

In Matter, the Spirit

Science Education in the Waldorf School

Roberto Trostli

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How do we teach science in the Waldorf school? How does the science curriculum meet the students' needs? What are the special tasks of the teacher? These are questions that bear special examination in light of current concerns about science education in America.

Whenever I consider a topic, I find it useful to begin by examining words because they often point out hidden or unexpected aspects of the topic. The word "science" comes from the Latin word *scientia*, which means "knowledge." It is derived from the Latin verb *scire*, which means "to know." Originally it meant "to know" in the sense of separating one thing from another, "distinguishing it" because *scire* is related to the verb *scindere*, which means "to cut, divide."

It is interesting to note that even the word "science" itself already poses some questions: What is the relationship between subject and object? What is the relationship between the knower and the known? What is the meaning of the division between self and world?

These questions lie at the heart of the reality of what science truly is, and they lead us to some of the goals of science teaching. Science helps students to bridge these divides. It helps students connect with themselves and other people, with the natural world, and with the world of technology.

Although science teaching helps students connect to all that they will meet during their lives on earth, it also has a deeper, more esoteric purpose.

Why Do We Teach Science?

In my opinion, every subject taught in the Waldorf school is a means by which we develop the students' soul capacities—their thinking, feeling, and willing. In addition, each subject has a special task. I believe that one of the major tasks of science education is to help students connect to the world.

Perhaps one should say re-connect, because students have experienced the world before but under different circumstances. We might consider this sense of connection in light of the word "religion," which comes from the Latin prefix *re-*, which means "again" or "back"; and *ligare*, which means "to bind" or "to connect." "Religion" literally means "to reconnect," and that is what we are aiming for in science teaching: reconnecting children with the world and all life upon it. Although science teaching helps students connect to all that they will meet during their lives on earth, it also has a deeper, more esoteric purpose.

The Esoteric Purpose of Science Teaching

In 1918 Rudolf Steiner gave a lecture called "The Work of the Angels in Man's Astral Body." This lecture is of utmost importance for Waldorf teachers, so I shall quote from its central sections at length. In this lecture Steiner describes how the Angels, at the behest of the Spirits of Form, are continually forming pictures in our astral bodies, pictures that will call forth ideals for the future of our life on earth. According to Steiner, the Angels have three major objectives.

The first is to occur within the social sphere: “In the future no human being is to find peace in the enjoyment of happiness if others beside him are unhappy. An impulse of brotherhood in the absolute sense, unification of the human race in brotherhood rightly understood—this is to be the governing principle of the social conditions in physical existence.”

The second objective is to occur within the human soul: “In future times every human being shall see in each and all of his fellow men a hidden divinity. ...To conceive man as a picture revealed from the spiritual world, to conceive this with all earnestness, all strength and all the insight at our command—this is the impulse laid by the Angels into the pictures.”

The third objective is to occur within the human spirit: “To make it possible for men to reach the Spirit through thinking, to cross the abyss and through thinking experience the reality of the Spirit.”

The Angels are preparing humanity for the future by forming these pictures. This process prepares human beings for a threefold truth, which will be revealed by the Angels.

Firstly, it will be shown how his own genuine interest will enable man to understand the deeper side of human nature. A time will come—and it must not pass unnoticed—when out of the spiritual world men will receive an impulse through their Angel that will kindle a far deeper interest in every individual human being than we are inclined to have today. This enhanced interest in our fellow men will not unfold in the subjective leisurely way that people would prefer, but by a sudden impetus, a certain secret will be inspired into man from the spiritual side, namely, what the other man really is. By this I mean something quite concrete—not any kind of theoretical

consideration. Men will learn something whereby their interest in every individual can be kindled. That is one point—and that is what will particularly affect the social life.

Secondly, from the spiritual world the Angel will reveal to man that, in addition to everything else, the Christ Impulse postulates complete freedom in matters of religious life, that the only true Christianity is the Christianity which makes absolute freedom in the religious life possible.

And thirdly, unquestionable insight into the spiritual nature of the world.

As Waldorf teachers we can also work towards these goals. By addressing the whole human being in body, soul, and spirit, by developing the soul faculties of thinking, feeling, and willing, and by using a curriculum that encompasses the world and plumbs the depth of the human being, we prepare our students to receive the threefold truth that the Angels will reveal.

The curriculum of the Waldorf school builds a basis for the pictures and the truths of the Angels. Which subjects help students develop the impulse of brotherhood? Geography and the world languages. By learning about the earth and its different peoples, by entering into the folk soul of another culture through its language and customs, our students are helped to realize their place within the human community.

Which subjects help students develop a sense for the hidden divinity within each human being? History and literature. By learning about the lives of significant individuals, by experiencing the loftiest expressions of the human spirit, our students are helped to view each person from a more spiritual perspective.

Which subjects help students develop the ability to reach the Spirit through thinking?

We are actually working on behalf of the Angels, helping our students remain receptive to the loftiest human ideals. We are preparing them for the future evolution of humanity!

Which subjects give insight into the spiritual nature of the world? Mathematics and science. By developing a rich conceptual life arising from observing and by coming to understand the mysteries of matter, our students are helped to view the material world as a manifestation of the spirit.

Our work in the sciences, therefore, has a lofty task. Not only are we introducing the students to nature study, the life sciences, and the physical sciences, we are actually working on behalf of the Angels, helping our students remain receptive to the loftiest human ideals, helping them to prepare for the future evolution of humanity.

We may not be conscious of this immense responsibility, and once conscious of it, we may well feel ourselves inadequate to the task. In our worst moments, when we feel incompetent and unworthy, we may even reject this responsibility, but it is always there, waiting to be recognized, waiting to be accepted.

The Gesture of the Science Curriculum through the Grades

By working with Rudolf Steiner's Foundation Stone Meditation over the years, I have been inspired to think of my work with the students and the curriculum in new ways. One connection I have begun to sense is between the first three parts of the Foundation Stone Meditation and the first three stages of child development. I believe that the youngest children have a special connection to the Father Spirit, the elementary school children to the Christ Will, and the high school students to the Spirit.

In the Foundation Stone Meditation, the first gesture is downwards from the heights to the depths:

*For the Father-Spirit of the heights holds sway,
In depths of worlds begetting life.*

The gesture of the Father Spirit is expressed through the first hierarchy down towards earth:

*Seraphim, Cherubim, Thrones,
Let ring forth from the heights
What in the depths is echoed,
Speaking:
Out of the Godhead we are born.*

I interpret this downward gesture to be the gesture of early childhood and the early grades—the school of the body in which the spiritual world has implanted and expresses itself, where spirit echoes in the material world.

The second gesture of the Foundation Stone Meditation is the encircling gesture:

*For the Christ-Will encircling us holds sway,
In world rhythms, bestowing grace upon souls.*

The gesture of the Christ is expressed through the second hierarchy:

*Kyriotetes, Dynamis, Exusiai,
Let from the east be enkindled
What through the west takes on form,
Speaking:
In Christ death becomes life.*

I interpret this encircling gesture to correspond to the work of the elementary school—the school of the soul in which the spiritual impulses find form and expression in the world rhythms, in the cycles of the seasons, and in the celebrations of all cultures.

The third gesture of the Foundation Stone Meditation is the upward gesture. This is the gesture of the Holy Spirit whose world thoughts reign in world being:

*For the Spirit's world-thoughts hold sway,
In cosmic being, imploring light.*

The gesture of the Spirit is expressed through the third hierarchy, the hierarchy closest to the human being:

*Archai, Archangeloi, Angeloi,
Let from the depths be entreated
What in the heights will be heard,*

*Speaking:
In the Spirit's cosmic thoughts the soul
awakens.*

I interpret this gesture to correspond to the time of the high school and beyond, where thinking is raised to the spiritual heights, where human aims and human problems are worked with in conjunction with spiritual beings.

The Science Curriculum

Even as the Foundation Stone leads us from body to soul to spirit, the science curriculum through the grades works with the principle that children first look at the world with eyes of the spirit, then with eyes of the soul, and finally, inexorably, with eyes of the body. William Wordsworth expressed this beautifully in his ode "Intimations of Immortality" when he said:

There was a time when meadow, grove,
and stream,
The earth, and every common sight,
To me did seem
Apparell'd in celestial light,
The glory and the freshness of a dream
It is not now as it hath been of yore;—
Turn wheresoe'er I may,
By night or day,
The things which I have seen I now can see
no more.

Then he describes the stages of early life:

Our birth is but a sleep and a forgetting:
The Soul that rises with us, our life's Star,
Hath had elsewhere its setting,
And cometh from afar
Not in entire forgetfulness,
And not in utter nakedness,
But trailing clouds of glory do we come
From God, who is our home:
Heaven lies about us in our infancy!
Shades of the prison-house begin to close
Upon the growing Boy,

But he beholds the light, and whence it
flows,
He sees it in his joy;
The Youth, who daily farther from the east
Must travel, still is Nature's priest,
And by the vision splendid
Is on his way attended;
At length the Man perceives it die away
And fade into the light of common day.

This transition—from being surrounded by the glories of God, to beholding the light and whence it flows, to being Nature's priest, attended by the vision splendid, to having that vision fade into the light of common day—traces the steps that children take, and it corresponds to what we need to do on our journey with the children.

Let me try to put it into more practical terms, beginning with a summary and then developing each part further.

1. In the preschool, children experience the world of science through rituals and traditions that celebrate the natural world.
2. In the early grades, children are affirmed in their experience of the spirit in their home surroundings by the stories and parables of nature that the teacher tells them.
3. In the middle grades, students hear lively descriptions of the natural world and begin to explore it and study it directly.
4. In the upper elementary school, students begin to observe the natural world and its forces more objectively through their introduction to physics and chemistry.
5. In the high school, students discipline their observations of the natural world, and they methodically begin to penetrate the details of the forces and substances in the world. At this time they also learn about the applications and implications of the forces, processes, and substances that they have studied.

Let us look how science is taught at the various grade levels so that we can understand

the development of the curriculum and how it works throughout the child's life even into adulthood and old age.

In the preschool, children experience the world of science through rituals and traditions that celebrate the natural world. During these years, when children are still surrounded by the celestial light, no teaching is necessary, for experience is the teacher. The child's experiences from these years become the bedrock of the child's sense of herself, of others, and of the world. The experiences of rituals, traditions, and celebrations give the child the sense that the world is good. This sense of the goodness of the world builds a sense of security for life.

At the other end of one's life, when one experiences a second childhood—when the thoughts and cares of adulthood begin to fade away and one is stripped down to one's essence—the experiences of childhood remain, blessing and consoling, affirming the goodness of the world and of life. The sense that “God is our home” allows an old person to look forward to that homecoming which is death.

In the early grades, children are affirmed in their experience of the spirit living in their home surroundings by the stories and parables of nature that the teacher tells them. As the child begins to awaken to his senses, the teacher affirms the spiritual nature of the world through her words and images.

Rudolf Steiner stressed the importance of sharing the parables of nature. On more than a dozen occasions he spoke about the parable of the butterfly emerging from the chrysalis as a picture of the emergence of the soul after death. He said that this picture is put into the world by the wise spirits who care for human beings. Steiner suggested that teachers look into the world to find these

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parables of existence and that they then share these parables with the children during the early years of elementary school. These stories—along with the moral tales such as fables and legends—are the science curriculum for the first school years.

Giving children parables that explore, explain, and affirm the world around them bestows on them a sense of security and confidence in the person standing before them.

It helps them to know that they are taught by a person who sees with more than physical eyes, a person who hears with more than physical ears. It gives them a sense that the world is beautiful.

In our late middle age—when we search for the flowers of wisdom that may be hidden among the weeds of our intellect—these pictures begin to have a new truth. The eyes that were once open to the mysteries of existence can be re-opened later in life through diligence, through pain and hard-won experience. If one has had the privilege of being taught and raised by adults who were open to the parables of existence, one will not need to look so hard for the meaning behind the challenges of one's life.

In the middle grades of elementary school, students hear lively descriptions of the natural world, and they begin to explore and study it directly. As the child's eyes open further, she begins to see the world as distinct from herself. The child has already experienced the great physical separation from the mother's body at birth. She has experienced further physical separations: from the ground when she first stands upright; from her parents when she starts sleeping in her own room; from her family when she leaves home to go to school. Each of these separations is accompanied by a soul experience that is largely unconscious but still deeply felt.

At the ninth year, the child experiences a sense of separation from the world. He is, as it were, cast out from Paradise where he had lived in community with the plants and creatures under the loving gaze of God. Although, in Wordsworth's words, he still "beholds the light, and whence it flows, He sees it in his joy," the child has the need to connect with the world in his own right through his own senses, with his own feelings. The child of this age needs a communion with nature, an affirmation that he is of the world and the world is in him. The child of this age needs pictures of connection to counteract the sense of separateness, to subdue the fears that dawn in each of us as we recognize that we are truly alone in this world. The study of the animals, the plants, and the world of the minerals and of the heavenly bodies expands the child's horizons, giving the child a sense of belonging, affirming the beauty of the world.

Topics that are brought in a living way during these elementary school years—topics that are brought in a way that affirms the human being's connection to the world—will stand the child in good stead during the middle of his adulthood. Middle age is the culmination of the sense of separation that we felt so strongly at age nine. These are the years when we are likely to feel most alone in the world, most alienated from ourselves and from others. If we have been given living pictures of the world and its creatures during our school years, we may have a reserve of a sense of belonging that counteracts the isolation of adulthood.

In the upper elementary school, students begin to observe the natural world and its forces more objectively through their introduction to physics and chemistry. Wordsworth's poem says "The Youth, who daily farther from the east / Must travel, still is Nature's priest, / And by the vision splendid / Is on his way attended." During these years

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when children still are nature's priests, we have the opportunity to present the invisible world of the forces of nature and the mysteries of substance. We have the privilege to celebrate with them the sacraments of the physical world so that they can be blessed by the phenomena they experience. As students are asked to make sense of their sense impressions, they learn new respect for their powers of observation and for the power of their thinking. They learn to respect and value the soul capacities that allow them to make sense of the world. This is the beginning of experiencing the important lesson that the world is true.

In our work in the sciences with the students, the ordinary can become special, the commonplace can become sacred. During the flowering of adulthood, when the world may seem mechanical and sterile, these kinds of experiences can help a person trust that there is meaning in existence.

With the advent of puberty and adolescence, something new is born in the human being, and, at the same time, something old dies. With the onset of adolescence, the gates of knowledge of our pre-birth existence clang shut. As these gates close, the young person can no longer look back with reverence at a world that was so beautiful, so meaningful, so worthy of imitation. Now the young person looks out into the world, seeking to find beauty, meaning, and something worth emulating. The science of the high school years and beyond leads the student into the world. Now students are required to be rigorous and disciplined in their observations, to record them accurately so that they can analyze them. Students are expected to observe or conduct science activities methodically so that they will be able to penetrate the details of the forces and substances in the world.

And as students develop true thoughts about the forces and substances that they

have worked with, they are called on to learn how these forces and substances are applied in the world. In several of his education courses, Rudolf Steiner exhorted teachers to help their students learn about the inventions and products that people have created. He did so not only to help ground students in the world they were entering but also because understanding the creations of human beings cultivates a sense of connection to those human beings. In *A Modern Art of Education* Rudolf Steiner stated:

Just think how many people nowadays get into a tram without having the faintest idea of the principles governing its motion and mechanism. Or they see a railway every day and have absolutely no notion of the machinery of a locomotive! This means that they are surrounded on all hands by inventions and creations of the human mind with which they have no contact at all. It is the beginning of unsocial life simply to accept these creations and inventions of the mind of man without understanding them, in a general way, at any rate.

It is the beginning of unsocial life not to understand the creations of other human beings. How well we know this to be true! It is not hard to see how the rise of inhumanity correlates to our reliance on technology about which we have not the faintest understanding.

High school and college give students a foundation of thoughts that allows them to understand the ideas that manifest in the world. It should also give them the foundation for transforming those ideas into ideals. In the early years of our adulthood, when we are first able to align ourselves with our ideals, we need a firm foundation concerning the

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way the world works so that our ideas are sound and our ideals meet the needs of the world. As the celestial light fades to the light of common day for our students, we want them to have the ability to recognize the inner light and to seek it in themselves, in others, and in the world. When, as adults, they perceive this light and whence it flows, they are fully affirmed in their decision to come to earth to work and learn.

The Waldorf curriculum is a magnificent tapestry, a tapestry woven with the warp of the child's growth through the year and the weft of the themes that reappear in ever new forms. But more important than the curriculum of the science main lesson blocks is the way we work with and relate to matter. Not only do our students watch us as we handle the equipment, as we demonstrate a process; they internalize our approach and are influenced by our attitude.

The Task of the Teacher

Teaching science, especially the physical sciences, can be delightful and rewarding, interesting and fun. Teachers who overcome their inexperience and trepidation will begin to feel more at home in a new world. They will relish being able to begin to reveal the mysteries of this world and to control the forces of nature. With this increasing sense of comfort and competence come temptations and dangers.

The first temptation is the Luciferic temptation to become a magician. As we become more and more comfortable in the sciences, we can begin to feel that we have a magic wand with which the mysteries of the universe can be revealed. See how we amaze the students! Look how we mesmerize and enchant them! How lovely to bask in the glow of their admiration, their wonder, their awe!

How easy it is to succumb to this temptation, for all of us yearn for our lessons

to take wing, for our words and deeds to illuminate and inspire. Yet if we succumb, we begin to turn our students into mystics, into dreamers with their heads in the clouds. Lucifer would like to transform the human being into a completely spiritual being. He works to divorce humans from the earth and make them into spiritual automatons. By giving in to his temptation, we aid him in his task.

The second temptation is the Ahrimanic temptation to become the proverbial power-hungry, mad scientist. As we become more proficient in the sciences, as we begin to know and anticipate the processes and outcomes, we begin to feel that we have the means of controlling the forces of nature. Look how nature does our bidding! See how we can manipulate and regulate the phenomena! How satisfying to feel the students' increased respect for our power!

How easy it is to succumb to this temptation, for all of us strive to be competent, to master our task and our material, to do things well. Yet if we succumb, we begin to turn our students into materialists with their feet rooted in the earth, their gaze focused downward. Ahriman would like to turn human beings into completely physical beings. He works to wed humans to the earth and reduce them to creatures of instinct. By giving in to his temptation, we aid him in his task.

We are neither magicians nor scientists, mad or otherwise. We are teachers, teachers who are being called to serve, to serve as priests of Nature, working in her service and on her behalf. We do not need to pull back the veil of the temple; we can allow Nature to reveal her mysteries to the students when they are ready. We do not manipulate the phenomena on the altar of the demonstration table; we perform our service and let the phenomena speak for themselves. When students observe a demonstration, they should be observing the

demonstration, they should not be observing us. We have to learn to stand aside, literally and figuratively, so that Nature may speak directly to the students' hearts and minds.

We have to learn to stand aside, literally and figuratively, so that Nature may speak directly to the students' hearts and minds.

This is the middle way between the Luciferic and Ahrimanic temptations, this is the way of the Christ Being. By striving to let the Christ work in us and through us, we are helped to find the means of relating to the material world in a human and moral way.

This is the central task of the science teacher; the rest will follow.

To educate youth
Means to foster and tend
In matter the spirit,
In today the tomorrow,
In earthly life
The spirit's existence.

*Roberto Trostli has been active in Waldorf education as a class teacher, high school teacher, adult educator, and lecturer for over thirty years. He is the author of *Physics Is Fun: A Sourcebook for Teachers*, numerous articles on Waldorf education, and many plays for children. He edited and introduced *Rhythms of Learning* and compiled *Teaching Language Arts in the Waldorf School*. Roberto is currently a class teacher at the Richmond Waldorf School.*