The Netherlands

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Introduction

Overview of the Education System

Dutch schools traditionally have significant autonomy. The Dutch education system is based on the principle of freedom of education, guaranteed by Article 23 of the Constitution.[1] Each resident of the Netherlands has the right to establish a school, determine the principles on which the school is based, and organize instruction in that school. Public and private schools (or school boards) may autonomously decide how and, to a large extent, when to teach the core objectives of the Dutch curriculum based on their religious, philosophical, or pedagogical views and principles.

The Minister of Education, Culture, and Science is primarily responsible for the structure of the education system, school funding, school inspection, the quality of national examinations, and student support.[2] The administration and management of schools is decentralized and is carried out by individual school boards. Specifically, these boards are responsible for the implementation of the curriculum, personnel policy, student admission, and financial policy. A board can be responsible for one school or for a number of schools. The board for public schools consists of representatives of the municipality. The board for private schools often is formed by an association or foundation. However, both school types are funded by the central government and, to some extent, by the municipalities.

Two-thirds of schools at the primary level are privately run. The majority of private schools are Roman Catholic or Protestant, but there also are other religious schools and schools based on philosophical principles. The pedagogical approach of a small number of schools is based on the ideas of educational reformers such as Maria Montessori, Helen Parkhurst, Peter Petersen, Célestin Freinet, and Rudolf Steiner.

The Dutch Inspectorate for Education makes visits at least once every four years to ascertain whether schools, both public and private, provide the expected quality of education.[3] Schools not meeting quality standards are visited

more frequently.[4] The inspectorate can apply sanctions to very low performing schools, however, the final decision about whether or not a school should be closed is made by the Minister of Education, Culture, and Science. The findings from school inspection visits are reported back to the individual schools, the government, and the public.

In the Netherlands, the same school offers preprimary and primary education. Most children begin preprimary education at age four, though the first year is not compulsory. Preprimary education (Kindergarten) lasts two years and has both a social and an academic function, although the basics of reading, writing, and mathematics usually are taught beginning in the first year of primary education. Together, preprimary and primary education consists of eight grades, so the majority of children are twelve years old when they begin secondary education.

Compulsory education begins the first day after the month of child's fifth birthday and either concludes at the end of the school year of the student's sixteenth birthday when he or she obtains an upper secondary education (ISCED level 3) diploma, or concludes at the end of the school year of the student's eighteenth birthday.

Most secondary schools in the Netherlands offer more than one track. After two years of basic education in secondary school (Grades 7 and 8), students enroll in one of the following three tracks:

♦ Pre-vocational Secondary Education—This track lasts two additional years and offers four learning pathways: basic vocational; middle management vocational; combined vocational and theoretical; and theoretical. After completing pre-vocational secondary education, students may continue on to one of two secondary programs: vocational secondary education, or senior general secondary education.

♦ Senior General Secondary Education—This track lasts three additional years and offers general secondary education in four different programs: science and technology, science and health, culture and society, and economics and society. Upon completion of a program, students can continue on to an additional, pre-university secondary education program or to higher education in a higher vocational education program.

♦ Pre-university Secondary Education—This track lasts four additional years and offers the same four programs as senior general secondary

education. Upon completion, students may continue to higher education in a three-year bachelor's degree program.

Tertiary, or higher education, is divided into two programs: higher vocational education programs, and bachelor's degree programs. Higher vocational education programs lead to a four-year bachelor's degree. Bachelor's degree programs lead to a three-year degree, after which a master's degree can be earned in an additional one to three years.

The *Platform Bèta Techniek* is an important initiative that encourages students to pursue a mathematics- or science-related career, and involves schools, universities, businesses, ministries, municipalities, and regions.[5] Commissioned by the government in 2004, the initiative's main goal has been to increase the number of students who participate and finish higher (vocational) education in science or technology. The success of the initiative has resulted in a continuation and extension of the program. From 2011 until 2016, the program will focus on firmly embedding science and technology into teacher education, encouraging 55 percent of students in senior general secondary education and pre-university secondary education and 40 percent of students in pre-vocational secondary education to choose a science track, and increasing the quality of teaching in primary and secondary education.[6]

An example of a project of the *Platform Bèta Techniek* is VTB-Pro, a program targeting primary school teachers. In this program, additional training in science and technology in an attractive, real-life context is provided to a total of 10,000 primary school teachers and students at teacher training colleges. The program's ultimate goal is to influence teachers' attitudes towards science and technology as well as to make science and technology education more attractive to primary school students and increase students', especially girls', self-confidence in these subjects.

Languages of Instruction

Dutch is the first official language in the Netherlands. Frisian, the second official language, is spoken by more than 350,000 people in the northern province of Friesland.[7] Dutch is the first language of instruction in schools, although Frisian or a regional dialect may be taught alongside Dutch. A minority of secondary schools offer Frisian as an optional final examination subject.

Approximately 11 percent of the general population and 15 percent of students in secondary education belong to a non-western ethnic minority.[8] By definition, a student belongs to a non-western ethnic minority if one parent

was born in Turkey, Africa, Latin America, or Asia (excluding Indonesia and Japan). These students, compared with native students and nonnative students from western countries, are overrepresented in the lowest track of secondary education (pre-vocational secondary education).[9]

Mathematics Curriculum in Primary and Lower Secondary Grades

The mathematics curriculum for primary school is described in eleven core objectives. During primary school, students should become familiar with mathematical basics offered in a recognizable and meaningful context. Primary school students will gradually acquire familiarity with numbers, measurements, and two- and three-dimensional geometric shapes and solids, as well as the relationships and calculations that apply to them. Students will learn to use mathematical language while gaining mathematical literacy and calculation skills.[10] By the end of primary school, students should be able to do the following:

♦ Use mathematical language;

♦ Solve practical and formal mathematics problems and clearly demonstrate the solution process;

♦ Identify different approaches for solving mathematics problems and learn to assess the reasonableness of solutions;

♦ Understand the general structure and interrelationship of quantities, whole numbers, decimal numbers, percentages, and proportions, and use these to do arithmetic in practical situations;

♦ Quickly carry out basic arithmetic calculations mentally, using whole numbers through 100, and learn the multiplication tables;

♦ Count and calculate by estimation;

♦ Add, subtract, multiply, and divide by taking advantage of number properties;

♦ Add, subtract, multiply, and divide on paper;

♦ Use a calculator with insight;

♦ Solve simple geometrical problems; and

♦ Measure and calculate using units of time, money, length, area, volume, weight, speed, and temperature.

For the first two years of secondary school, the mathematics curriculum is described in nine core objectives.[11] By the end of these two years (the end of Grade 8) of mathematics education, students should be able to do the following:

♦ Use appropriate mathematical language to organize mathematical thinking, explain things to others, and understand explanations in the context of mathematics;

♦ Learn, individually and in collaboration with others, to recognize and use mathematics to solve problems in practical situations;

♦ Establish a mathematical argument and distinguish it from opinions and allegations, thereby learning to give and receive mathematical criticism with respect for other ways of thinking;

♦ Recognize the structure and coherence of the systems of positive and negative numbers, decimal numbers, fractions, percentages, and proportions, and thereby learn to work with these systems meaningfully in practical situations;

♦ Make exact calculations, provide estimates, and demonstrate an understanding of accuracy, order of magnitude, and margin of error appropriate in a given situation;

♦ Make measurements, recognize the structure and coherence of the metric system, and calculate with measurements in common applications;

♦ Use informal notations, schematic representations, tables, diagrams, and formulas to understand connections between quantities and variables;

♦ Work with two- and three-dimensional shapes and solids, make and interpret representations of these objects, and calculate and reason using their properties; and

♦ Learn to systematically describe, order, and visualize data and to critically judge data, representations, and conclusions.

Science Curriculum in Primary and Lower Secondary Grades

In primary education, science is taught within the Personal and World Orientation content area. The curriculum in this area is organized to teach students to "orientate on themselves, on how people relate to each other, how they solve problems, and how they give meaning to their existence."[12] The

educational content of personal and world orientation is presented coherently, and content from other learning areas is applied as much as possible. The seven core objectives for nature and technology, and the science subcategory of Personal and World Orientation, lead students to be able to do the following:

♦ Distinguish, name, and describe the roles and functions of common plants and animals;

♦ Describe the structures of plants, animals, and humans and the form and function of their parts;

♦ Research material and physical phenomena, including light, sound, electricity, power, magnetism, and temperature;

♦ Describe weather and climate in terms of temperature, precipitation, and wind;

♦ Find connections between form, material composition, and function of common products;

♦ Design, implement, and evaluate solutions to technical problems; and

♦ Describe the positions and motions of the Earth-sun system that cause the seasons as well as night and day.

In secondary school, the first year of science is taught as part of the core objectives of the Man and Nature content area and comprises eight objectives.[13] By the end of the first year (the end of Grade 7) of secondary school science, students should be able to do the following:

♦ Transform questions arising from topics pertaining to the sciences, technology, and human health and welfare into research questions; and carry out an investigation on a scientific topic, and present the results;

♦ Acquire knowledge about and insight into key concepts of living and nonliving things and connect these key concepts with situations from everyday life;

♦ Describe how people, animals, and plants are related to each other and the environment, and how technological and scientific applications can have permanent positive or negative influences on these living systems;

♦ Acquire knowledge about and insight into the nature of living and nonliving things, as well as their relation to the environment, through experimentation;

♦ Work with theories and models by investigating chemistry and physical science phenomena, such as electricity, sound, light, movement, energy, and matter;

♦ Acquire knowledge about technical products and systems through investigation, estimate the value of this knowledge, and design and construct a technical product;

♦ Understand the essential structures and functions of human body systems, establish connections between these systems and the promotion of physical and psychological health, and take responsibility for one's own health; and

♦ Care for oneself, others, and one's environment, and positively influence one's own safety and the safety of others.

Instruction for Mathematics and Science in Primary and Lower Secondary Grades

Instructional Materials, Equipment, and Laboratories

Schools are free to choose the instructional materials they use with no government prescription. Several varieties of commercially developed instructional materials and teaching methods are available for schools, though some schools develop their own materials. The Dutch Institute for Curriculum Development advises schools about the appropriateness of available instructional materials and teaching methods for the Dutch curriculum. Primary schools usually do not have science labs, but most secondary schools do.

Use of Technology

Since 1997, the implementation of information and communication technology (ICT) in education has been an important component of the governments' educational policy.[14] Almost every school uses computers for educational purposes. There is approximately one computer available for every five students in the Netherlands, and virtually all computers have Internet access.[15] Sixty to ninety percent of primary and secondary teachers use computers in their teaching.[16] The use of smartboards also is widespread in both primary (on average, one in every two classrooms) and secondary schools (on average, one in every six classrooms).

Knowledge Net (*Kennisnet*) is the main public support organization for educational ICT use in primary, secondary, and adult education in the

Netherlands and is supported by the government. The mission of Knowledge Net is "to support and inspire educational organizations with independent expertise and services regarding the effective use of ICT." [17]

Grade at Which Specialist Teachers for
Mathematics and Science are Introduced

In primary education, mathematics and science are usually not taught by specialized subject teachers. A primary school teacher is trained to teach all subjects (except physical education) and all grades of preprimary and primary education. In secondary education, all teachers are subject-specific teachers. As a consequence, different types of colleges provide education for primary and secondary education teachers.

Homework Policies

Schools can decide homework policies individually. Although students in primary education are not expected to do homework, some primary schools give students homework to prepare them for homework in secondary education. In secondary education, homework is very common, but the assignments vary significantly among schools and teachers.

Teachers and Teacher Education

Candidates must earn a diploma from one of the Netherlands' primary school teacher education colleges to qualify to work as a primary school teacher.[18] Primary school teacher education usually takes four years to complete. Primary school teacher training is provided at the higher vocational education programs level. Students with a diploma at the highest level from pre-university secondary education, senior general secondary education, or vocational secondary education also can apply to these programs. Each primary school teacher is allowed to teach all grades and all subjects in primary education, with the exception of physical education.

Since 2006, students starting at a teacher education college have been tested on their Dutch language and mathematics skills in order to guarantee standards of competence.[19] If students fail the test, they have one school year to improve their language and mathematics skills. If such students are not capable of passing the test by the end of the year, they cannot continue to the next year.

From the first year of teacher education, students receive practical work experience through regular teaching practice in primary schools. About a quarter of teacher training is devoted to instructional practice. Halfway

through teacher education, students can choose to specialize in lower primary (Kindergarten to Grade 2) or upper primary (Grades 3–6).

Secondary school teachers are subject teachers.[20] Most of these teachers are trained in one subject as well as general teaching at teacher training colleges for secondary education. These teacher education colleges admit students with a diploma at the highest level from pre-university secondary education, senior general secondary education, or vocational secondary education. In the final year of their program, students receive practical work experience during a combined period of work and study at secondary schools. With a bachelor's diploma from a teacher training college, a teacher qualifies as a Grade 2 teacher and is allowed to teach the lower grades (Grades 7, 8, and 9) of senior general secondary education and pre-university secondary education and all grades of pre-vocational and vocational secondary education. Teachers qualified as "Grade 1 Teachers" often have a university degree (e.g., a master's degree in mathematics) with an additional master's degree in general teaching. A "Grade 1 Teacher" can teach all grades in all tracks in secondary education.

Requirements for Ongoing Professional Development

A variety of courses and other voluntary professional development activities are available for both primary and secondary school teachers. Teacher professional development courses are offered by teacher training colleges, universities or (commercial) institutes, as well as organizations offering educational advice and support. Furthermore, teachers can participate in subject-related workshops or conferences. Many general and subject-specific digital journals, magazines, and newsletters also are available for teachers.

Monitoring Student Progress in Mathematics and Science

In addition to autonomously deciding how and, to a large extent, when to teach the core objectives of the Dutch curriculum, schools may decide when to assess students. Schools often use "curriculum-embedded" tests that match the subject matter provided in the textbooks that are being used to teach various subjects.

During primary education, there are no national examinations. At the end of primary school, however, the vast majority of schools use multiple-choice tests developed by Cito (the National Institute for Educational Measurement). Cito tests measure academic skills in four areas: language, arithmetic and mathematics, study skills (e.g., using different sources of information, schedules, and tables), and world orientation (e.g., knowledge of history,

science, and geography).[21] The results of these (or similar) tests, along with the recommendations from classroom teachers, are used to determine the most appropriate secondary school track for each student.

The end of primary school examination also is part of a student monitoring system called the Student Tracking System (*Leerling-en onderwijs volgsysteem*, or LOVS), which is used to assess the competence of students in Grades 1–8. LOVS allows teachers and schools to monitor and improve the development of individual students, as well as entire classes, throughout primary education and the first two years of secondary education. This system, developed by Cito, also is used by the Dutch education inspectorate to assess the quality of education in each school.

Secondary education concludes with national examinations in each subject during the last month (usually around May) of the final year of education (Grades 10, 11, or 12, depending on the track). The content of these examinations depends on the track and the program of the student. Cito also has developed a student monitoring system for the first three years of secondary education, called VAS, under which students are tested regularly. This system includes an instrument called Studeon that is used for measuring the social-emotional development and learning motivation of students.

Student grade promotion policies are determined by individual schools and are described in the School Guide. The Ministry of Education, Culture, and Science discourages retention, because it is assumed that retention will decrease student motivation and not necessarily address the student's learning difficulties.[22]

Impact and Use of TIMSS

After participating in both IEA's First and Second International Mathematics Studies and the First and Second International Science Studies, the Netherlands has participated in all TIMSS studies conducted to date: in 1995, Dutch students participated in Grades 3–4, Grades 7–8, and in the final year of secondary education; in 1999, students participated in Grade 8; in 2003, students participated in both Grades 4 and 8; and in 2007, students participated in Grade 4. The Netherlands also participated in TIMSS Advanced 2008 (Grade 12).

The Dutch government aims to be among the top five knowledge economies of the world. High quality education and well-educated students, especially in mathematics and science, are necessary to achieve this. Until 2003, the Netherlands performed very well in TIMSS, especially in mathematics (one

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of the top ten countries). However, the TIMSS 2007 results showed a slight but significant decline in mathematics performance at Grade 4, compared to TIMSS 1995. The results of PISA 2009 for secondary education were consistent with the TIMSS results in Grade 4. As a result, these results have supported governmental initiatives and projects to increase student performance in mathematics.[23]

A growing concern about Dutch children's mathematical proficiency also has led to a public debate in recent years about the way mathematics is taught in the Netherlands. There are two opposing camps: those who advocate teaching mathematics in the "traditional" manner, and those who support "realistic mathematics education." [24] The results from TIMSS 2007 have been used as arguments for both sides in the debate. However, in the last two decades, most primary schools have implemented mathematics methods based on realistic mathematics education.

At the primary school level, TIMSS results have not generated the same level of conversation among science educators.

Suggested Readings

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