

From dualism towards an emphasis on talent: an overview of curriculum development in Flanders.

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Abstract

The article comprises the following themes:

- How has the general technology curriculum in compulsory education in Flanders developed over the last two decades?
- How do Flemish pupils and teachers perceive the current curriculum?
- Towards a greater emphasis on talent: local initiatives for discovering and developing pupils' talents and competences.
- Looking forward: renewal of general technology methodology in Flanders.

The first curriculum initiatives for general technology education were launched in the 13 to 14 age group of compulsory education in the early eighties. This subject tried to establish a position in an educational context where neo-humanism was still prevalent. After a short experimental period with an emphasis on professional orientation, the topic of 'information technology', recently supplemented by aspects of machine control, started to exert pressure on the curriculum. The orientation towards this more abstract subject gave general technology education more credibility. Until now, the pattern of the curriculum had been dominated by topics derived from science and engineering, such as electric circuits, information technology, energy and technical communication. There is one rather cross-disciplinary subject called 'technology at home' which supposes a more project-based approach. The development of methodology in these subjects is based mainly on the 'applied science' concept, combined with "making/manufacturing" assignments inspired by the vocational orientation originating in the technical education tradition.

Flemish pupils' perception of the subject area is negative: the natural interest in technology is decreasing and pupils' view of 'what technology is' remains very limited.

Although the Programme for International Student Assessment (PISA) shows very good results in reading, scientific and mathematical literacy in 15-year-old Flemish pupils, there is a severe drop-out problem in compulsory education. The pronounced hierarchy and difference in perceived status of general/technical/vocational education generate discouragement, incorrect orientation, undeveloped pupil talents, lack of interest in technological and scientific studies, etc. Languages and, more recently, mathematics in particular have acted as selection criteria in this process. A broad-based Flemish taskforce representing the major actors in society came to the conclusion that a greater emphasis on talent is necessary in education. Secondary technology education, which is held in low esteem, is a particular obstacle to appealing to pupils' talents.

The article describes an 'equal opportunities' project supported by the European Social Fund as a concrete example of a regional initiative for supporting a gender-sensitive orientation towards a choice of study made by pupils discovering and reflecting on their skills and abilities/capabilities.

Finally, a review of recent debate and initiatives on curriculum change is given.

Early development of the general technology curriculum and practice in Flanders.

The first experiment in general technology education¹ arose in 1972. Main activity was the analysis of products and systems out of daily life: analysis of used materials, used production techniques, use of different systems, applied scientific concepts. Technological processes like designing, making, distributing ... were not explored².

The introduction of general technology in grades 7 and 8 in the beginning of the eighties was accompanied by an initiative to reform secondary schooling in Flanders: this new concept, VSO³, intended a more democratic, participative, comprehensive approach. Still, in Flanders, most secondary schools had a profile coupled with general OR technical/vocational education. The result was an early streaming of children when they made the switch from primary to secondary school. A greater emphasis on orientation in the VSO-system went well together with the introduction of general technology. It softened the strict neo-humanistic separation between general and technical education.

The new curriculum of general technology in 1981 introduced the concept "technological process". Contexts were 'technology at home, energy, food, clothing, communication, hygiene, care, sales, and administration'.

Teachers were responsible for the concrete workout of this curriculum framework. A poor support of teachers and their experience with vocational technology and home-economics resulted in a lot of 'easy' making-tasks.

A separate curriculum for pupils with low cognitive capabilities, the B-stream, took shape. Until now, the curriculum for this group of pupils hasn't changed that much. It can be seen as relatively successful. Pupils can orientate themselves towards a choice of study by making tasks related to a rich variety of technical domains/sectors such as building, wood, metal, textile, food, electricity, horticulture,

During a few years, the more comprehensive VSO model competed with the traditional education system and at the end of the '80 a compromise-education system arose: "het éénheidstype"⁴ (unified secondary schooling-system).

In 1988, as a response, a new general technology curriculum appeared. All pupils received 2 hours/week (or more) of general technology in grades 7 and 8. Themes are: communication technology, electrical circuits, information technology (grade 7) and energy, technology at home and information technology (grade 8). From now on, the complete technological process had to be studied, and not only the making-process. The theme 'information technology' became very important. Problem solving with logic panels take 40% of the curriculum.

1997. The Flemish community described curriculum minimum goals⁵ ("eindtermen") that were to be reached by all pupils, for general technology for grades 6 (primary

¹ In Flanders general technology in secondary school is called "technologische opvoeding".

² Van Hecke, W. Hints for teaching technology (Tob niet over top, een vingerwijzing voor technologische opvoeding) (brochure). Zoersel, 1988.

³ VSO= vernieuwd secundair onderwijs (new secondary education)

⁴ Flemish administration of education. Statistics of education in Flanders. Internet, Brussels 2005 (<http://www.ond.vlaanderen.be/onderwijsstatistieken/>)

school) and 8 (end of junior high school).

Despite curriculum changes, the change in teaching practice in grades 7 & 8 remained limited: the minimum goals became situated in existing practice. In primary school, technology is introduced.

In 1999, the education inspection assessed the teaching practice for general technology in grades 7 and 8⁶.

During grades 7&8, the pupils' natural interest for technology declined and the impact on choice of study was neglectable. Critical points were teaching conditions such as infrastructure and class group sizes, teacher education, a lack of coherent vision on general technology as a subject and unbalanced curricula.

2002: an acceleration occurs in curriculum development and discussion.

In this year, the introduction of cross-curricular themes⁷ with minimum goals for general technology education for grades 9-12 in general secondary education⁸ is launched.

Also, a period of reflection and discussion begins:

The role of competences in society becomes increasingly more important and this not only in economic life, organisations and companies but also in life-long learning, social and cultural emancipation. Inspired by a project from the Organisation for Economic Co-operation and Development (OECD) for defining and selecting competencies, (DeSeCo), a think-tank starts reflecting about the meaning of this for the Flemish context (Dunon and Van Driessche, 2001)⁹.

Meanwhile, a commission representing the major actors in society describes an action plan¹⁰ for the implementation of an integrated vision on learning and working. An important factor is the gap between the perceived status of secondary technical and vocational studies and the economic needs expressed by a shortage of applications for several technical occupations. Further key-elements of the plan are:

- the renewal of management in education organisations and schools;
- a reform of the educational system in an attempt to remove the social and appreciation barrier between "general", technical and vocational education;

⁵ Decreet van 24 juli 1996 - tot bekrachtiging van de eindtermen en de ontwikkelingsdoelen van de eerste graad van het gewoon secundair onderwijs. [Belgisch staatsblad](#) 14/08/1996.

⁶ Ministry of the Flemish community. Education department. [Onderwijsspiegel. Verslag over de toestand van het onderwijs, schooljaar 1999-2000](#), p.69-72. Internet, Brussels,2004. (<http://www.ond.vlaanderen.be/schooldirect/inspverslag/SO-TO.htm>)

⁷ Decreet van 18 januari 2002 - betreffende de eindtermen, de ontwikkelingsdoelen en de specifieke eindtermen in het voltijds gewoon en buitengewoon secundair onderwijs. [Belgisch staatsblad](#) 08/02/2002; err. B.S. 12-4-2002.

See also: Cross-curricular themes. Internet, Brussels, DVO, (http://www.ond.vlaanderen.be/dvo/publicaties/over_de_grenzen/OVER_DE_GRENZEN.pdf)

⁸ General secondary education: algemeen secundair onderwijs (ASO)

⁹ Dunon, R. & Van Driessche A. [Defining and selecting key-competencies in Flanders \(Definitie en selectie van \(sleutel\)competenties in Vlaanderen: een stand van zaken anno 2001.\)](#) Brussel, Ministry of the Flemish community – Education department. 2001.

¹⁰ Bossaerts, B. Denys, J. and Tegenbos, G. [Accent op talent. Een geïntegreerde visie op leren en werken.](#) Garant. Antwerpen. 2003. 130pp.

See also internet, Brussels, 2005

(http://www.ond.vlaanderen.be/schooldirect/BL0203/KBS_AccentTalent.htm
<http://www.kbs-frb.be>)

- to facilitate a better choice of study by optimising the orientation of pupils, certainly in junior high school.

During 2003-2004, the corresponding taskforce 'a greater emphasis on talent' starts with experimental projects based on the conclusions of the commission.

The department for education development of the Flemish community starts a discussion on general technology teaching by means of a comparative international curriculum quick-scan "techniek voor iedereen" ("technology for everyone") (Moens, 2002)¹¹. It suggests a more balanced framework based on the idea of technological literacy and defines context-areas as the basis for learning. Those contexts are health, food, energy, information and communication, transport, articles of use and building.

2003-2004.

The network of community schools¹² initiates a curriculum reform for general technology grades 7 and 8 based on the ideas of the study. The network of Catholic schools (VVKSO)¹³ starts a think-tank and prepares gradual curriculum changes.

The minister of education appoints a coach for general technology teaching in Flanders. Several conferences for teachers take place (VVKSO, 2002; Arteveldehogeschool, 2003; Popular science centre "Technopolis", 2004).

Teachers' and pupils' perception of the subject

At the end of the curriculum, pupils associate technology with electricity, electronics and mechanics. They see almost no links with human needs, economic, social and ecological impact of the subject. The natural interest for technology decreases through grades 7 and 8. Besides infrastructure and class group size, teachers criticize the curriculum for being too charged and for putting an overemphasis on information technology (Boolean logic, logic circuits, programmable controllers).

Teacher education

A large amount of teachers has never received a specific initial training¹⁴ for general technology. Most of them were formerly active in teaching home-economics, vocational technology in textiles, mechanics An other group are the science teachers. The minimum qualification level is very low. When schools can't find good technology teachers, so to speak, even gym teachers can teach technology. As a result, the foundations of general technology are not very well known. Sometimes, lessons refer more to science or to vocational technology.

¹¹ Moens, G. Technology for everyone: fundamentals for a transparent subject (Techniek voor iedereen Grondslagen voor een transparant vak Technologische Opvoeding). Ministry of the Flemish community education department – Department for education development - studies and documents, Brussels. 2002. 55pp.

¹² School networks in Flanders: public schools and free schools. Public schools consist of a network of Flemish community schools (17%) and a network of schools associated with cities and provinces (16%). The largest group are the free schools (mainly Catholic, about 67%).

¹³ VVKSO: Verbond van het Vrij Katholiek Secundair Onderwijs (network of free Catholic secondary schools).

¹⁴ Initial training: bachelor in education- secondary education option teaching general technology

A greater emphasis on talent, also in general technology education: the OriënTO project

At the end of 2004, the Arteveldehogeschool associated with Ghent university, disseminates a development called "OriënTO"¹⁵ (Coulier, Hantson, Van de Velde, 2004), a product for gender sensitive orientation towards choice of study in grades 7 and 8. This development is financed by the European Social Fund and the Flemish community.

The main idea is based on structuring the reflection process of the pupils. This is stimulated by playing several interactive computer games and by conversations with teacher(s), parents, ...

Pupils get to know more about:

- their 'technological intelligence' (defined as a combination of Gardner's multiple intelligences¹⁶);
- their "blue" and "pink" competences;
- the nature of work in our society;
- economic sectors, the nature of companies, professions and occupations;
- the role of professions and occupations linked with technological processes;
- history of work coupled with technology development;
- their view on socialisation processes, male and female role patterns linked to technological activities;
- their learning style by testing preference of approach in technological problem-solving;
- their interests and talents for developing key-competencies in technology such as investigating and innovating systems, managing and executing processes.

The tool consists of an interactive cd-rom, a reflection-poster and a comic-book for pupils. For teachers, school management and other actors active in education, there are checklists to support a gender sensitive interaction in teaching, use of images, use of language.

The project includes a search for distinguishable key-competence fields as they can be observed in technological (sub)processes like identifying needs, designing, producing, distributing and servicing, assessing.

This framework (Van de Velde and Hantson, 2004) serves to refine the look on pupils' technological interests: have they already been profiled as researchers, innovators, managers, operators?

Which steps in the technological process have their interest? Do they feel something for the interaction technology-man-society or are they more product-oriented?

This framework helps to design a test comprising a series of meaningful technological problems where pupils must indicate their preferred way of solving. This test refers to authentic practices in technological processes as indicated in the framework (figure 2).

When defining clusters of key competencies in technology such as researching/gathering knowledge, innovating, managing and executing, a link with

¹⁵ Coulier, C, Hantson, P. en Van de Velde, D. Oriënto, [Gendersensitive oriëntation towards choice of study and occupation in general technology education \(genderneutrale studie- en beroepskeuzeoriëntatie in technologische opvoeding\)](http://www.oriento.be). Gent, Arteveldehogeschool. 2004. Internet (www.oriento.be).

¹⁶ Gardner, H. Frames of mind. Basic books. New York, 1983.

Kolb's learning styles¹⁷ (Kolb and Fry, 1975) could be noticed. These relations are indicated in figure 1 (Van de Velde, Hantson and Coulier, 2004).

During grades 7 and 8, the tool should be discovered gradually through the curriculum development. As a result, pupils can progressively enrich their self-concept.

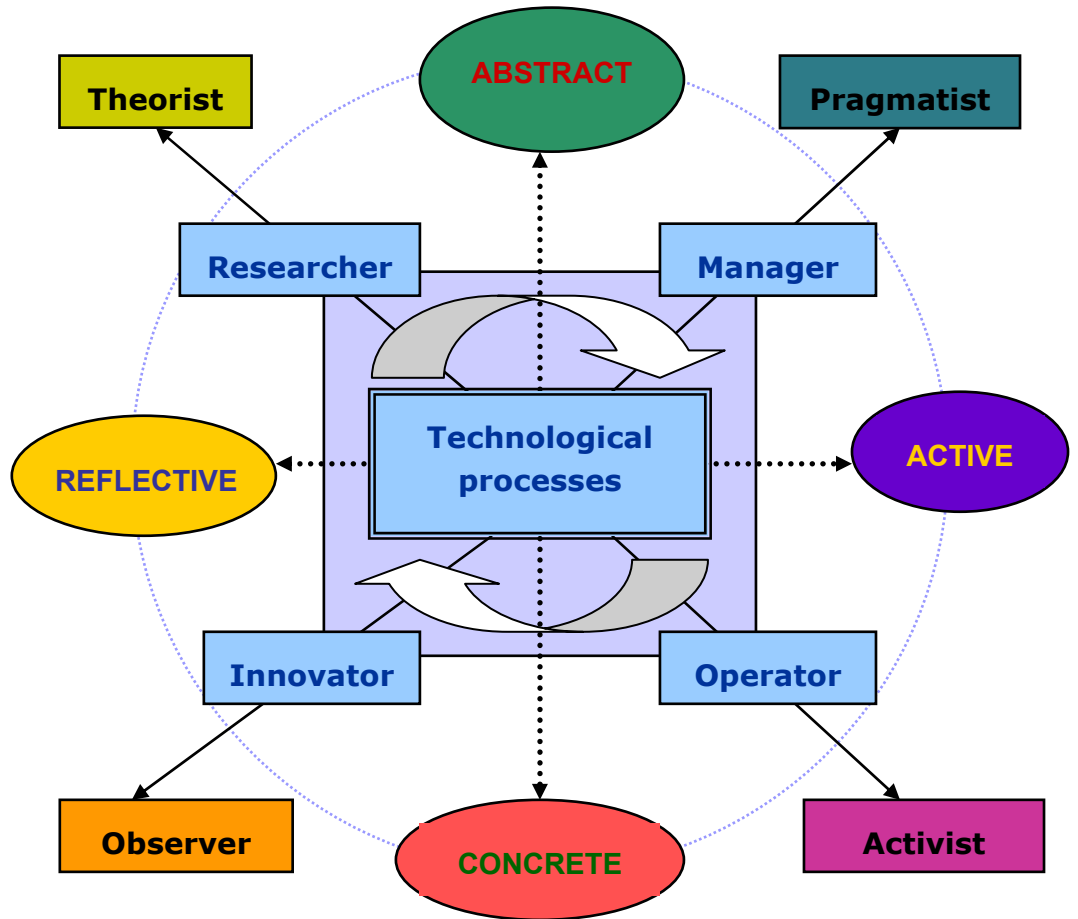


Figure 1¹⁸: linking learning styles to key-competency areas in technological processes.

¹⁷ Kolb, D. A. and Fry, R. Toward an applied theory of experiential learning; in C. Cooper (ed.) Theories of Group Process, London: John Wiley. 1975.

¹⁸ Van de Velde, D. Hantson, P. and Coulier, R. 2004

Key-competence clusters in technological process steps				
Clusters	Researching	Innovating	Managing	Operating
Process steps	Logical thinking, analysing, synthesising, reflecting, dealing with concepts	Creative thinking, observing, sensing, reflecting, dealing with variables	Planning, organising, structuring, managing, controlling	Making, performing, executing
Identification of needs Social, communicative, marketing and research competences	Analysing needs of individuals, groups, markets	Promoting, advertising, marketing, improving identification methodologies	Managing accounts Managing application of regulations	Questioning Promoting Recepting clients Administrating
Design Modelling, technological communication, creative competences	Analysing (sub)systems: properties of new materials, techniques, Researching technological possibilities of natural phenomena	Applying new techniques and materials in designs.	Controlling and optimising processes	Technical drawing Making models and prototypes, testing Executing work procedures

<p>Production Process competences</p>	<p>Analysing processes and their aspect such as safety, healthy, environment, ergonomics, methods, tools, ...</p>	<p>Optimising processes (methods, tools, ...)</p>	<p>Planning, organising, following and maintaining processes (e.g. machines, stock, production, employees, ...)</p>	<p>Executing competences such as accuracy, punctuality, quality, order, attention for safety, environment, productivity, ..</p>
<p>Distribution Installing, servicing, transporting, testing,...</p>	<p>Researching methods for distributing, logistics, conditioning, storage, use and maintaining, servicing, ...</p>	<p>Optimising systems for distribution, storage, conditioning, servicing, ...</p>	<p>Planning, organising, following and maintaining processes such as distribution, logistics, service, ... and systems for conditioning, transport, storage, ...</p>	<p>Executable competences in logistics, service, flexibility, ...</p>
<p>Evaluation Analysing, reflecting, judging, improving, consulting, assessing...</p>	<p>Assessment of interaction between technology and customer, market, society... Researching technology assessment methodology, ...</p>	<p>Designing strategies for assessment of systems and processes based on existing assessment concepts</p>	<p>Planning and assessment of customer satisfaction and assessing the implementation of diverse regulations</p>	<p>Execution of given standards and procedures:</p> <ul style="list-style-type: none"> - control - testing and measuring - data acquisition - analyse data

Fig. 2. Key-competence clusters in technological process steps

In every step there is teamwork needing social and emotional intelligence. Every step needs also competences in ICT.

Every occupation/profession in technology demands a specific combination of competences.

Recent debate in general technology education

Since 2002, when the curriculum was about to be revised, the following elements have been in the centre of the debate:

- active and constructive learning
- the choice of contexts
- change of the curriculum: less is more?
- the structure of the curriculum
- discipline based subject with links to vocational technology and science or multidisciplinary and problem solving based learning subject.

Active and constructive learning

At this point, an agreement has been reached that future teaching practice must be more directed towards active and constructive learning. There is some debate on how to reach this goal: some want to activate pupils by putting more assignments for pupils in the current curriculum structure, others want to go further by replacing a content- oriented approach with a more project-based approach.

Choice of contexts

This debate is rather confusing because of the various interpretations of what a context stands for. Only a few participants in the debate see contexts as elements coming out of real life situations: e.g. as pieces of the designed world¹⁹ or as domains in the life of children: technology at home, in school, in their free-time, in companies. The idea that a context should be linked with the structure of a traditional science or engineering subject is wide-spread.

Some actors want to broaden the range of contexts and want to add the contexts food and health. This options fits with the idea of transferring technology- specific key-competencies needing a range of different and authentic contexts. It also broadens the view of pupils on technology as a human-made world and gives more possibilities to appeal to girls' interests.

Advocates of the present practice argue that those contexts were part of the curriculum in the eighties and see this as a return to the past. They see the study of electricity, mechanics, information technology and machine controls, building, technical communication as a good base for learning technology.

Some actors justify the present overemphasis on information technology by arguing that it is a powerful context for developing logical thinking and problem solving. Recent research²⁰ even indicates that transfer of those capabilities to other contexts and daily life is not simple.

¹⁹ International Technology Education Association. Standards for technological literacy: content for the study of technology. Reston, VA: Author. 2000.

²⁰ De Corte, E. On the Road to Transfer: New Perspectives on an Enduring Issue in Research and Practice , International Journal of Educational Research 31. 1999.

From content based towards process-based learning: bringing structure in teaching technology programs.

The structure of the present curriculum consists of basic themes (technical drawing and communicating, electrical circuits, transmissions, information technology). During grade 7, pupils learn these "basics". Grade 8 intends a more project-based approach based on applying these basics. Problem is: the curriculum description shows little differentiation for both approaches and project/problem-based teaching practice is not common. Curriculum themes like technical communication develop spatial intelligence, but poor integration in other themes and limited contextualization makes learning not connected, situated and meaningful enough.

So the actual teaching practice is based on a logical and linear development of a theme derived from a particular technology such as electricity: the curriculum theme reflects the structure of the underlying scientific/engineering subject. As an example the theme 'electrical circuits' starts with exploring a simple circuit, learning the components of a simple circuit and their properties, learning the properties of circuits with batteries, switches, loads, ... in series and in parallel. Such a theme often concludes with a "making-task" of a product with a function, in this example, based on electrical circuits.

This more content-based approach puts the structure and the conceptual knowledge of the underlying scientific/engineering subject in the centre.

At the same time, there is no attention for the specific profile of the several technological sub-processes, the kinds of procedural knowledge in technology such as identifying needs, investigating systems, designing, making, problem solving, assessing the impact of technology for the natural world. In most cases, pupils are trained to solve vaguely profiled technical problems following a unified 5-step heuristic process (identifying the problem/searching solutions/making the solution/testing/evaluating). This problem solving is based on very brief context descriptions.

The approach in technology education should be more project and process-based with pupils drawing on a rich range of learning styles. As also pointed out by Stevenson²¹ and McCormick²², more attention for "connectedness of meaning" and "situatedness" is needed. So problem solving should be situated by means of rich and meaningful context descriptions. In order to achieve this, curricula should downsize the more context- and traditional subject-specific content.

Leaving the logical structure of the development of a subject as a supporting background generates a paradigm shift. This however will take some time for implementation into teaching practice. To enforce meaningful learning, more project/problem-based learning is necessary referring to authentic technological processes (procedural knowledge) and concepts of systems theory (conceptual knowledge). The traditional discipline-based subjects become a well structured tool-box for problem-solving inspired by real-life situations. Nevertheless, a mapping of subject-specific competence will be necessary in combining the advantages of both approaches. This more meaningful learning supports the discovery of pupils' talents and thereby the orientation process.

²¹ Stevenson, J. Developing technological knowledge. International Journal of Technology and Design Education 14, 5-19, 2004.

²² McCormick, R. Issues of Learning and Knowledge in Technology education. International Journal of Technology and Design Education 14, 21-44, 2004.

Conclusions

This paper illustrates the importance and role of the 'more emphasis on talent' policy in Flanders in recent curriculum and teaching development. It is the Flemish approach in an attempt to change the attitude of pupils and parents towards a choice of study for technology. The underlying approach is key-competence- based learning, more attention for orientation towards choice of study in grades 5→8 and broadening pupils' horizon by means of more meaningful and more connected learning. Although the recent debate on curriculum reform is not cleared out yet, it is to be expected that this policy of renewal will greatly influence future developments.

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