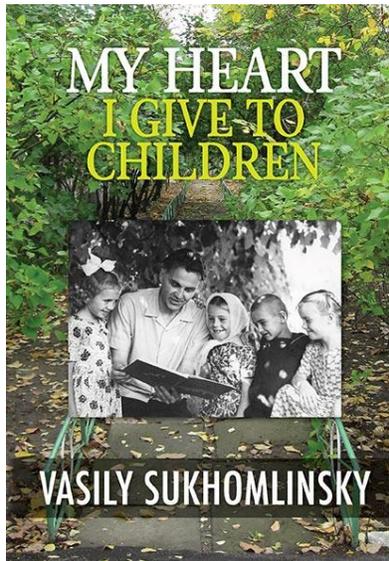


## Sample Chapter

### *My Heart I Give to Children* By Vasily Sukhomlinsky



### **Three hundred pages of the 'book of nature' (pp 152-172)**

The German mathematician Felix Klein compared a school student to a cannon that is primed with knowledge for ten years and then fired, after which nothing remains. I remembered this sad joke when I observed the work of children who were forced to memorise material they did not understand—material that did not awaken vivid ideas, images and associations in their minds. The substitution of memorisation for thought, the replacement of direct perception and observation of the essence of phenomena with rote learning, is a major vice that blunts a child's wits and, in the end, destroys the will to study.

Which one of us has not been amazed at the sharp, retentive memories of little preschool children? Consider a five-year-old child who has just returned from a walk with his mother and father in the forest or fields. He is bursting with impressions of vivid images, pictures and phenomena. A month passes, and then a year, and the mother and father are planning another walk. Their son is looking forward to the quiet sunny morning and remembers how, an unimaginable time ago, he went with his mum and dad to the forest. The mother and father are struck by the vivid, living details that sparkle in the child's recollections: the child remembers a wonderful flower with petals of two different colours. The father is amazed to hear him repeat

the beautiful legend of the brother and sister who turned into this flower; the father had recounted that legend to the mother on the edge of the forest. At the time the child had not appeared to be listening to what his father was saying; he had been chasing a butterfly. How had his memory retained these apparently minute details from the surrounding world?

The point is that children are amazingly sensitive to bright images, vibrant with many shades of colour and sound, and retain them deep in their memories. A little child will surprise older people with the most unexpected questions that arise in the process of perceiving images from the surrounding world. In this case, remembering the wonderful flower, the child asks his father, 'Can the brother and sister see each other or not? You said that plants are alive—does that mean they can hear and see? And talk to each other? And can we hear them talking?' This torrent of thought amazes the father: why did his son not ask about this a year ago? How could he retain not only the vivid image of the flower but the emotions of those unforgettable moments for so long? The father is convinced that the little child can still see the edge of the forest with its many-coloured carpet of flowers, and hear the distant sound of an aeroplane.

Reflecting on this, I asked myself: why is it that after two or three years studying in school, a child with a lively, vivid imagination and a keen memory, with such a sensitive emotional reaction to the surrounding world, cannot remember a grammatical rule and has difficulty remembering how to spell the word 'steppe' or what six times nine equals? I came to a conclusion no less sorrowful than that of the German mathematician: the process of acquiring knowledge at school is often disconnected from the spiritual life of students. The reason a child's memory is so keen and retentive is that it is fed by a clear stream of vivid images, pictures, perceptions and ideas. The reason a child's thought strikes us with its keen, unexpected, 'philosophical' questions is that it is fed by the living source of this stream. How important it is not to allow the school door to shut out the surrounding world from a child's consciousness. I tried to ensure that all through the years of childhood the surrounding world of nature constantly fed the minds of the students with vivid images, pictures, perceptions and ideas; that children came to apprehend the laws of thought as a well-ordered structure, whose architecture was dictated by an even more well-ordered structure—that of nature. So as not to turn children into mere receptacles for knowledge and their minds into storerooms cluttered with truths, rules and formulas, we have to teach them to think. By their very nature, a child's consciousness and a child's memory require that the bright surrounding world, with its natural laws, should not be shut out for a single minute. If the environment in which the child is learning to think, memorise and reason can become the surrounding world, I am convinced that the keenness of children's memories and the clarity of their thought will not only not fade when they start school, but will become stronger.

At the same time we should not exaggerate the role of nature in intellectual development. Teachers are deeply mistaken if they think that being surrounded by nature will in itself provide children with a powerful stimulus for intellectual development. Nature does not have some magic power, directly influencing the intellect, feelings and will. Nature will only become a

powerful stimulus for education when people attempt to understand it, and gain insight into its cause and effect relationships. I am not exaggerating the role of visual images in the intellectual development of a child. To overvalue the use of visual aids is to have too limited a view of children's thought processes, to limit cognitive activities to the sphere of the senses. We should not make a fetish of particular characteristics of a child's thought, including the characteristic that children think in images, colours and sounds. This characteristic is an objective fact, whose importance has been convincingly demonstrated by Konstantin Ushinsky. But just because children think in images, colours and sounds does not mean that we should not teach them to think abstractly. In emphasising the importance of visual images and the major role of nature in intellectual development, I see in these factors a means for developing abstract thinking and purposeful study: to help children master the logic of thought.

I carefully thought about what should stimulate my pupils' thinking and defined what the children would observe, day by day over four years; that is, which phenomena from the surrounding world would become the wellsprings of their thought. That is how the 300 pages of the 'Book of Nature' came together. It is composed of 300 observations, 300 vivid pictures, each of which made an impression on the children's minds. Twice a week we went to visit nature to learn to think. Not just to observe, but to learn to think. These were, in essence, lessons in thought. Not just enjoyable walks, but lessons. But the fact that a lesson is very enjoyable and very interesting enriches a child's spiritual world even more.

I set myself the goal of impressing the children's minds with vivid pictures of reality so that their thought processes would develop on the basis of living, graphic representations; so that while observing the surrounding world, the children would be able to establish the causes and effects of phenomena, and would be able to compare the qualities and characteristics of objects. My observations confirmed a very important principle regarding the intellectual education of children: the more abstract truths and generalisations that have to be mastered during a lesson and the more intense that intellectual work is, the more frequently students need to turn to nature—to the original source of knowledge—and the more vividly the images and pictures from the surrounding world need to be impressed on their minds. But vivid images are not just recorded in a child's brain as if on a roll of film. However vivid they are, representations are not an aim in themselves and not the goal of study. Intellectual education begins with theoretical thought, where living contemplation is not the end goal but a means to an end. A vivid image from the surrounding world is, for the teacher, a stimulus whose various forms, colours and sounds give rise to a thousand questions. In raising these questions the teacher is, so to speak, turning the pages of the Book of Nature.

I am looking at the first page of our 300 page Book of Nature. It is called 'Living and non-living'. At noon, on a warm, sunny day in early autumn, we walk to the bank of the river and stop in a grassy clearing. In front of us is a meadow, sprinkled with autumn flowers. In the transparent depths of the river fish are swimming. Butterflies are flitting in the air, and swallows are flying in the blue sky. We walk over to a tall cliff face, on which over many years a cross-

section of soil has been exposed. With interest the children examine the many-coloured layers of clay and sand—yellow, red, orange and white.

We notice a thin layer of white clay, under it some golden sand, and below that some beautiful cube-shaped crystals. The children compare the top layer of soil—black earth—with the deeper layers.

‘What can we see in the top layer of soil, children?’

‘Plant roots’, answer the children. ‘Down deep there aren’t any roots.’

‘Look, children, at the green clump of grass growing on the very edge of the cliff, and at that layer of golden sand. What is the difference between the grass and the sand?’

‘The grass grows in summer, fades in autumn, and comes to life again in spring’, say the children. ‘The grass has little seeds that scatter on the earth and new shoots grow from them ...’

‘And the sand?’ I want all the children—especially the slow thinkers: Petrik, Valya and Nina—to compare objects in the surrounding world. There are still children in the class whose stream of thought can be compared to a slow, full river: Misha and Sashko. And there is one little girl, Lyuda, whose thinking processes are still a complete mystery to me. At first I thought that her intellectual development was delayed and that it was difficult for her to understand things that the other children grasped easily. But in the girl’s lively, impressionable eyes I sensed thoughts that were restrained by some inner effort; it was as if the child was in no hurry to say what she knew very well ...

‘Look children, here is some golden sand, and here is some green grass. Or even better, here is some green sand, and here is some green grass. In what way are they unlike each other; what makes them different?’

The children think, looking at the green meadow and the bare cliff. Lyuda’s eyes are thoughtful; Petrik is frowning; Valya is pouring sand from one hand to the other.

‘Sand does not have any flowers, but grass does’, says Lyuda.

‘Cows graze on grass, but just try grazing cows on sand!’ exclaims Petrik.

‘Grass grows when it rains’, reflects Misha, ‘but have you ever heard of sand growing from rain?’

‘Sand is deep in the earth, but grass is on the surface of the earth ...’ suggests Yura.

But Seryozha objects: ‘Don’t you get sand on the river bank? Grass reaches for the sun, but sand only warms itself in the sun ...’

Then we compare a little pebble that someone has picked up with the small green leaf of a maple tree, a shard of red glass with a camomile flower, a fish swimming in a pond with a goose feather, the iron railings of a bridge with the stalk of a hop plant entwining a tree. The children's thoughts are bubbling over. The boys and girls notice obvious connections between the objects and phenomena of the surrounding world, and also discover connections that are not so obvious. Gradually in the children's minds their first notions of living and non-living take shape. Some things are alive and some are not alive—the children can see this from many observations—but they cannot answer when I ask them, 'What distinguishes the living from the non-living?' Gradually working towards a conclusion, their thinking constantly comes back to what their eyes can see. Along with correct characteristics, the children make some mistakes, which are corrected in the process of real life observations made on the spot. When Kostya says: 'Living things move, but non-living things do not move', nearly everyone agrees with him, but then there is a silence while the children look around them, and objections are heard:

'That stick is moving, floating on the river, but does that make it alive?'

'A tractor moves, but it's not alive.'

'The moss on an old roof doesn't move, but it's alive, isn't it? Or is moss non-living?'

'And sand also moves. When we were at the quarry we saw the sand flowing in streams.'

No, it turns out that movement is not what matters. How is the living distinguished from the non-living? The children compare objects from the surrounding world over and over. Shura exclaims joyfully,

'Living things grow, but non-living things do not grow!'

The children consider these words, and again their gazes are directed to the surrounding objects. They reason aloud: grass is alive, grass grows; a tree is alive, it grows; the dogrose bush is alive, the dogrose grows; a stone is not alive, it does not grow; sand is not alive, because it does not grow. It is true: everything that is alive grows; everything that is not alive does not grow ... Misha is thinking about something and looking off into the distance. Is he hearing the words of his friends? When the children have listed all the living and non-living things surrounding them, the boy says,

'Living things cannot live without the sun', and he points at the forest, the meadow and the field.

These words convince me yet again, that slow thinkers are often distinguished by their keen perception, attentiveness and observation. Misha's words light up the children's minds. 'Why didn't I think of that before?' the girls and boys are asking themselves. Their tenacious thoughts again reach out to explore the objects of the surrounding world, and the children again think aloud: 'Neither grass, nor flowers, nor trees, nor wheat can live without the sun. People also cannot live without the sun ... Or could a human being live without the sun? No, is it possible to

imagine people living deep underground? We know very well that grass dies in the shade of a spreading tree. And father says, "If the sun warms the soil after the rain the winter crops will send up green shoots, but if the sun does not shine things will be bad ...". But a stone is the same, whether it is in the sun or in a cellar. No, not quite the same, in a cellar it will be covered with mould ... And what about mould? Is that alive or not? The sun is not always helpful; it can burn the crops if there is no rain for a long time. So all living things love not only sunshine, but water.'

In such streams the children's thoughts flow in all directions, and then come together into a single current as it becomes more and more clear to the children that there are processes going on in all living things that we do not yet understand, but that depend on the sun, on water, and on everything that surrounds us in nature ... The children are reading the first lines on the first of 300 pages of the Book of Nature. They have understood that the whole world consists of two elements—living and non-living. Their first notions of living and non-living give rise to a multiplicity of questions. On the way home, the children examine phenomena that had previously seemed commonplace, noticing things they had not noticed before, and the more they notice the more questions arise: why does the little shoot from an acorn turn into a mighty oak tree? Where do the leaves, branches and the thick trunk come from? Why do leaves fall from the trees in autumn? Do trees grow in winter or not? It is not possible to answer all these questions at once and we should not set ourselves such a goal. It is good that the children have all these questions. It is good that in thinking, the children are turning to the primary source of knowledge and thought: to the surrounding world. It is good that they find precise, appropriate words to convey their thoughts. Clarity of thought—that most important attribute of thinking—is acquired in the process of direct communion with the surrounding world.

Children think in images, colours and sounds, but that does not mean that they should remain at the stage of concrete thinking. Thinking in images is a necessary stage for the transition to thinking in concepts. I tried to ensure that the children were gradually able to operate with concepts such as phenomenon, cause, effect, event, conditionality, dependency, difference, similarity, commonality, compatibility, incompatibility, possibility, impossibility and others. The experience of many years had convinced me that such concepts play a major role in the development of abstract thinking. It is impossible to master such concepts without investigating living facts and phenomena, without reflection on what children can see with their own eyes, without a gradual transition from concrete objects, facts and phenomena to abstract generalisation. The questions that arise in children's minds as they study nature facilitate this transition. I taught my pupils to observe the concrete phenomena of nature, and to seek cause and effect relationships. Thanks to this close connection between thought and concrete images, the children gradually acquired the ability to operate with abstract concepts. Of course this was a lengthy process that took years.

Reading the Book of Nature was of great interest to the children, but that interest is not an end in itself. Soviet pedagogy does not believe in relying too heavily on what children's immediate

interests are or in making children's activities the ultimate objective of the process of instruction. Even in the nineteenth century, Konstantin Ushinsky wrote: 'Teach a child to do not only what is entertaining, but also what is not entertaining—to do it for the sake of fulfilling his duty. You will prepare a child for life, for in life not all duties are entertaining.'<sup>1</sup>

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In Soviet pedagogy the personal interests of the child are seen as a means of achieving the school's instructional and educational goals—the acquisition of a range of scientific knowledge, the formation of personal scientific-materialist convictions. I did not see reading the pages of the Book of Nature as an entertaining pastime or an amusing game, but as a pathway into the world of scientific knowledge. The children were reflecting on phenomena in the surrounding world in which the laws of nature were revealed. The teacher had chosen the content of the Book of Nature not on the basis of the personal interests of each child, but on the basis of the dialectic of scientific knowledge of the world. This is the main difference between the aims of student activities in Soviet pedagogical theory and the well-known position of the pragmatists: that activity of itself gives knowledge.

Activities in Soviet pedagogy are not a substitute for systematic scientific education, but a means of achieving instructional and educational goals. At the same time, activities facilitating the acquisition of knowledge are meaningless without the personal interest of the child. In Soviet pedagogy, interest is considered to be the active involvement of the student's creative spiritual energies in the process of interpreting and investigating. Interest in what is studied and learnt deepens as the truths that the student assimilates become personal convictions.

We read the pages of the Book of Nature one after another and learn to think. The second page with which the children become acquainted is called 'The non-living is connected to the living'. We go to the greenhouse to see how the older students are growing cucumbers, tomatoes, barley and oats in that very same golden sand that is taken from deep underground, and in small fragments of crushed rock. The little ones see how they pour sand and crushed rock into metal and wooden boxes, and irrigate that mixture with a solution of chemicals. The roots of the cucumbers and tomatoes derive nourishment from that medium so they can grow and bear fruit. Dead fragments of rock and a white powder dissolved in water—that seems to be all that is needed for life. And in some flat containers, green stalks of barley are growing even without the sand and rock: the roots are absorbing nutrients from the solution of white powder. But when the children carefully examine the process of flowering and fruit bearing, they see that the non-living becomes a medium for the living only in the presence of sunlight and water. Life is impossible without light, warmth and water. Today is overcast and electric lamps are burning in the greenhouse. Outside it is a cool morning, but in the greenhouse central heating pipes are warming the air.

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<sup>1</sup> Ushinsky, KD, *Sochineniya*, vol. 6, Moscow: Russian Academy of Pedagogical Sciences Press, 1949, p. 252.

The teacher says, ‘Look very carefully at everything you can see, and consider whether the living can exist without the non-living. Here is a big chest with lots of little drawers containing various chemical fertilisers. Look at how your older schoolmates are taking white, yellow and grey powder from different drawers, mixing it, and dissolving it in water. And over here they are making a fertile soil, mixing coarse sand with humus. Can you see the juicy tomatoes that are growing in this mixture? Where does a plant get the building material for its leaves, stems and fruit? From the non-living. The non-living provides an environment for the living.’ These truths awoken in the children’s souls a feeling of wonder at the secrets of nature.

Again I am reminded of an ancient saying attributed to Aristotle: thinking begins with wonder. Sincere feelings of wonder as one discovers the secrets of nature provide a powerful stimulus for burgeoning thought. Yes, I have been convinced of the deep meaning of these words a thousand times. Wonder and amazement give rise to questions. When the children see how so many different plants—tomatoes, cucumbers, barley—are growing in a solution of chemicals, they bombard me with questions: ‘How does that transparent solution turn into thick stems, bright flowers with bees flitting about them, and juicy fruit?’, ‘Where does the life come from? The sun does not carry bits of green to the plant; it only gives light and warmth’, ‘Why do green cucumbers and red tomatoes grow from the same solution?’, ‘Why is the cucumber green and the tomato red when they are growing next to each other?’, ‘What is in those different coloured powders?’, ‘Why do plants get greener from humus in the soil?’

Those first visual demonstrations of the link between the living and the non-living are so important for children’s ongoing intellectual development! As they reflect on the questions ‘Where does living substance come from?’ and ‘How does the sun “make” the living out of the non-living?’, children are preparing to read the great book of life, to learn the secrets of complex processes.

I saw reading the Book of Nature as a means of promoting independent intellectual activity. Concepts, pictures, images—these are just the beginning of active thought. ‘Any method is bad’, wrote Diesterweg, ‘if it teaches students only perception and passivity, and is good to the extent that it awakens independence.’<sup>2</sup> I tried to ensure that reading the pages of the Book of Nature did not take the form of just perceiving the pictures and images of nature, but provided a basis for active thought, for theorising about the world, for systematic scientific knowledge.

‘The best content’, writes the Soviet psychologist G Kostyuk, ‘reaches the consciousness of students when it is part of their own activity.’<sup>3</sup> Not activity for activity’s sake, or for satisfying personal interests, but activity that reveals the content of scientific knowledge: therein lies the true link between activity and scientific efficacy in Soviet pedagogy.

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<sup>2</sup> Diesterweg, A, *Izbrannye pedagogicheskie sochineniya* [Selected pedagogical works], Moscow: Uchpedgiz, 1956, p. 128.

<sup>3</sup> Kostyuk, G, ‘Psikhologichni pitannya polipshennya yakosti uroku’ [Psychological issues in improving the quality of lessons], in *Psikhologichni pitannya polipshennya yakosti uroku: zbirnik*, Kyiv: Radianska shkola, 1959, p. 5.

‘Everything in nature changes’—that is the name of the next page in our Book of Nature. We return to this page several times. On a clear midday in autumn the class goes to the orchard. The branches of the apple and pear trees are weighed down with fruit. ‘Do you remember, children, what the orchard was like in winter?’ asks the teacher. ‘Bare branches covered in frost, trunks covered in snow ... And now the branches are covered in thick foliage, and the apples and pears are swelling with the sap of the earth.’

Two months later we return to the orchard. What is it like now? Yellow leaves form a soft carpet on the earth and the branches are half bare. Standing next to each other are an old, hollow apple tree and a little self-sown tree. The old apple tree was planted by our grandparents. Half its branches have withered. Only a few branches have leaves, but they bear large, juicy fruit. The old apple tree will stand in the sunshine for another year or two, and then we will have to cut it down. But on the slender trunk of the self-sown tree is a tender green shoot where students have grafted a bud from the old tree. The years will pass, and the shoot will turn into a flowering apple tree, and golden fruit will ripen.

‘Look around you children. Is there even a single plant that always stays the same?’

The children do not have much life experience, but from infancy they have lived in the world of work and of nature, and they know that plants are born, flower and bear fruit ... They talk about how a tender green shoot appears from the earth, how it turns into the thick stalk of the plant, how buds open on trees and leaves appear ... The children are amazed at the rapid changes that happen in the world of the living, sometimes occurring in leaps and bounds. Yesterday we were in the peach orchard and saw black buds on bare branches. Today we come early in the morning and a new picture greets us: the branches are covered in little pink flowers ... Why did the buds open so quickly, in a single night? Why did the whole tree flower at once? Does the tree sleep at night or not? In general, do trees sleep or not? Does it hurt the tree when they prune branches? Why does a tree get old and die? I had to think for a long time to find answers to these questions. But the answers led to a new barrage of questions.

We read this page of the Book of Nature on the bank of a pond, in a gully, in a thicket and in a field. In shallow water some little tadpoles are swimming—the children know they turn into frogs, but how does that happen? Why is it that a little fish in an aquarium already looks like a fish, but a tadpole looks nothing like a frog? We observe how the collective farm workers rear silkworms. From a little egg, as small as a poppy seed, appears a voracious baby worm. It eats only mulberry leaves—why? The baby worm grows into a big worm that sheds its skin several times, leaving the old skin behind—why? Then it wraps a silken web around itself and hides in a little golden house, its cocoon. What is happening to it inside? We take several cocoons, put them on the window sill, and after some time we see some beautiful, big butterflies emerge. The butterflies lay eggs and the same cycle repeats itself all over again. How does the worm make the fine silk thread? Why does it eat so many mulberry leaves before it is time to spin its cocoon?

The more their activity is connected with the active exploration of nature, the deeper and more meaningful the children's perception of the surrounding world becomes. With every month they notice more and more phenomena that they had not previously paid attention to. For instance they observe forms of life unlike anything they had seen before. In a dark, damp cellar, white threads appear on potato tubers. What are they, roots or future shoots? On the dark, northern side of tree trunks, green moss grows—why is it hiding from the sun? Why doesn't moss have seeds? How does it reproduce? All plants flower, but moss doesn't flower. What sort of plant is that?

Some lines in the Book of Nature convince the children that it is not only living things that change. We go to a cliff on the river bank. The children examine the grey stones and notice that they have fine cracks in them. On one stone a thin layer peels off, and crumbles in our hands. Does that mean a stone does not always remain a stone? The children remember how several months earlier, they had said, 'A stone is the same, whether it is in the sun or in a cellar.' During the day stones heat up, and at night they cool down. Cracks appear, and water seeps into the cracks. It turns out that a stone does not last forever.

Analysing the lessons in thought devoted to the page 'Everything in nature changes', I became convinced that as children learn more and discover previously unnoticed natural laws in everyday life, their desire to learn deepens, their sense organs become more sensitive to the phenomena of the surrounding world, and connections between sense organs and thought processes become more subtle. In the works of the Soviet anthropologist Professor MF Nesturkh there are some words that, in my opinion, provide a key to understanding the process of a child's intellectual development: 'Subjected, during the childhood years, to a constant flow of more and more new information, it is at this age in particular that a human being develops a growing urge to learn.'

The flow of information: that is the most important precondition for full intellectual development. But what happens if, for one reason or another, that flow of information weakens and is not augmented? What a child sees by himself is not a flow of information. Human education consists of elders passing their knowledge of the surrounding world on to children, constantly feeding the flow of information with the energy of their thought, bringing their influence to bear upon the child.

I began to study the family environment of each child, from the time of their birth up to their enrolment at school. I discovered some interesting correlations. If children are left to themselves during the preschool years and their elders do not create the flow of information essential to a normal human environment, a child's brain remains in a state of inertia. Curiosity and the thirst for knowledge fade, and indifference develops. Is it not true that a growing urge to learn provides the driving force behind thinking, and determines to a huge extent the intellectual development of a child? This does appear to be true.

Petrik was left to himself as a child. His mother and grandfather left for work in the morning, and he was left at home alone. He was left inside a play pen under the eaves of the barn or on some grass. From time to time a neighbour looked in to make sure he was all right. That is how Petrik was 'brought up' from the age of two to the age of five. It was a vegetative kind of upbringing. The child was well fed, clothed and shod, but deprived of the most important thing: human company. From the age of five Petrik played outside with other children, mainly his own age. When he came to school he did not know the meaning of some very simple words in his native language. His indifferent eyes skimmed over the things that surrounded him and seemed like the eyes of a little old man. I concluded that the living material supporting thought—the cells of the cerebral cortex—were inert in this child, because during the most important period in the development of the nervous system, during the infancy of the brain, the boy was deprived of the natural flow of information from the surrounding world. That is why reading the Book of Nature should play a major role in this child's education.

We turn to the next page: 'The seeds of life'. In autumn the children collect the seeds of pears, apples, peaches and plums to sow in our fruit tree nursery bed. The children know from experience that plants grow from seeds. In spring and summer, when life blooms in the steppe, forests and woods, seeds ripen on the plants and the life of the species continues. We go on an excursion. The spring breeze plucks white balls of fluff from the poplars and the dandelions. The children find little seeds in the middle of these light fluffy balls. They are amazed at the care nature has taken to look after these seeds. They do not grip the surface of dry soil, but as soon as they come in contact with damp soil they stick, 'anchoring themselves', and the seeds send forth shoots. The children read each line of this page of the Book of Nature with interest. They see how many plants 'shoot' out little grains so that little seeds of life fly in all directions. They see how, when a poppy head is tossed in the wind, the first poppy seeds to ripen fly out of little 'windows'. With a magnifying glass we examine the 'cunning' hooks, pads and 'crampons' by which many seeds grip on to people's clothes or the fur of animals. We make a collection of seeds from grain crops. The children think about how a big plant grows from a little seed. Is a seed living or non-living? The children read some interesting lines from this page in winter: some plants cast their seeds in the snow. The seed have to lie in the snow for several weeks before they will germinate.

The stronger the urge to acquire knowledge, the greater the interest with which children work and the more deeply they explore the experimental nature of work. The flow of information from the surrounding world becomes a particularly strong stimulus for learning when the hands assist thinking, when through their work children are trying to find the answers to exciting questions, to solve a puzzle, to prove the truth of something that is still only a hypothesis. Children who have become hard workers, not because they are forced to but because they really want to, will become true thinkers. Children's desire to work hard comes mainly from the desire to find out something new. If that desire is developed, children's interest in work will be strengthened. The

love for work that we speak of in educational practice is in fact a fusion of curiosity, the thirst for knowledge and a child's feeling of self-worth.

A deep impression is made on the minds and the emotional memories of the children by journeys devoted to one of the most exciting pages of the Book of Nature: 'The sun is the source of life'. On a hot and sultry day in summer we visit a field, an orchard and a grape plantation. We can see a field of wheat and sunflowers, bunches of grapes, pears turning yellow, and ripening tomatoes. In these gifts of fertility the children see the light and warmth of the sun. Thanks to the sun, the earth gives people everything they need. This conclusion was arrived at after numerous observations and comparisons, and the establishment of cause and effect relationships, awakening the little ones' sense of wonder and providing a fresh stimulus for their flights of thought. The children examine the surrounding world, thinking about the origins of each object, and their sense of wonder deepens even more when they become convinced that the sun is the sole source of life.

Grain, potatoes, sunflowers—nothing could exist without the sun. Meat, milk and butter would also not exist, because animals feed on what grows in the earth thanks to the sun's light and warmth. The astounded children ask: 'And what is the sun? Where does the warmth of the sun come from? Why does the sun warm the earth so little in winter? It won't go out will it? What will happen if it is put out?'

The questions that arise while reading the Book of Nature mark the beginning of a headlong flight of thought towards that high point in learning, from which, in several years' time, the complexity of life's secrets will become apparent. I took care to see that my pupils were inquisitive researchers and explorers of the world; that truth was not presented to them by the teacher on a platter as a ready-made conclusion, but as a vivid picture of the surrounding world experienced with a quickened heartbeat. If a discovery excited children, the truth would become a personal conviction, treasured for life. Intellectual feelings, experiencing the joy of discovery, awe at nature's grandeur and at the beauty and harmony of her laws—these give rise to a strong memory.

I saw in such intellectual feelings the main means for developing and strengthening the memories of certain children. Valya had a very poor memory. Everything seemed to go in one ear and out the other. I had to ensure that the girl's heart beat faster from a feeling of wonder at the images of the surrounding world. For several days we went to the fields, the forest, the river bank, the orchard and the apiary, to study the page of the Book of Nature entitled 'Every living creature adapts to its environment'. I directed the children's attention to the fact that some flowers close their petals in hot weather and open them when the cool of evening comes. I showed them how the slender stem of a snowdrop pierces a thick layer of dead leaves like an arrow, how bees build hives and fill the honeycomb with honey, how the roots of a grapevine penetrate the soil to a depth of three metres to obtain moisture, how the branch of a weeping willow sends down roots when it drops into silt so a new tree can grow... These discoveries

filled the girl's heart with joyful excitement. The expression of indifference in the child's eyes was replaced with lively interest. Silent Valya started talking, and asked: 'And how does a bee know which way to fly home? How does it find its hive? Aren't the snowdrops cold? There is still snow under the trees.' Wherever there is a question, there is thought; and wherever there is thought, the memory retains pictures of the surrounding world and of the laws of nature.

Here are the names of some pages of the Book of Nature that we read one after another: 'The plant and animal kingdoms', 'The journey of a drop of water', 'People use the forces of nature', 'Nature wakes up in spring', 'The longest days of summer', 'Spring flowers in the forests, fields and meadows', 'Summer flowers', 'Lilies and violets', 'Chrysanthemums—the children of autumn', 'Life in a pond', 'The last days of an Indian summer', 'Nature waits for winter', 'The first winter morning', 'The life of birds in a winter forest', 'Ears of wheat', 'The life of a bee colony', 'A swallow builds its nest', 'A thunderstorm approaches', 'Gloomy autumn weather', 'The world of flowers in the middle of winter', 'A forest stores moisture', 'The storks have arrived', 'Birds prepare to migrate to warmer lands', 'The sun after a summer shower', 'A rainbow over the river', 'Winter and spring crops', 'The sunflowers have bloomed', 'Stars in the sky', 'The life of the soil', 'A green leaf is the sun's pantry', 'Mushrooms and moss', 'How an oak tree grows from an acorn' and many others.

'A bad teacher presents the truth, a good one teaches how to discover it', wrote Diesterweg.<sup>4</sup> Nowadays an investigative approach to the phenomena of the surrounding world takes on a special significance. It is very important that children's thinking is based on investigation and research, that the realisation of a scientific truth should be preceded by the accumulation, analysis, juxtaposition and comparison of facts. Observing the phenomena and pictures of nature, a child learns to master the forms and processes of thought and acquires concepts, each of which embodies real cause and effect relationships, detected by the sharp eyes of the inquisitive observer. Experience confirmed that the thought processes of children reading the Book of Nature were distinguished by a remarkable characteristic: when operating with abstract concepts, the children mentally referred to those ideas, images and pictures that had formed a basis for the development of those concepts.

When my pupils who had read the Book of Nature in childhood became adolescents and then young men and women, I was especially interested to see how their active exploration of the surrounding world influenced their general intellectual development, the character and style of their intellectual work, and the variety of their intellectual interests. I became convinced that the intellectual life of those students was distinguished by a thirst for knowledge. They were interested in everything. Everything that surrounded them touched their feelings and thoughts. One of the features of the intellectual life of my pupils in adolescence and youth was the ability to see the interconnections between various phenomena and objects. Anything that was not clear,

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<sup>4</sup> Diesterweg, A, *Izbrannye pedagogicheskie sochineniya* [Selected pedagogical works], Moscow: Uchpedgiz, 1956, p. 158.

that they did not understand, they looked up in books. For them books became a source of knowledge and a spiritual imperative.

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