

Science

Science

Science is a way of understanding the richness and complexity of the world. Waldorf education recognises that there are different ways of understanding how we arrive at reliable knowledge, and that science, although it is not the only valid way, is one important aspect of this.

In the lower and middle school, science focuses on experiencing and describing phenomena. This means encountering the world, observing it, observing ourselves and what the world does to us, describing our experiences and then forming judgements about them. The Waldorf science curriculum starts holistically by being and working in the world alongside rich imaginative experiences through storytelling, so that children build their knowledge of the local natural environment and the vocabulary with which to discuss and describe it. From class 4, there is a deepening focus on specific aspects of the life sciences, beginning with animals, then plants and eventually relating these to geology and geography. At each step we look at the particular, zoom out to set it in its context and then formulate what characterises the phenomena. As children's ability to work scientifically is developed, observations become more systematic and analytical, and they can form and justify categories.

From class 6, physics, chemistry and biology become distinct subjects, where experiments in optics, acoustics, chemistry, electromagnetism and more bring pupils into the presence of phenomena that provide sensations that excite, move and affect them; experiences that gain meaning when pupils' experiences are shared, discussed and documented, and will not easily be forgotten.

In the upper school students learn the specialist methods and terminology that each scientific discipline uses.

The Waldorf science approach is a process of meaning-making from experiences which develops conceptual understanding. It appreciates that we cannot always grasp the whole because of its complexity, so we take manageable parts, respectfully get to know them, then relate the part back into the wider context and its implications. Thus knowledge of the wider, greater whole grows step by step.

The Waldorf approach also shows that knowledge of the world has grown over a long time, with roots in many cultures such as the science of Islam in the Middle Ages, of Ancient India and China and the applied sciences of many peoples in African and the Americas before European colonization. It shows us that scientists are people from all over the world who work in teams using their skills and insights who, for example, develop vaccines in incredibly short times when we need them, develop solutions to renewable energy and resources, and help us to understand the past, predict the future and help to learn about the incredible beauty and complexity of the world.

Science: Purpose of Study

Science is a way of understanding our experience of the world. The Waldorf science curriculum starts from a holistic, integrated experience of the world through focussed attention and then moves to a differentiated approach using the prism of the scientific disciplines of biology, chemistry and physics. A successful science curriculum starts with and builds on embodied experience of what is familiar to us, using observation and description

of phenomena in context to generate excitement and curiosity to understand the world. Through carefully selected examples which exemplify key phenomena, pupils then build up living concepts of the natural world that are woven over time into a coherent structure of disciplinary knowledge. Throughout this process, pupils progressively learn to use and apply the scientific methods of noticing and observing; exploring, discovering and experimenting; using tools and equipment; empathic identification; understanding in context; process thinking; comparing, analysing and classifying; following processes and working systematically and rationally; recording, reporting and presenting. In the Waldorf curriculum, science also includes the study of people in different cultural and historical contexts who work/have worked systematically to understand and learn from nature (scientists). Pupils learn that scientific knowledge and progress can and should be for the benefit of humankind, and shared across countries and cultures.

Science: Aims

The Waldorf curriculum for science aims to ensure that all pupils:

- develop the capability to generate understanding of scientific knowledge through study in the disciplines of biology, chemistry and physics
- can apply appropriate scientific knowledge and methods to help them to answer questions about the world around them
- have a sound basis for making informed judgements about scientific knowledge and the impact of its application in the world

Long Term Curriculum Intent

Language and communication

- Translating sensory experiences into language and images
- Precise and accurate description
- Remembering and using technical and scientific vocabulary
- Using scientific written language conventions, e.g. writing in the 3rd person.
- Creating models and diagrams
- Understanding and interpreting data in many forms

Health and well-being

- Being confident to explore and experiment
- Using tools and equipment effectively and safely

Senses

- Multi-sensory observation that is accurate and precise, without preconception, assumed prior knowledge, expectation or explanation

Imagination and play

- Developing mental models of scientific concepts and processes
- Hypothesising - imagining solutions and consequences
- Changing perspective - seeing the world as a scientist

Empathy

- Understanding the impact of scientific discovery and progress on others

Aesthetics

- Appreciating beauty in nature and science, e.g. chemical and microscopic structures

Inquiry

- Phenomenological study
- Use of relevant or related mathematical knowledge to ask and answer questions

- Accurate and precise measurement and recording
- Understanding the histories and biographies of scientists and scientific discovery
- Retaining an inquisitive mind: asking both open and specific questions.

Democratic participation and society

- Understanding of the motivations for technological and scientific development, and reflecting on the political aspects scientific progress.

Lifelong learning

- Viewing the world scientifically
- Understanding that theories are a working model, that 'facts' are not immutable and that paradigms shift.
- Working methodically, sequentially, accurately and precisely.
- Being able to be wrong - accepting that your hypothesis was incorrect.

Future thinking

- Seeing science as a means of engaging with wicked problems
- Considering the impact of human development on local and global eco-systems.
- Anticipating the future and imagining the role of science in building sustainable futures.

Holistic thinking / Spirituality

- Understanding science in the context of social, cultural and technological development over time
- Understanding science in the context of personal lived experience
- Understanding the historical context of the relationships between people, societies, cultures, theories, beliefs and 'facts'.

Judgement

- Questioning the reliability of sources, evidence and results.
- Evaluating what is true through careful and accurate observation.
- Reflecting on the moral and ethical questions surrounding scientific progress