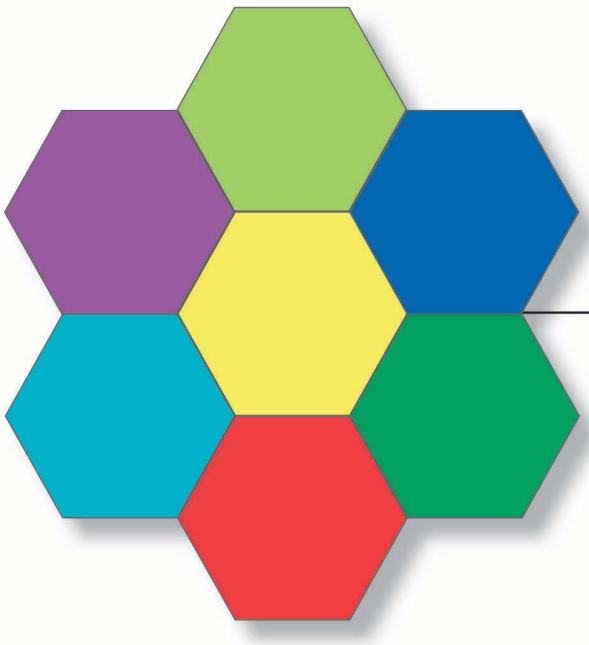

Learning Skills for Science

Teachers' Guide

Science Enhancement Programme
Weizmann Institute of Science
Nuffield Curriculum Centre

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Developed at **the Department of Science Teaching, Weizmann Institute of Science**

Authors
Dr Zahava Scherz and Dr Ornit Spektor-Levy

Project consultant
Prof Bat-Sheva Eylon

Associate author
Yahavit Loria

Developed and produced for schools in the UK by
Gatsby Science Enhancement Programme and Nuffield Curriculum Centre

Project manger
Sally Johnson, sally.johnson@ioe.ac.uk

Editing and resource development
David Brodie and Robin McCron

Publishing
Nina Towndrow, Nuffield Curriculum Centre

Design
Aukett Fitzroy Robinson; Karim Rkaina, KDR Creative

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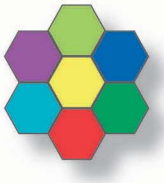


Learning Skills for Science

Contents

Introduction

Writers: **Zahava Scherz , Ornit Spektor-Levy and Sally Johnson**

High-order skills are an integral part of a good science education. These include inquiry and problem-solving skills, thinking skills and learning skills (see Figure 1) and are essential to the development of independent learners.

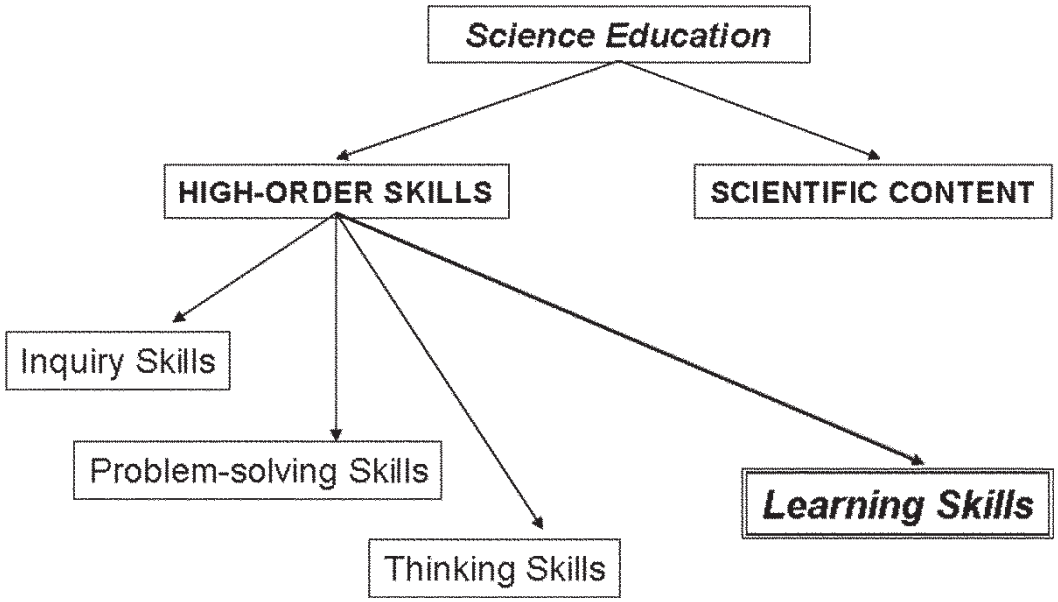


Figure1: Components of scientific study.

A major goal of science education in school is to prepare all students for life in a world of rapid scientific and technological change, as well as preparing a smaller number for a highly specialized scientific career. The shift is towards placing the curriculum content in more authentic contexts, making it more inquiry-based. Assessments should reward students' ability to engage in inquiry activities, as opposed to simply memorising content knowledge. This shift in goals has led to reforms in science and technology education in many countries including the new GCSE specifications at Key Stage 4 in the UK. These reforms reflect the overall tendency of encouraging students to integrate into their lives what they learn in the science classroom and of replacing traditional transmission instruction with more student-centred and active learning.

This programme integrates learning skills into the teaching of scientific content. It offers teaching methods and materials to facilitate explicit, guided, and well-planned learning opportunities that foster skills development.

The goals of the programme

1. To enhance learning skills for science among secondary school students.
2. To provide teachers with resources that can be easily integrated into a variety of scientific subjects.
3. To design flexible teaching and learning tasks suitable for different levels of students and a variety of learning styles.

The teaching model

The programme focuses on the learning Skill Areas of ***information retrieval***, ***listening and observing, scientific reading***, ***data representation, scientific writing*** and ***knowledge presentation***. Each of these is further divided into sub-skills. For example, scientific writing covers the knowledge of how to prepare a report, write an article and construct an abstract (Figure 2).

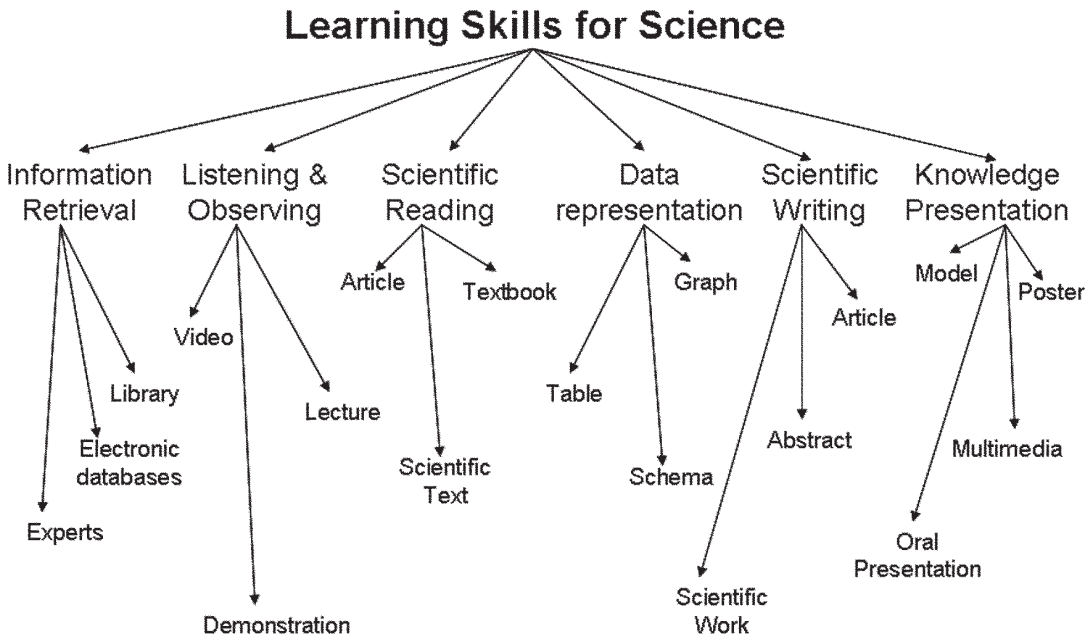


Figure 2: Skill Areas and sub-skills of the programme.

The characteristics and resources of the programme

Framework: The framework consists of many common activities supporting the development and practice of different skills. These activities can be used in conjunction with any given content in the science curriculum.

Integration: Teachers can tailor these generic activities into specific science topics and adjust the development of skills to the level and abilities of the students.

Spiral instruction: Throughout Key Stages 3, 4 and 5 students can be introduced in depth to different sub-skills and given the opportunity to practise these strategies several times in the course of their studies.

Modularity & flexibility: The teacher can plan a scheme for teaching skills, using the generic activities and can decide what skills will be developed, the content, the timing, and the level of complexity.

Extended guide for the teacher – This booklet includes relevant theoretical background information about the skills and their teaching along with guidance, examples and tips for the implementation of the activities.

Activity workbook – An A4 folder of worksheets for all six modules with instructions for the classroom activities. This can be photocopied.

Interfaces – A website providing supporting resources such as scientific articles and texts and worksheets that can be downloaded for modification and reproduction. It also includes a notice board for exchange of good practice between teachers using the programme. www.sep.org.uk/lss

Training – Introductory and continuing professional development for teachers about Learning Skills for Science. This training will be available through the Regional Science Learning Centres.

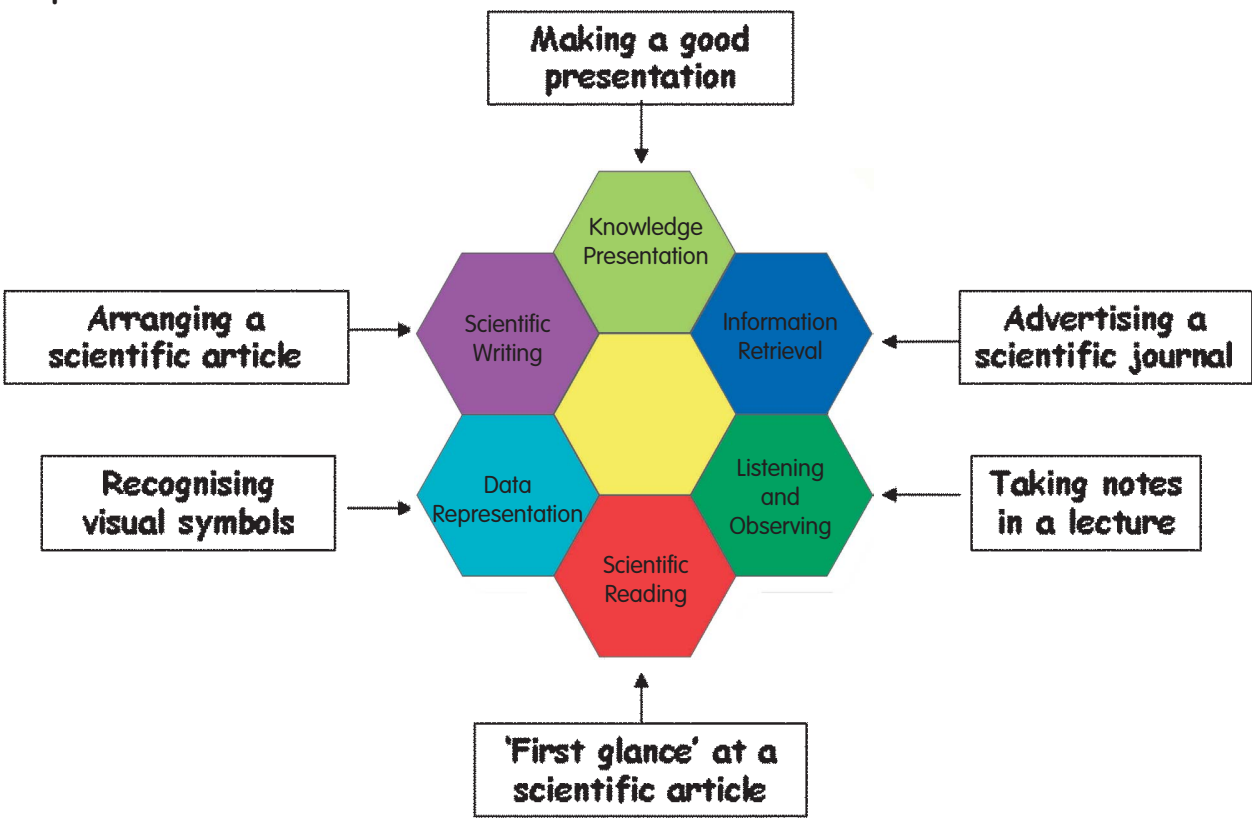
Development and Implementation of the Programme

The Programme and materials were produced at the Weizmann Institute of Science and are widely used in schools in Israel.

During 2004-05 the Science Enhancement Programme (SEP) started adapting the teaching programme to fit with the curriculum in this country. Two teachers were trained, from each of eight schools, in the use of the activities. These teachers have been trying different ways of implementing the tasks in science classes. Feedback from this pilot is encouraging and a larger training programme is commencing in 2006. The Learning Skills for Science programme is considered particularly helpful for students preparing for 'Twenty First Century Science' and other new GCSE specifications.

SEP are collaborating with the Nuffield Curriculum Centre over the publication of the Teachers' Guide and Activity book. Resources to support the activities are being developed and can be accessed on the SEP website, www.sep.org.uk/lss.

Example Activities



Information retrieval: *Advertising a scientific journal*

This activity helps students become familiar with scientific journals suitable to their level. Working in teams, students are given samples of a scientific journal. They have to explore the journals following specific instructions, introduce the journal to the class, and prepare an attractive advertisement to encourage others to use this journal in the future. In doing so, they present the structure of the journal, its goals, the different sections and give a critique about the level of the journal and its target audience. In preparing the advertisement, the students utilize their creativity and compose jingles, draw posters, and write slogans.

Listening and observing: *Taking notes in a lecture*

In this activity students gain experience in summarising and documenting information transmitted orally through a lecture, a discussion, etc. In the activity the student is given a guided 'prescription' on how to summarise the information transmitted within a lecture. After the lecture they are asked to think and self evaluate in terms of whether they succeeded in concentrating and listening to the lecture, and how they accomplished the task.

Scientific reading: *The 'First Glance' into a scientific article*

In this activity students acquire the skills of browsing and sorting scientific articles in order to find out which are suitable, relevant and credible for a specific assignment.

By 'First Glance' is meant skimming through an article, but nevertheless drawing information from it and becoming acquainted with it. The aim is to decide whether an article is relevant for the reader's aims and thus worth reading in greater depth. Generally, after a 'First Glance' the initial selection of articles can be reduced by around 80%. Following the activity the reader should know whether they are interested in the article in terms of its suitability for the assignment in hand and its scientific level.

Data representation: *Recognising visual symbols*

In this activity, students are given a map of the climatic regions of the world, without a colour key, and asked to interpret the significance of the colours on the map. If necessary, they can be provided with a number of aids – weather-forecast icons at various points on the map, a symbol key, a colour key and a title to the map.

The activity demonstrates the need to use aids to interpret an unfamiliar visual representation, as well as the contribution of each of the various aids, including standard symbols from daily life.

Scientific writing: *Arranging a scientific article*

Students are asked to order correctly an article in which the pages have been shuffled. To make things a little easier for the students, certain words are marked **in bold** in the text to give a clue as to the nature of the section, i.e. from the introduction or the study's methods, etc.

After they have identified the various sections, students are asked to arrange the article in the standard order. The activity ends with the students being asked to answer a number of questions, as a check on whether they have understood the article and the central message it presents.

Knowledge presentation: *Making a good presentation*

In this activity, the students are required to prepare a brief presentation of knowledge after having read a short scientific article. The teacher enables several students to present what they prepared. The remaining students listen to the lectures, while drawing up a list of criteria and tips for preparing a scientific lecture and presenting it to an audience. The immediate product of the activity is a set of criteria of a good lecture. This may also be varied by creating an acronym (based on the first letters of the criteria formulated), or a series of illustrations, that provides students with a humorous reminder of what they have to remember when presenting information.