# Teaching STEM-topics in secondary education in the Netherlands

This document is written in request of the SMART project to provide insight into the Dutch school system in general and the teaching of STEM-topics in particular.

## General school system in secondary education

Compulsory education under Dutch law applies to children of all nationalities from 5 to 18 years who are residing in the Netherlands. Children are under a learning obligation at five years old for 12 years full-time education, and one or two years part-time (until the attainment of a diploma). In the Pisa/OECD (2012) international rankings for 15-year-olds in 65 economies, the Netherlands was 'above average' for mathematics (10th), and ranked 15th for reading and science. The school system is, however, quite unusual.

The Netherlands is among the world's top countries for equity in education opportunities, and there's a commitment to educational choice in the Netherlands. Schools following particular religious or pedagogic principles have had equal state funding as public schools since 1917 and the number of privately run schools more than doubles public ones, with one in five primary schools comprising less than 100 pupils. International education is available at both Dutch and private schools throughout the country, and up to 20 schools are expected to implement bilingual education by the end of 2015.

## Types of schools in the Netherlands

### Public schools
State-run schools (non-denominational) provide secular education, but they can also offer teaching around specific philosophic or pedagogic principles (Montessori, Steiner etc.). Public schools are governed by the municipal council or a public leg legal entity or foundation set up by the council.

### Private schools
Most private schools are denominational (Roman Catholic, Protestant, Islamic, Hindu) or follow specific philosophic principles, as above. Private schools are governed by a board or the foundation that set them up. Financially, they have the same status as public schools and are basically free, although all schools ask for a contribution for things such as school trips.

### Ipad schools
Since 2014, some 22 so-called 'Steve Jobs schools' have opened in the Netherlands, pioneered by Dutch entrepreneur Maurice de Hond. These government-funded schools provide children with iPads and educational apps, which replace everything from books to blackboards. Teachers act as 'coaches' to help students direct their own learning.

## Costs

Primary and secondary state education is free, with parents being asked to contribute a 'voluntary' nominal amount, which varies from school to school.

## Education policy

The Ministry of Education, Culture and Science sets quality standards, attainment targets and social objectives but individual schools 'fill in the details' of the curriculum and budget allocation. Education

policy includes increasing bilingual opportunities, connecting education with the job market, and raising the quality of schools that do no meet the Education Inspectorate's standard.

As of 1 August 2015, the government will allow primary schools to teach 15 percent of courses in English, German or French. Not only will pupils learn a second language, such as English, they can also learn other subjects, such as biology or history, through one of these languages.

## Dutch Primary education

There are eight years of primary schooling. Children are placed in group one upon entry, and move up a group every year; different age groups may therefore be in the same class depending on when each child started. In their last year, 'Group 8' children in 85 percent of primary schools sit the CITO test in February, which advises their next level of education. As of spring 2015, all children in Group 8 will be required to sit a test to assess numeracy and language skills. The government sets attainment targets in six curriculum areas: Dutch, English, arithmetic and mathematics, social and environmental studies, creative expression and sports and movement.

## Dutch secondary education

From 12 years, pupils choose from vocational or pre-university diplomas based on their ability. In the first years all pupils study the same subjects (to different academic levels), known as the basisvorming, followed by a second stage in which specialist profiles are selected.

**VMBO (a further four years of school):** Prep school for vocational secondary education; those who achieve the highest level can enter HAVO studies. VMBO graduates must continue studying until age 18 or until they obtain a basic qualification (minimum MBO level 2).

**MBO: Secondary vocational education**. MBO programmes vary from one to four years depending on the level (1–4). If a student has successfully completed the Dutch VMBO the MBO can prepare pupils for work or, if level 4 is achieved, professional studies (HBO).
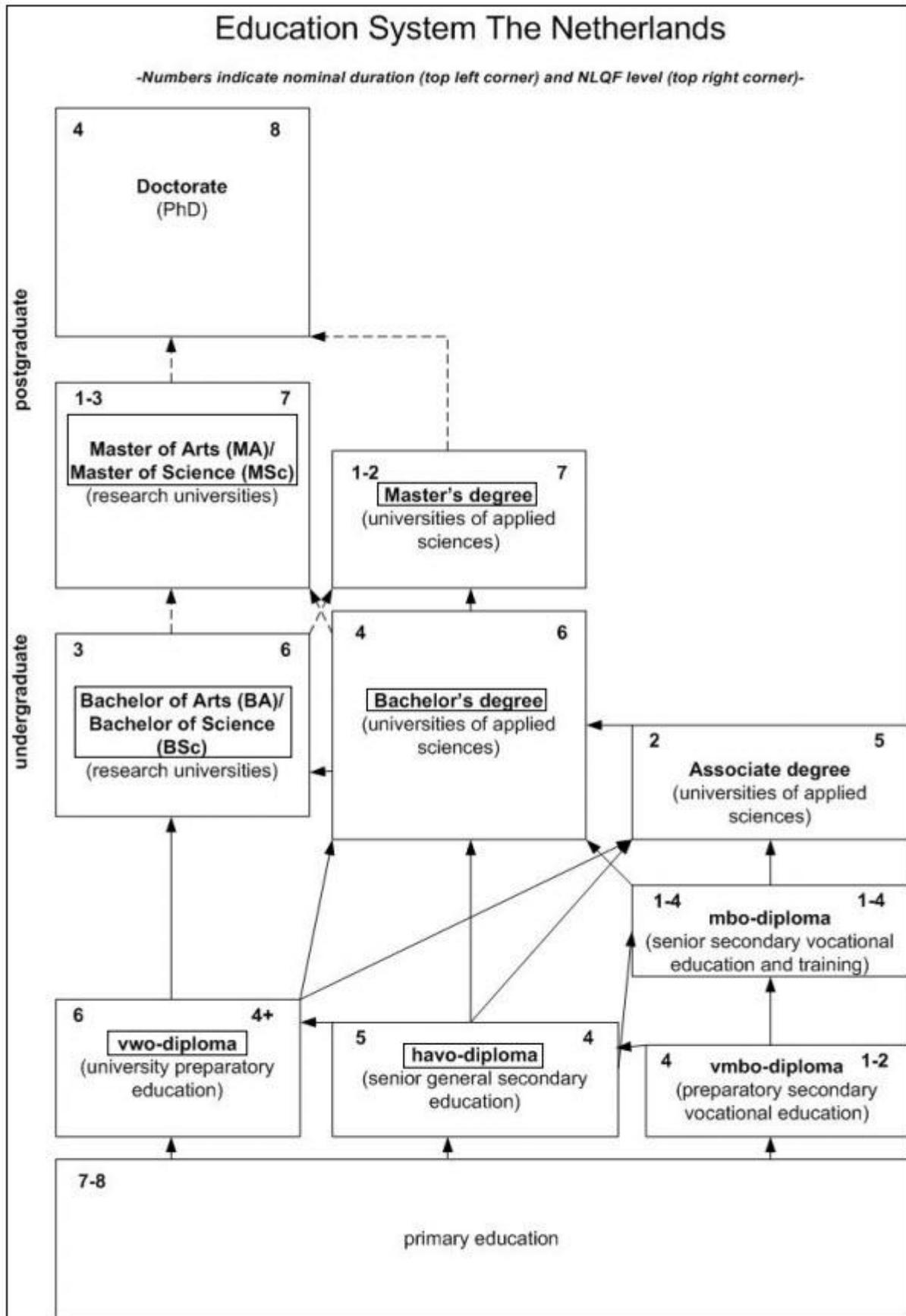
**HAVO (five years):** Senior general secondary education. Provides entrance to higher professional education at 'vocational universities'.

**VWO (six yeares):** Pre-university education. Prepares students for academic studies at a research university. VWO schools can be athenaeum, gymnasium or Technasium. A difference being that Greek and Latin are core subjects in gymnasium programmes and Design and Research are extra subjects in Technasium programmes.

Just under a third of the 659 secondary schools are run by the public authority. English and Mathematics are compulsory subjects. VMBO pupils study one modern language and HAVO/VWO pupils at least two. Other core areas include history, humanities, arts and sciences.

### Bilingual education

There are 117 schools with a VWO bilingual stream, plus 45 HAVO and 24 VMBO schools have bilingual departments. Only students that master the Dutch language at an appropriate level will be admitted (www.europeesplatform.nl/tto).

# Education System The Netherlands

*-Numbers indicate nominal duration (top left corner) and NLQF level (top right corner)-*

| | |
|---|---|
| **4**      **8** | |

postgraduate

**Doctorate**
(PhD)

**1-3**      **7**

**Master of Arts (MA)/
Master of Science (MSc)**
(research universities)

**1-2**      **7**

**Master's degree**
(universities of applied
sciences)

undergraduate

**3**      **6**

**Bachelor of Arts (BA)/
Bachelor of Science
(BSc)**
(research universities)

**4**      **6**

**Bachelor's degree**
(universities of applied
sciences)

**2**      **5**

**Associate degree**
(universities of applied
sciences)

**1-4**      **1-4**

**mbo-diploma**
(senior secondary vocational
education and training)

**6**      **4+**

**vwo-diploma**
(university preparatory
education)

**5**      **4**

**havo-diploma**
(senior general secondary
education)

**4**      **1-2**

**vmbo-diploma**
(preparatory secondary
vocational education)

**7-8**

primary education

Source: Evaluation of foreign degrees and qualifications in the Netherlands, Nuffic.

# Focus on STEM topics in secondary education

Over the past decade a wide range of activities were put into place to incorporate more math and science into the Dutch curriculum, ranging for primary to secondary schools and training for both primary and secondary (vocational) educators.  But choosing a study into the field of Science and Technology does not always mean that students actually take a job in that field. Making the involvement of industry into the activities an essential part of the deal. This resulted in the setup of the Dutch Technology Pact 2020 (summary in English: http://techniekpact.nl/wp-content/uploads/2014/03/Dutch-Technology-Pact-Summary.pdf ).

Within the Dutch educational system there is a strong focus on the education on STEM-courses. Not because Dutch pupils are underperforming in these topics (PISA results 2012), but because pupils tend to choose not to study STEM courses in higher education. STEM courses have the image of being nerdy, require a lot of hard work and are no fun.

An important moment in choosing future education is the choice of a specific study profile in secondary school: In HAVO and VWO education, students need to make a choice of the following 'profiles':

- Culture and Society
- Economics and Society
- Science and Health
- Science and Technology

In 2012 about 45% of all pupils in HAVO and VWO education choose a Science profile. For 2015 the target is set to have 55% of these pupils choosing a Science profile.

## Platform Beta en Techniek

The Platform Beta en Techniek contributes to the Dutch knowledge economy by providing a good availability of beta technician for the labour market. It puts a lot of effort into the education of technically skilled youngsters. Their strategy is characterized by focusing on the whole chain of education form primary to higher education and from government to industry.

This platform is the backbone to all kinds of activities directed on secondary education. It supports the different, regional networks between secondary and higher education, **VO-HO Netwerken**. These networks focus on the following topics:

- Excellence for pupils (summercourses, Excellence Track, Masterclasses, etc.)
- Teacher training in STEM topics (teaching of excellent students, STEM teaching materials Development Teams)

**Jet-Net** is a cooperative structure between secondary education and technological companies. Together they develop inspiring STEM-course materials and introduce pupils to the vocational practice of technology. In that way the youth can experience that technology is both meaningful and relevant to society.

The **STEM Teacher Academy** provides teaching staff and student teachers with means how to improve their didactics and learn to use the course materials developed in addition to the standard

teaching modules from the text books. Teachers are also invited to take a side step into industry, so they will be able to help their pupils orient on their future studies or profession.

Furthermore girls and immigrants are specially targeted, since these groups of pupils are under represented in technology education and profession.

### Databases with learning materials on STEM topics

Some of the above activities lead to the development of interesting and inspiring learning materials. The following websites contain these learning materials.

- www.Wikiwijsleermiddelenplein.nl
- http://www.itsacademy.nl/

  This website provides a mixture of STEM-topics in different didactic approaches:
    - On location: Masterclasses, labs or excursions at participating higher education institutions
    - At school: 'science box', mini-modules, online labs and e-classes
    - Teacher training: courses, network meetings, Teaching materials development teams and support in class

## Consultated Sources

- http://www.expatica.com/nl/education/schools/Education-in-the-Netherlands_100816.html
- Nuffic http://www.nuffic.nl/en/library/country-module-netherlands.pdf .
- PISA results 2012 http://www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf
- Dutch Technology Pact 2020 (summary):
  http://techniekpact.nl/wp-content/uploads/2014/03/Dutch-Technology-Pact-Summary.pdf
- Platform Beta en Techniek  http://www.platformbetatechniek.nl/home