Informatics and Secondary Education in the Netherlands

Karl de Leeuw
Amsterdam Professional School of Science
University of Amsterdam
(karl.de.leeuw@xs4all.nl)

Alban Ponse
Informatics Institute
University of Amsterdam
Netherlands
(A.Ponse@uva.nl)

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Introduction

In this note we briefly describe three aspects of secondary education in informatics in the Netherlands: the general requirements for examination as laid down by the government, the training and certification of informatics teachers, and the course material that is used most in this teaching.

General requirements for examination

In the Dutch education system, secondary school begins when children have reached the age of twelve, after their completion of grade 8. By then, it is decided whether they should focus on practical, or vocational training right away, or to broaden their scope by learning languages, mathematics and science. This has long been regretted by a broad spectrum in Dutch politics, which is vehemently anti-elitist, but all efforts to mend this situation have been in vain so far.

Informatics is taught not throughout the curriculum, but only during the last two or three years preceding the examination. In the *vwo* curriculum, a six-year secondary education program preparing for continued study at a university, informatics is taught for the last three years of the program, and in the *havo* curriculum, a five-year secondary education program preparing for continued study at a polytechnic, it is taught during the last two years. This is a marked difference. As of August 2007, the program preparing for university (comprising of 440 hours[1]) offers much more room for individual assignments than the program preparing for the polytechnic (comprising of 320 hours[2]), but it is decided at the level of the school how this room

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[1] Ministry of Education, Culture and Science, see (in Dutch)
http://www.minocw.nl/documenten/schema_vwo.pdf.
[2] Ministry of Education, Culture and Science, see (in Dutch)
http://www.minocw.nl/documenten/schema_havo.pdf.

is used. There is no central examination,[3] and the scope and depth of training depends in large measure on the understanding and the ambition of individual school teachers. There are, however, general requirements for examination, laid down in length in a ministerial order.[4] There, the subject is divided into 4 domains, with one domain referring to the social context in which informatics is practiced, one domain referring to the basics of computing, such as programming and a basic understanding of the machine, one domain about systems and communication networks and one domain about project management and project development. The last domain mentioned is not intended as a separated field of study, but rather for the application of everything learned during the course in a single, final project. Generally speaking, the curriculum is oriented towards acquiring practical skills, such as making JAVA applets, programming in SQL in order to understand how databases work, and the use of schemes to represent information flows. Apparently, the idea behind this is that one learns to understand a computer first and foremost by handling a computer, and all the rest will follow as a matter of course. Guiding principles, the philosophy behind the program so you will, have or had never been made explicit and remain, by consequence, a matter of conjecture.

This did not prevent informatics from acquiring a firm position in Dutch secondary education over the past decade as we will describe below.

Training and certification of informatics teachers

Roughly sixty percent of all secondary schools now offer informatics as part of their curriculum, with plus or minus 350 teachers currently being active; it is estimated that about 250 of these are certified informatics teachers.[5] The training and certification of informatics teachers has been a bottleneck for many years, however. That there are currently sufficient teachers to meet the demand, is mainly due to the CODI-program[6]: a massive effort to provide certified secondary teachers in other fields with a training in informatics as well, undertaken between 1998 and 2006. This first generation of teachers has developed into a vibrant community, with conferences, working groups and websites of its own, and focusing on the development of appropriate courseware and the exchange of experiences and ideas. CODI has now

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[3] A by the Ministry of Education, Culture and Science certified examination that for 50 percent determines passing, as is the case for most other courses (mathematics, science, languages etc.).

[4] See (in Dutch) http://www.cfi.nl/public/websitecfi/Default.aspx. This is the document *"Bijlage 1 behorende bij artikel 1 van de Regeling van de Staatssecretaris van Onderwijs, Cultuur en Wetenschap van 4 juni 2007, nr. VO/OK/2007/13731, houdende vaststelling examenprogramma's havo en vwo per 1 augustus 2007. De staatssecretaris van Onderwijs, Cultuur en Wetenschap, J.M. van Bijsterveldt-Vliegenthart"*.

[5] SLO, Vakdossier 2007 Informatica, available at http://www.slo.nl/themas/00108/341330003_Vakdossier_2007_informatica.pdf/.

[6] CODI (abbreviating Consortium Omscholing Docenten Informatica) has been a consortium that organized the retraining of secondary school teachers to first-grade Informatics teachers in a two-year part-time program in the period 1998-2006. The initiative to start up CODI was called for by the VSNU (a cooperation of the Dutch universities) and CODI was formally approved of by the Ministry of Education, Culture and Science. Currently, a new accreditation of CODI seems to be on its way, motivated by the expectation that the regular institutes will not manage to educate a sufficient number of Informatics teachers, and by the ageing present population of these teachers.

been terminated, and its role is taken over gradually by the regular didactical institutes of the universities, albeit at insufficient pace. In 2007, for instance, only fifteen informatics teachers were following courses nation-wide, whereas many more have dropped out since CODI closed its doors. Clearly, the uncertified teacher is on the rise. There are plans to revive CODI, however, but nothing definitive can be said yet.

Course material

It is hard to say anything final about the lessons that are actually being given, but the schoolbooks and websites provide us with an idea of how the exam requirements are met in practice. Currently, there are three methods available, two of which are distributed by non-commercial parties. All three methods are well written, and illustrated attractively with pictures and graphs. The essentials are clearly indicated, and secondary information is represented accordingly. All three methods contain plenty of questions for rehearsal, and programming assignments that will allow the pupil to put his understanding to the test.

There are also some differences to be noted. ENIGMA,[7] a method consisting of a blue theory and a green practice book with the same picture up front, pays little attention to societal aspects of informatics. Security issues are ignored, for instance, as are organizational models and the virtues of project management. This corresponds to a remarkable disinclination of most teachers to address these subjects. Polls show that they would rather have moved them from the curriculum entirely.[5] A third part is promised to the reader, however, specifically intended for pre-university teaching (i.e., the vwo program). This may make up for much that is missing in the other parts, but we will have to wait and see.

The other method, not very surprisingly being called INFORMATICA,[8] looks slightly less attractive, but does address the issues omitted in the first book mentioned. Moreover, it goes at great length to show that the computerized processing of information has its roots in the real world, for instance in accounting or stock keeping. This may occasionally result in brilliant didactical findings, such as the illustration of the principle of recursion, a topic of great importance in the discipline, by the triangle of Sierpinsky.

The third method is called FUNDAMENT INFORMATICA.[9] This method also consists of two volumes and is supported by an interactive website with an abundance of questions and assignments. The idea is to make the book suitable for a practical as well as a theoretical approach. The subject matter is presented even more clearly than in the methods mentioned previously, is beautifully illustrated, and includes topics omitted elsewhere, such as open source software.

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[7] Enigma. R. Franquinet, R. Leijtens, H. Reinders, and M.J. ter Wal. Informaticacommunity ENIGMA, 2007. (See also www.enigma-online.nl.)
[8] Informatica, nowadays renamed into Informatica Actief and offered via the web: www.informatica-actief.nl/moodle/login/index.php.
[9] Fundament Informatica. Josien van der Laan (red.). Instruct, 2007. (Additional material at www.informatica-online.nl.)

None of the methods mentioned, however, pays much attention to informatics as a scientific discipline, or to the enormous potential computer science has for changing the world, and the history of computing is treated modestly. Topics like these may greatly contribute to the intellectual curiosity of gifted pupils, who need to see the challenges a particular discipline may face. This flaw may have been caused by the fact that very few computer scientists actually participated in the development of this course material. The down side of CODI has been that people from a great variety of backgrounds, but not computer scientists, have come to dominate the field. This may have been detrimental to an exploration of more arcane topics, however fundamental to the discipline.

Afterword

Summarizing,
- Informatics is offered at roughly sixty percent of all secondary schools (in the *vwo* and *havo* programs)
- As for most courses, general requirements for examination in informatics are laid down by ministerial order
- In contrast with most other courses there is no central examination for informatics; to a large extent, school teachers determine the scope and depth of training
- Both teachers and developers of course material stem from a great variety of backgrounds; guiding principles behind the program are not made explicit
- Currently, there is a relatively large number of non-qualified teachers (ca. 100 out of 350)
- Planning of the training of future informatics teachers seems problematic and short-staffing/understaffing is expected

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About the authors of this note:

Dr. Karl de Leeuw is a policy officer at the Amsterdam Professional School of Science. He has written extensively about the history of cryptology and acted as editor of *The History of Information Security. A Comprehensive Handbook* (Elsevier: Amsterdam, Boston, Heidelberg, London, New York 2007).

Dr. Alban Ponse is an associate professor in the Informatics institute of the University of Amsterdam. He has written many papers in the area of concurrency theory, in particular on process algebra, programme algebra and thread algebra, and was one of the editors and authors of the *Handbook of Process Algebra* (Elsevier Science - North-Holland, 2001). Furthermore, he is one of the authors of UvA's *Webklas Informatica – Wat is een programma?*, a guided distance learning course designed as additional material for Informatics at vwo level.