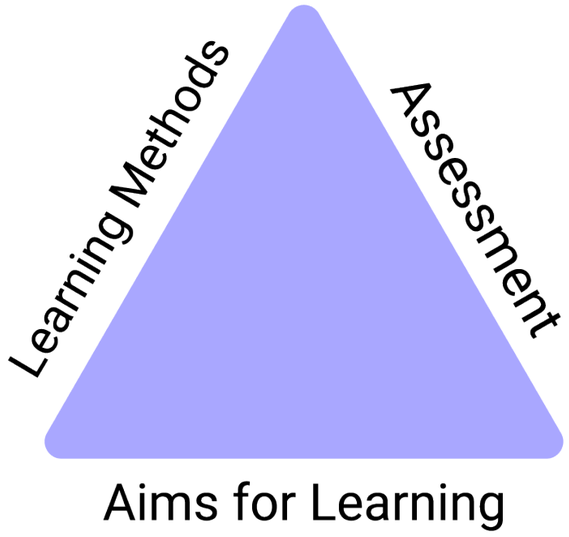
In sociocultural learning theories, thinking skills, problem-solving skills, and an ability to work together with others play central roles. These skills are the so-called **future skills** that many curriculums emphasize. It is evident that for example, problem-solving skills can't be that easily measured or tested but assessing these skills requires information about the children in action.

Formative assessment is widely used to assess learning processes and skills while the learning is ongoing (Corrigan, Buntting, Jones & Gunstone, 2013). Formative assessment is defined as '"frequent, interactive assessments of student progress and understanding to identify learning needs and adjust teaching appropriately' (OECD, 2008, p.1). Hence, formative assessment provides continuous feedback for children about their progress. It should be encouraging and motivate children to learn. Numbers or grades gained from tests tell nothing about children's learning process nor give information about what in the learning process could be changed.

Formative assessment can be formal or informal (Ruiz-Primo & Furtak, 2004). Commonly, the formal formative assessment includes, for example, children's self-assessment, portfolios, project works, and in-depth discussions with the children. Informal formative assessment can be, for example, observing children's interactions and their expressions in the learning situation to see how they're reacting to and communicating about what they're doing. Both formal and informal formative assessment should be carefully planned while setting the aims and planning the learning process.

1.4 Inseparable entity of aims, methods and assessment

In general, aims for learning, learning methods and assessment form an inseparable entity. **Aims define what kind of activities will happen, and we can assess only the aims that have been already set.** Aims also define what kind of assessment methods and practices will be used: If we aim to improve children's science process skills, we need assessment methods that can, for example, describe children's actions during the inquiry. Science process skills can't be measured only by pen and paper tests. On the other hand, assessment tells us how aims were addressed and therefore, assessment affects what kind of aims will be set for the next lesson or learning moment. If we notice that children need more practice in making observations, there is no point to move towards other science process skills. Hence, we should set an aim for the next learning moment to practice observation skills further.



Children should always be aware of the aims for learning. A thing that will greatly benefit the learning process is **allowing the children to realise what they are supposed to be learning.** By keeping the aims of the learning situation visible, the children can focus their attention accordingly, and get the most out of the situation. Assessment of children's learning should only be focused on the transparent learning goals that the teacher and the children are all aware of. Just imagine you are going to a driving test and when getting the results of the test, you see that you also got points for your singing voice and the length of the sleeves on your jacket. The example might sound drastic, but the experience and effectiveness of being assessed on something you were not aware of are the same.

1.5 Positive emotions

If a child is not motivated to do something, and if they are not enjoying the activity they are doing, they most probably won't do it – at least not voluntarily. **Having positive experiences while learning science will motivate the child** (Coballa & Glynn, 2007), and we know from the research that formative assessment practices that are built on a supportive and trusting atmosphere have remarkable effects on children's motivation (Cauley & McMillan, 2010). To sum it up, positive experiences from learning and assessment can have long-lasting effects in building their interest and motivation towards the subjects learned.

When we are assessing learning, we, of course, do it to help the child to reach the goals set for learning. That is why we want to take into account the long-lasting effects of positive experiences. If we can implement assessment practices in a way that children can maintain their positive attitudes towards learning, feel safe and supported, build a positive learner identity and have agency and control in the situation, we've managed to do our job very well (Fleer & Quiñones, 2013).

What makes our job very hard is the fact that the negative experiences sit even tighter than the positive ones (e.g. Baumeister & Finkenauer, 2011). That is why we need to create an environment for assessment, where children can actually show what they can do. For instance, assessing the skill of collaboration by asking the child to describe collaboration as a concept is probably not reflective of their skills to collaborate with their peers. If the child fails to answer such a difficult question, they would have a negative experience and feel like they have failed, even though they might actually have extraordinary collaborative skills. Instead, we could observe the child, ask them to play with their peers, and collaborate with the child ourselves. That could give us more information on the development and holistic skills the child has and prevent unnecessary negative experiences, which often follow when we are assessing the wrong thing or the wrong way.

2. Assessing Participants in the Learning Process

Assessment is quite often perceived as something that the teacher does to the child (Wiliam et al., 2004), which is also quite often the case. When we think about assessment a bit more holistically, it is important to identify all the people who are essential to it and to define their responsibilities in the process.

Describing these parties and aims helps to clarify the big picture of the assessment process and ensures that the purpose of assessment is as clear as possible for all parties (Stiggins, 2005). The people involved in the learning process are the child, the teacher, the guardian and sometimes also others, such as the principal (Buldu, 2010).

2.1 The child

The child as an assessor

The child should be an active participant in the assessment process (Bell & Cowie, 2001). It will make the assessment relevant to the child since they will see first-hand what they are being assessed on and get to give their own insights on their learning process. We obviously can not read a child's mind, but children have pretty good insights on what is happening in their heads.

The problem is we can't make very young children, for example, produce a lot of pen and paper tasks to get all those great ideas visible and communicated. We can give the child opportunities to self-assess by just asking their views and writing those down together, or we can ask a child to draw and explain their drawing (Buldu, 2010). Formative assessment can take place in all kinds of interactions happening between child and adult or in a group, and it will give the adults insights on what the child has been interested in and to see if the child is progressing towards the aims that were set (Ruiz Primo & Furtak, 2004). Of course, there is a possibility that a young child self-assesses on a whim and may rate a lesson they really liked as 2 or 5 stars based on how they understand the rating that day. Working with children, that is just something we have to take into account.

There are many tools for doing formative formal assessment in a child-oriented way. Naturally, the assessment needs to be adjusted to suit the child's level of development. Older children are probably able to fill out simple handouts and answer questions more independently, but younger children will still need a lot of support and adult guidance.

What can the child assess then? We can, for example, ask the child to assess if they had fun, did they learn something new and ask them to make a drawing of an experiment they did or their observations. The teacher (or another adult) can also write the child's answers on a form to document the learning. It is important to note that the situation in these cases should be as natural as possible. If the child feels they are interviewed or tested, it affects their possibilities to show their capabilities.

To help you with documenting child's learning in a child-oriented way, we have made some ready materials for you. In chapter 4 (Kide Science Assessment Tools), we look at our assessment tools more closely and give concrete tips on how to use them.

Cooperation between early childhood education and health services is beneficial

In Finland, early childhood education and health services work very closely together. The purpose of the cooperation is to promote the overall well-being of children and to identify the possible special needs early on. The child health clinics in Finland arrange an extensive health check-up for all the four-year-old children, which also includes an assessment of the children's strengths and possible difficulties (The Strengths and Difficulties Questionnaire). The purpose of the assessment is to find out if the child needs special support, for example, for learning or social situations. Assessment of the strengths and difficulties can also be repeated at a later age, at ages 5 to 16, if the child's parent or teacher has concerns about the child's psychosocial development.

2.2. The teacher

Formative assessment helps the teacher to plan and evaluate their own teaching

You might have heard something about the Finnish education system since the Finnish model has gained a lot of publicity during the last decade. The latest PISA results have shown that Finland has been able to provide both academic resilience and student happiness at the same time (OECD, 2019). This also reflects how we approach evaluation in Kide Science.

Evaluation in Finnish early childhood education (ECEC) is comprehensive and is intended to serve as a tool for developing the early childhood education pedagogy (Vlasov et al., 2019). Learning, the learning environment, learning objectives, and evaluation form an inseparable entity. Evaluation is a pedagogical process led by the teacher and the other staff, and the children and the guardians are also involved in the process.

Kide Science's pedagogy **stems primarily from the latest research about early STEAM education** (e.g. Vartiainen & Kumpulainen, 2020), **but the model is strongly aligned with the Finnish ECEC curriculum.** One of the special features of this curriculum is evaluation. **The evaluation focuses on pedagogical activities and learning environments instead of assessing the characteristics, level of development or learning outcomes of the children.**

One of the key purposes of formative assessment is to provide information about children's learning while they are still learning. This way, the teacher can plan the next lessons better, too. However, instead of focusing on which information the teacher should teach next, we want to encourage teachers to evaluate their own pedagogical methods and the used learning environment. This way, the evaluation will help teachers to develop in their pedagogical practices and to provide better learning experiences.

It is beneficial for the teacher to **use self-evaluation to make learning experiences even better for children.** Even though the self-evaluation is done by the teacher, the process should be made from the child's point of view as well. Let's take an example of a typical situation in class: The teacher is teaching about refraction of light, a phenomenon that is rather complicated, and the children behave very well – they are sitting peacefully and being quiet. After the lesson, the teacher may think: "What a nice lesson. Everyone was interested, and they listened quietly." However, the teacher really cannot say if the children have learnt anything since here, the evaluation is based only on the behaviour of the children.

Instead, the teacher could observe what the children did and through that, reflect how they, as a teacher, have succeeded as a facilitator of learning. For example:

- Did the children ask questions?
- Did they communicate their observations or interpretations in one way or another?

Through these observations, they can evaluate their teaching by asking, for example, the following questions.

- Did I create opportunities for these interactions?
- Did I ask questions?
- Did I give a chance for the children to demonstrate what they learned?

What are we actually evaluating?

As it was stated in the chapter above, sometimes it may feel like a lesson has been successful if everything went smoothly and the children were obedient and calm. However, that is not always the same as successful learning. Total disinterest and total interest can also look the same.

We invite you to take a closer look at your lessons and think: What does a successful lesson, where learning has truly happened, look like? Does it always look the same?

2.3 The guardian

But what about the parents – how could you explain all of this to them?

Parents want the best for their children, and naturally, they want their children to learn new things and skills. When children go to school, parents are often used to seeing something concrete as proof of their child's learning. The proof could be, for example, a graded test, a drawing the child has made, or a machine the child has designed. However, these might just show the end result of what the child has possibly learnt. When we only focus on something the child needs to achieve, we might miss the very valuable information about the process of learning, which is ongoing all the time.

Still, quite often parents are used to seeing the proof of learning only when the graded test comes in. Kide Science concept does not use tests to assess the children but assesses the child's learning process by using, for example, portfolios like the Scientist's Treasure Chest to document it. At the same time, we help them to develop new skills. And, quite frankly, there is plenty of time in life to answer questionnaires. We want the main focus to be on the learning process of the child. Other adults, like teachers and parents, can help children achieve these new skills by supporting and helping them.

It is also very important to understand where the need for testing might come from. The reason why parents seem to want to receive concrete grades for their children's skills may also be quite understandable; when the parents were younger, they might have taken many tests. At Kide Science, we interviewed several parents around the world on the subject of assessment, and we were surprised at how open-minded parents actually are about this new kind of assessment. Parents want the best for their child. They want to see progress and growth. Tests are one way to do it, but it's not the best way, and the parents are surprisingly receptive to these new ideas because they know how tests fall short.

How to support the parents?

How can we then show parents some proof of learning? A child may not be able to communicate what they learned during a lesson precisely. This is part of why we emphasize communication as a skill; it's important and difficult! This does not mean they have not learned anything.

Support parents by advising what kind of questions they should ask the child. The parents can, for example, use the stories in our lessons to help the child to describe their experiences: How did you help Hoseli the Robot this time? What kind of experiments did you do? They can also ask what the child has observed and what they know now that they didn't know before. There are many ways to show parents that learning is happening.

We also support the parents through home experiments. We encourage parents to do experiments with their little scientists so that they can see the skills their children have developed. The home experiments include a poem that helps the child remember the

story and earlier experiments. The relevant scientific phenomena are also mentioned so the parent can use those concepts while doing the experiments and communicating with the child.

2.4 Assessment is cooperation

Assessment is most effective and useful when it involves all of the main players in the learning process: the child, the teacher, and the guardians (Buldu, 2010). Assessment should be more than the teacher giving the child a grade. Proper assessment includes the thoughts of the child and communication with the guardians.

2.4.1 Pedagogical documentation: Child-oriented approach

Pedagogical documentation is a comprehensive way to assess the whole learning process (Buldu, 2010). There are plenty of ways to do pedagogical documentation, and how the documentation is used for developing the learning environment is more important than what kind of materials are documented. It is also important to distinguish, in each case whether the documentation is done for the teacher or the child.

We highly recommend tangible pedagogical documentation. We call it a Scientist's Treasure Chest (or a Scientist's Portfolio, if it's done online). After each lesson, the learner collects all of the materials they found important in a box or folder. It can be a report, a drawing, a photo, supplies used in the experiment, or something else! It's very important that the child has opportunities to explain why they have chosen the items they've collected.

An adult should note the child's thoughts and include that in the portfolio as well. For example, a three-year-old boy might pick a picture of Esther, one of our characters, and say that he wants to show the picture to his big sister – she has a hoodie of the same colour and she will get excited! This is a perfect object for the treasure chest. At first, the adult might think that this has absolutely nothing to do with the lesson – the child learned nothing. But if you think carefully, the child has learned a lot! He listened to the story so well that he still remembers the name of the character, he can name a colour and compares it with the sister's hoodie, and he also shows preliminary ideas of empathy: he wants to delight his sister. It is very important to document these kinds of observations a teacher can make in the learning situation.

For teachers, pedagogical documentation is a frame for developing their teaching process (Buldu, 2010). Pedagogical documentation can help teachers see what the children are interested in, how they have progressed, and where they would need more support. Pedagogical documentation also helps teachers evaluate and reflect on their teaching methods and learning activities.

For parents, the pedagogical documentation works as a channel to understand the child's learning process. This way, they can see the progress and the child's ideas about what they have learned.

2.4.2 The role of home experiments in Kide Science concept

Home experiments continue the phenomena and processes the child explored during the lessons. They allow guardians to take part in the learning process and see what the child has been practising.

Home experiments are an opportunity for children to continue with what is familiar to them. Conducting multiple experiments with similar subject matter builds skills and knowledge. Repetition is a trusted way to improve skills in every arena. At home, the supplies, the environment and the helping adults are different, which helps the child see the same phenomena from a different perspective.

Still, to use the home experiments as an assessment tool requires something from the adult. They can support the child by asking questions and wondering together. This gives the child a chance to explain what they are doing to the adult and show how they understand it. At home, it is also possible to repeat the experiment multiple times if desired, which is not always possible during the lessons.

The home experiment instructions include the same science process skills the children use during the lessons as drawn symbols by the related steps, so the adult can use those to ask more questions. The questions shouldn't be aimed at testing knowledge of scientific facts. Instead, they provide an opportunity to ask the child about the process. What do they observe? What do they think will happen? Why? What is their conclusion? Adults should use the names of the scientific concepts to support the child's learning.

The final goal of the home experiments is not to "do it correctly" but to go through the process, practice the skills learned, and have fun!

3. How to Track Learning

3.1 Scientific thinking skills and assessment

Developing children's scientific thinking is at the core of Kide Science's values and goals. It is scientific thinking, not scientific knowledge that we are after. Understanding scientific phenomena is one of the goals of science education, but the ability to use scientific thinking is what truly counts. The child can learn facts through memorisation, but this does not mean they understand them, or why they're important. Little scientists should use information to think for themselves and find out about how the world around them works.

It might take time for the child to understand a scientific phenomenon correctly. That's normal. That is part of learning and a part of the development of their thinking. They might start with pieces of information they have gathered about a phenomenon, and start to build their understanding from that. Their first understanding of a phenomenon is probably incomplete and/or incorrect. Their theories are slowly improved as they gather new information and encounter the phenomenon repeatedly. This is why assessing just "can the child explain phenomenon x" is not fruitful, because it doesn't take the process into account.

Science is about purposeful thinking and seeking knowledge, not just knowing and memorising facts. Seeking knowledge is also not just the accumulation of isolated pieces of information. Assessing scientific thinking must also reflect this.

Learning scientific thinking is an ongoing evolving process, not something that is "ready" at any one point. The child (or an adult) is never going to tick a box of mastering scientific thinking, but this does not mean that the process cannot be monitored and assessed.

Proper assessment is not based on knowing facts or specific phenomena. This is secondary. Moreover, having the right and wrong answers might also block the child's curiosity and imaginative exploration. New innovations do not come from always having the right answers; they come from trial and error, and the use of imagination. More important is their thought process and how they reach their conclusions. We cannot see these factors through simple answers on a test.

One of the most important goals of assessing scientific thinking is to make the learning process visible. It is important to make the children aware that they are using science process skills: making observations, communicating their findings, making predictions, and so on.

Observation

Observations are made by using our senses. We use our senses to collect information about the thing we're observing. When assessing the development of the skill of observation, you can draw attention to these things:

- How did the children make observations?
- Did they use all their senses?
- Did they verbalize their observations?

Interpretation

Interpretation happens when the child explains their understanding of 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" as long as it is a subjective view of the situation. It is possible, for example, that someone might be outside swaying the tree. When assessing the development of interpretation, you can ask these questions:

· How did the children argue their interpretations?

· Were their interpretations related to their observations?

3.2 How to assess learning scientific thinking skills?

In general, **the purpose of formative assessment is to provide information about students' learning while they are still learning and to show the teacher the points where the student still needs support.** At the same time, formative assessment helps the teacher to plan their teaching.

It is trivial to assess the student's knowledge. Teachers can just arrange questionnaires or tests. However, in Kide Science lessons, children learn skills, not facts. **Where loose facts are forgotten, skills are permanent.** Skills accumulate gradually, overlapping in relation to other skills. A skill is never complete, and that's why you have to dive into the learning process to assess its development. **Kide Science pedagogy is designed to support the development of science process skills.** These are observation, interpretation, measurement, communication, classification, prediction and conclusion.

Measurement

We can measure using either standardized units (e.g. centimetres, grams, or minutes) or non-standardized units (e.g. the length of a finger or a pen). Measuring can also be counting: three spoonfuls or ten leaves. Older children can do more accurate and precise measurements. Measuring is strongly related to mathematical skills. You can assess the development of measurement skill (and mathematical skills) by asking these questions:

- Did the count and measured amount correspond with each other? Did children come up with their own ways of measuring?
- Did they use their own units of measure or stan dardized units of measure?

Classification

Things can be classified in three ways. Single-level classification is done by 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, on the other hand, means classifying objects 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 is arranging the objects in an order based on an increasing quality (a block tower from lowest to highest). With young children, we start practising the classification skill by single-level and serial classification. The multi-level classification can be practised when the single-level classification goes well. Use these questions to assess classification skills:

· What ideas did the children have about classifying things?

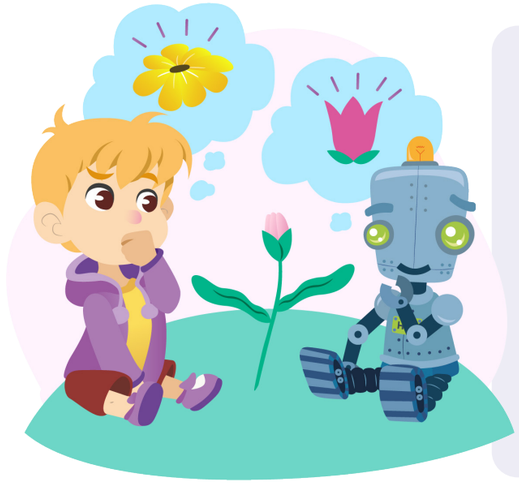
· Can they classify things in several ways (by colour, by size, by shape etc.)?

· How do they verbalize their classification? Do they use comparatives when classifying objects (smaller than this, heavier than this etc.)?

Communication

Communication entails asking questions, wondering, explaining thoughts, non-verbal cues and any other aspect of the scientific process. Science is not a solo activity. The ability to communicate with other scientists is key. Communication also ties together all the other science process skills.

- How do children communicate with each other during the lesson? Do they share their ideas and observations?
- What kinds of non-verbal communication do the children use during the lesson?



Prediction

A prediction is an educated guess about what is going to happen or be observed. A prediction is made using previously learned information or previous experiences, and that's why prediction is an advanced science process skill.

- First, assess whether the child has the possibility to make a prediction. Does the child have previous experience about the phenomenon?
- Was the child able to connect their previous experiences to the new situation?

Conclusion

By conclusion, we refer to the skill of summarising the information gathered during the inquiry. In Kide Science lessons, the storyline helps children form a conclusion. The conclusion could be: "We should seal the gas formed in the reaction inside a balloon so that Hoseli could fill the balloons without using lungs!" We use all the science process skills to gather data and answer the research question by making a conclusion. But how could we assess the conclusion making skill? You can start with these questions:

- Do children refer back to the story when they make their conclusions?
- Do they use their observations when they argue their conclusion?
- Did they come up with a solution to the problem?

3.3 Assessment in different age groups

We are often asked how it is possible to do assessment of children of different ages if the lessons are the same for all age groups. As said, skills are at the heart of Kide Science lessons, not knowledge learning. **Skill is something that can be practiced at any age and can be continuously developed.** We have compiled indicative examples of how a skill develops as a child grows in the **Skill Mapping Tables** (in the toolkit).

Practice observation skill by making observations of a chemical reaction.

At level 1, the objective is: Scientists practice making observations about the chemical reaction.

At level 2, the objective is: Scientists make observations of a chemical reaction and try to communicate their observations. They use many senses to make observations.

At level 3, the objective is: Scientists show in their actions that they know the method for making observations and can make independent observations about the chemical reaction. They can communicate their observations to their peers and discuss them together.

Often the pedagogical tips will also guide you to assess the observation skill with different age groups.

Level 1

Level 2

Level 3

"I've heard a lot that people think that progressive education is difficult and it requires training and experience. It's not just black or white, it's not that you passed or failed it. Actually, that kind of assessment can make everything you have done not progressive.

Kide Science is a great example of progressive pedagogy. The Curriculum has quite many abstract concepts that can't be learnt immediately. A child needs revisiting these phenomena multiple times, and the understanding emerges little by little. That's why it's even impossible to say has the child learnt, e.g. what volume or mass means. We have to make the learning visible by splitting the learning process to very clear and reachable objectives. That's what Kide Science lesson plans have: the objectives and pedagogical tips are visible for each age group. "

Nyla Tariq
Pedagogical specialist
Co-founder of Mirai and Gradewise

4. Introducing Kide Science Assessment Tools

We don’t want to leave this just as an idea, and that’s why **we have designed several assessment tools for you to use.** You do not need to choose just one but can mix and match and use those that best suit your needs. It is important to do both formal and informal assessment. It will result in more detailed knowledge about the learning happening during Kide Science lessons.

How should I start?

Some of these methods may seem more familiar than others, so take your time to go through them. Older children are able to do self-assessment in more complex ways and are probably more motivated to do that as well, while younger children may find long handouts too complex. Choose one tool and try it out.

While you’re using the method of your choice, you may consider the following questions: Is the level of assessment suitable for the children in your group? Do you gain insights about their learning through this method?

4.1 Formal Formative Assessment

Formal formative assessment can be done through different methods of pedagogical documentation (more information on that in chapter 2). Here we present some concrete examples on how to do this.

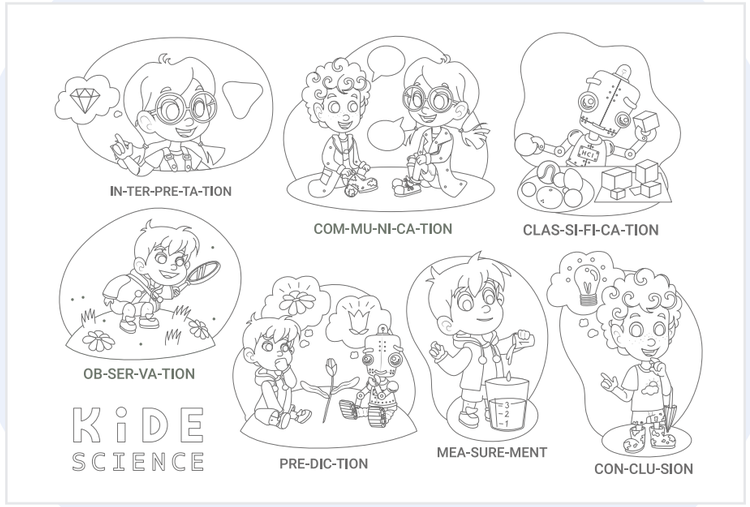
Scientist’s Treasure Chest

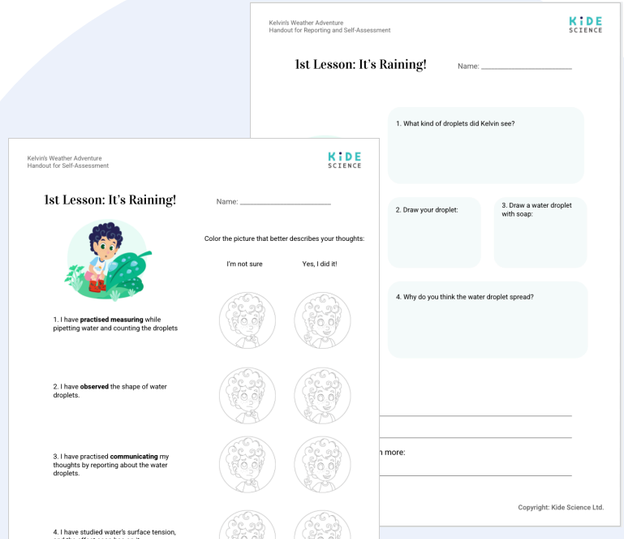
The Scientist’s Treasure Chest is a simple way to do **child-oriented documentation of the learning process.**

The actual Treasure Chest can be made out of used cartons, shoe boxes or similar materials. To make it personal, the child can decorate their own Treasure Chest. The only requirement is to make it big enough to fit, for example, drawings or small objects related to the done experiments.

After each lesson or home experiment, the child gets to choose what is put inside the Treasure Chest. What thing would remind them of what they just experimented with, what they found the most interesting? The Treasure Chest should be very child-oriented, and it is possible to do with children of all ages.

We have tested the Scientist’s Treasure Chest in our clubs and have gotten great feedback.




Kelvin's Weather Adventure
Handout for Reporting and Self-Assessment

KIDE SCIENCE

1st Lesson: It's Raining! Name: _____

1. What kind of droplets did Kelvin see?

2. Draw your droplet:

3. Draw a water droplet with soap:

4. Why do you think the water droplet spread?

n more:

Copyright: Kide Science Ltd.

Kelvin's Weather Adventure
Handout for Self-Assessment

KIDE SCIENCE

1st Lesson: It's Raining! Name: _____

Color the picture that better describes your thoughts:

I'm not sure | Yes, I did it!

1. I have **practised measuring** while pipetting water and counting the droplets

2. I have **observed** the shape of water droplets.

3. I have practised **communicating** my thoughts by reporting about the water droplets.

4. I have studied water's surface tension, and the effect soap has on it.

Copyright: Kide Science Ltd.

Handouts
The handouts can be used for reporting and for self-assessment.

It's important to focus on assessing the skills in relation to the objectives of the lessons. Does the child feel like they have met the objectives? This type of assessment can also give very valuable information for the teacher to evaluate their teaching. If the children do not know if they have completed the objectives, there might be some need to communicate the objectives more clearly, for example.

Our objectives are most often related to the science process skills, and they can be assessed separately as well. The child can familiarise themselves with the science process skills, name and identify them after the lesson and assess which science process skills they just practised. It can be done by, for example, using a colouring page handout with the illustrated science process skills.

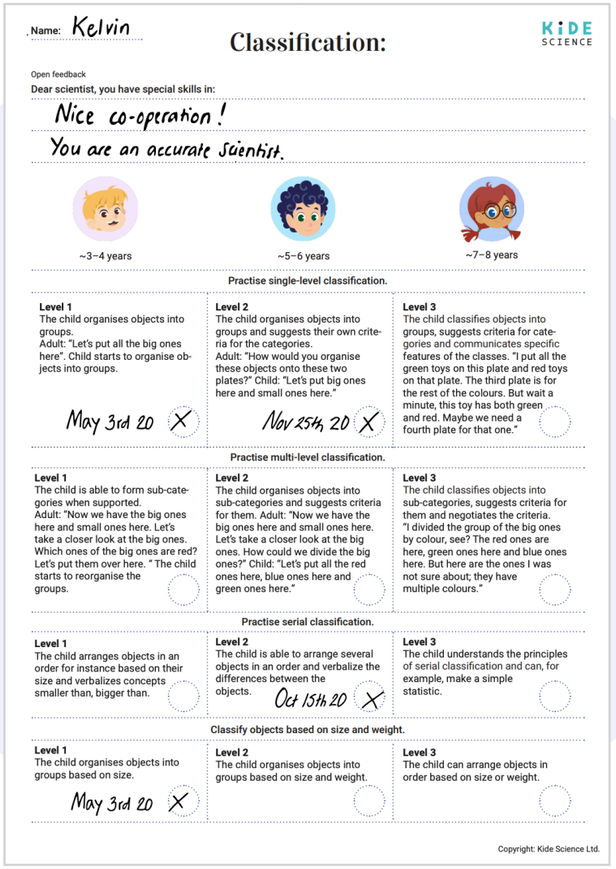
Learning Objectives
If you want to keep the assessment lighter, it can also be done through a Look What I've Been Learning -leaflet. We provide one booklet for each story theme and it includes all the lessons with their key concepts, skills practised, and STEAM elements related to that particular lesson. The booklet does not offer many possibilities for more creative self-assessment but could be used in addition to the Scientist's Treasure Chest.

4.2 Informal Formative Assessment

Informal formative assessment provides information about the child's level of understanding in an informal setting. This means that the assessment is done during the lesson by the teacher. **It does not have to include form-filling but can be observing while the lesson is being conducted.** Things to observe may include, but are not limited to, are, for example:

- Do the children seem interested in what they are doing?
- Does the story motivate the children?
- Are the children excited during the lessons?
- Think about the objectives of the lesson. If the objective has been, for example, to practice precise measuring, you can evaluate it during the whole lesson. Questions to ask could be, for example: Is the child interested to practice measuring? Am I giving the child a chance to try for themselves? How could I motivate the child to practice? Is this kind of measuring (for example, using standardized units) still too complex for the child?

Before the lessons, the teacher can go through the lesson and check which science process skills are especially practised during each experiment. Preparing can give some guidelines on what to pay attention to during the lesson to make the assessment easier and to support the children's learning.


Name: Kelvin

Classification:

KiDE SCIENCE

Open feedback

Dear scientist, you have special skills in:

Nice co-operation!

You are an accurate scientist.

~3–4 years | ~5–6 years | ~7–8 years

Practise single-level classification.

Level 1
The child organises objects into groups.
Adult: "Let's put all the big ones here". Child starts to organise objects into groups.
May 3rd 20 X

Level 2
The child organises objects into groups and suggests their own criteria for the categories.
Adult: "How would you organise these objects onto these two plates?" Child: "Let's put big ones here and small ones here."
Nov 25th 20 X

Level 3
The child classifies objects into groups, suggests criteria for categories and communicates specific features of the classes. "I put all the green toys on this plate and red toys on that plate. The third plate is for the rest of the colours. But wait a minute, this toy has both green and red. Maybe we need a fourth plate for that one."

Practise multi-level classification.

Level 1
The child is able to form sub-categories when supported.
Adult: "Now we have the big ones here and small ones here. Let's take a closer look at the big ones. Which ones of the big ones are red? Let's put them over here. " The child starts to reorganise the groups.

Level 2
The child organises objects into sub-categories and suggests criteria for them. Adult: "Now we have the big ones here and small ones here. Let's take a closer look at the big ones. How could we divide the big ones?" Child: "Let's put all the red ones here, blue ones here and green ones here."

Level 3
The child classifies objects into sub-categories, suggests criteria for them and negotiates the criteria.
"I divided the group of the big ones by colour, see? The red ones are here, green ones here and blue ones here. But here are the ones I was not sure about; they have multiple colours."

Practise serial classification.

Level 1
The child arranges objects in an order for instance based on their size and verbalizes concepts smaller than, bigger than.

Level 2
The child is able to arrange several objects in an order and verbalize the differences between the objects.
Oct 15th 20 X

Level 3
The child understands the principles of serial classification and can, for example, make a simple statistic.

Classify objects based on size and weight.

Level 1
The child organises objects into groups based on size.
May 3rd 20 X

Level 2
The child organises objects into groups based on size and weight.

Level 3
The child can arrange objects in order based on size or weight.

4.3 Skill mapping tables

To visualize the child's learning process and skill development, we have created a tool for teachers to observe and map the process. We call this tool **a skill mapping table**. There are eight tables in all: one for each of the seven science process skills and one for other important skills.

The purpose of the skill mapping tables is to visualize the current phase of the development of the child. This helps all the parties of the assessment process to see how the skill is developing.

How to use the skill-mapping tables:

1. Choose the skill that you are going to observe. You should try to concentrate on one skill at a time.
2. Print the corresponding sheet for each child that you're observing.
3. Pick a relevant learning goal for the upcoming lessons. You can concentrate on a few goals at a time.
4. Observe the child during the lessons and mark down what you notice by marking the checkbox that most closely describes the skills being shown.
5. Mark the date of observation on the sheet.

It's good to note that the skill progress varies individually. A child can be advanced in one skill, even though they would need more practise in another skill. The age-levels are there to help the teacher in estimating the average skill level within an age group. However, they are just estimates and each child will develop at their own pace, so remember not to demand too much from a child.

Even if you don't print the tables for every skill and child, reviewing the skill-mapping tables as a framework can help you understand the target skill progression!

Note: Most of the Kide Science printouts are related to a story theme, but **these skill mapping tables are general and it can be used all year round.**

5. Conclusion

Assessment is not rocket science, but it requires some effort from all the participants. We hope we stirred up some thoughts and have given you new ways of thinking about assessment.

Here are the most important points presented in this guide:

- Learning goals should be transparent for the learner and assessment should be linked to those goals.
- Assess the whole learning process, not just the end result.
- Focus on supporting learning.
- Focus on how to make the practising of the science process skills visual.
- The child should be active in the assessment process, along with the teachers, guardians and others that might be working with them. All the participants are learners in the process.

We here at Kide Science are ready to support you on your journey.

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