A new curriculum for technology education in Schleswig-Holstein

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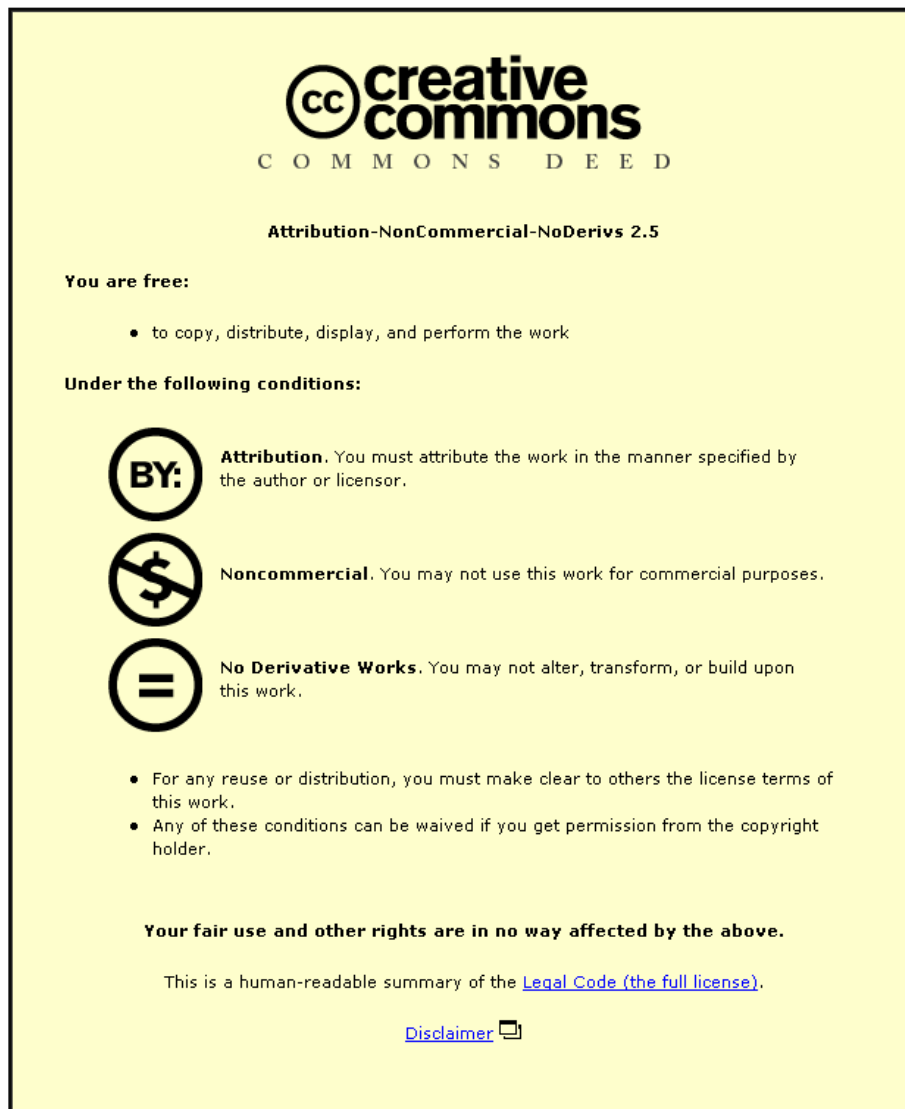
A new curriculum for technology education in Schleswig-Holstein

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Abstract

The existing Curriculum - valid since 1986 - is structured in fields of action: working and production, transportation and traffic, building and built environment, supply and disposal, information and communication. 1992 a revision of all curricula began. Guidelines for this revision were:

1 *New curricula should lead to a discussion on core problems (e.g. basic values of living together in peace in different cultures; preservation of the elements of life; future change of economic, technological and social conditions; equal status of women and men; the right of all human beings to form their political, cultural and economic living conditions).*

2 *New curricula should secure a common basic education.*

3 *New curricula should enable the interweaving of learning experiences.*

4 *New curricula should enable co-operation across the bounds of school subjects.*

5 *New curricula should relieve lessons.*

The German Educational System

After World War II, the Federal Republic of Germany was established after the model of the United States of America. Figure 1 shows the federal states ("Länder") and their population figures. In the German Federal Republic the federal states are independent in educational matters.
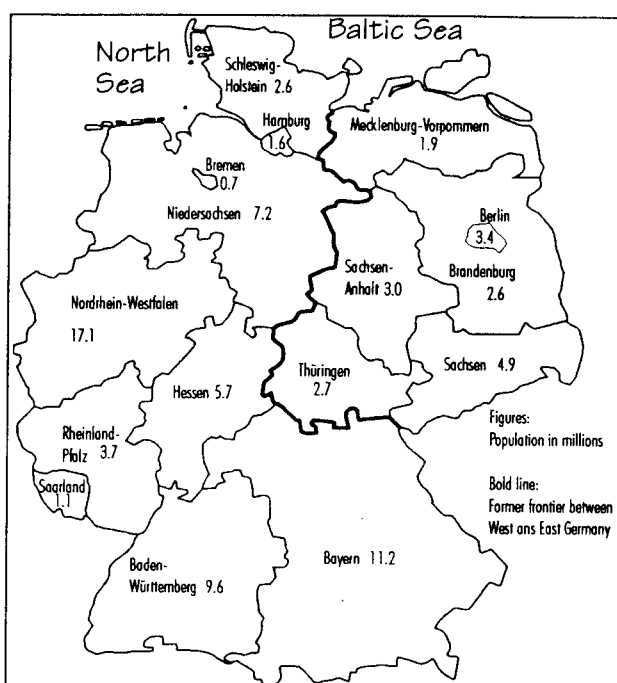

Figure 1   Federal States of the German Federal Republic

In spite of the independence, the educational system in the federal states is nearly the same (Figure 2). Although in all states there are comprehensive schools, the normal system consists of a primary school and three branches of secondary schools:
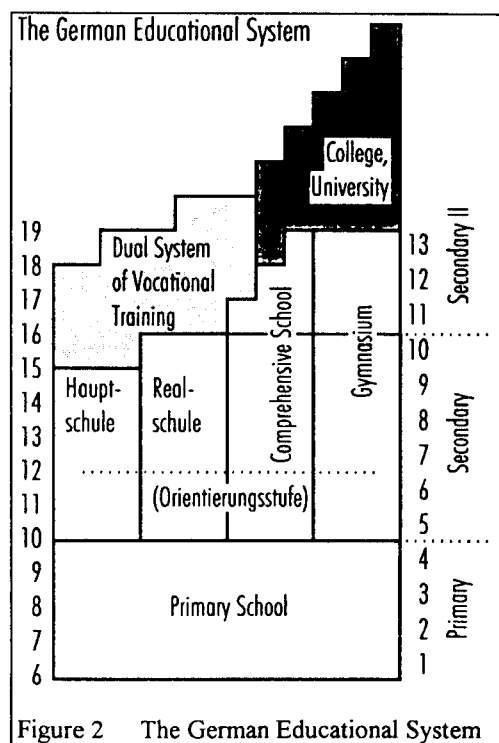
Figure 2   The German Educational System

Hauptschule (general secondary school), Realschule and Gymnasium (high school). In some states the first two years of secondary school form a school on its own, the Orientierungsstufe.

The school leaving certificate of the Hauptschule entitles the student to enter into an apprenticeship. The same is true for the Realschule, although under certain conditions the student can go to the Gymnasium. The leaving certificate of a Gymnasium entitles the student to go to a college or university. Today approximately one third of the pupils attend each type of school Hauptschule, Realschule and

Gymnasium. Only a few pupils attend comprehensive schools.

In most of the federal states technology education is taught only in Hauptschule and Realschule. (Figure 3)

Figure 3   Technology Education in German Schools

Technology is:

◆ Compulsory subject

■ One of compulsory subjects to choose from

◆ Optional subject

■ Part of an integrated subject

◆ Part of an optional integrated subject

☐ Can be taught, if the personal and spatial facilities are available

State	Primary School 1 2 3 4	Secondary Schools 5 6 7 8 9 10 11 12 13	School Type
Baden-Württemberg			Hauptschule / Realschule / Gesamtschule
Bayern			Hauptschule
Berlin			Hauptschule / Realschule / Gesamtschule
Brandenburg			Hauptschule / Realschule / Gesamtschule
Bremen			Hauptschule / Realschule / Gymnasium
Hamburg			Hauptschule / Realschule / Gymnasium / Gesamtschule
Hessen			Hauptschule / Realschule / Gymnasium / Gesamtschule
Mecklenburg Vorpommern			Hauptschule / Realschule / Gymnasium
Niedersachsen			Hauptschule / Realschule / Gymnasium / Gesamtschule
Nordrhein-Westfalen			Hauptschule / Realschule / Gymnasium / Gesamtschule
Rheinland-Pfalz			Hauptschule / Realschule / Gymnasium / Gesamtschule
Saarland			Hauptschule / Realschule
Sachsen			Realschule / Gymnasium
Sachsen-Anhalt			Hauptschule / Realschule / Gymnasium
Schleswig-Holstein			Hauptschule / Realschule / Gesamtschule
Thüringen			Hauptschule

Revision of Curricula in Schleswig-Holstein

To meet the common problems of today's schools, the Schleswig-Holstein Ministry of Education decided to revise all curricula of schools providing a general education. The revision began with an evening opening ceremony in the castle of Kiel on December 6, 1991. The inaugural address was given by Secretary of State Bodo Richter: Educational policy for the world of tomorrow. Only two more speeches were held that evening. Hans Heinrich Driftmann, chair of the Schleswig-Holstein commission of educational policy of the society of employers' associations, spoke on "Demands of the economy for a future oriented educational policy". Martin Baethge, professor of sociology of Göttingen university- described "Educational expectations and demands for qualifications - educational sociological cornerstones for tomorrow's society".

The event continued on the next day at Kiel university. Here the framework for the revision of the curricula was explained by Klaus Karpen, head of the department "basic problems of educational policy" at the ministry of education. He referred to the Prime Minister's policy statement on internal school reform. The main targets were:

- opening lessons in respect of subject matter, methods, and organisation
- discussing new tasks and challenges
- expanding cross curricular and cross school branches co-operation
- democratising school life

The revision of the curricula was to take place in the Sekundarstufe I (junior secondary schools, forms 6 - 10 of Hauptschule, Realschule, Gymnasium, and Gesamtschule). The basic ideas are:

1. *The new curricula should come to terms with core problems*

Today's views on life and educational conceptions are hardly agreed on any longer. The concept of orientation toward science is no longer sufficient as the only reference point for teaching and learning. Nevertheless curricular work needs a common base. Such a base could be formed by working on core problems. Present core problems are:

- Basic values of human living together, in particular peace, human rights and living together in a world with different cultures, social systems, peoples, and nations as an individual and global task.
- Preservation of the natural fundamentals of life, of one's own health and other people's well-being.
- The future change in economic, technological, and social conditions of life and their impact on shaping conditions of life.

- Equal status for women and men, boys and girls, in family, vocation and society.
- The right of all human beings to organise their own political, cultural, and economic conditions of life, their participation and joint responsibility in all areas of life.

2. *The new curricula should secure a common basic education*

The explosion of knowledge and accelerated change hamper a joint participation of all people in culture, economy and society. That is the reason why cross school branches common basic education is necessary. An education in which the student can develop factual competence, judgement, ability to act and communicate. The target is to enable the student to participate in common assignments in school, vocation, and society.

3. *The new curricula should help to connect the experiences of life*

While in former times for most of the students school was the only important place of learning besides neighbourhood, today's students live in multiple worlds and correlation of learning.

4. *The new curricula should strengthen cross curriculum co-operation*

Subjects remain the most important way in school, to provide a variety of information for teaching and learning. The academic disciplines and their didactic studies therefore remain the basic frame of orientation for curricular work. The contents of the curriculum must have - in addition to the subject purposes - a discernible relation to educational targets and have to come to terms with the core problems. That is the reason why the work of the commission for each school subject is accompanied by permanent co-ordination of related school subjects.

5. *The new curricula should relieve teaching*

Today great demands from everywhere are made on schools. A Place for new subject matters can only be found when former ones are discarded. The different school branches have to shape a distinct profile.

Learning happens in different ways and individually. Curricula must make room for free learning, internal differentiation, and individualised learning. Teachers need more free room for creativity.

6. *The new curricula should strengthen profile and co-operation of school subject, school stages and school branches*

The new curricula ought to show what has to be done in the lessons in a clear and intelligible way. But they do not substitute for the planning of

lessons or academic articles.

There will be curricula for each subject in each school branch, but they have to be well co-ordinated in order to secure a common basic education. The curricula will get a new structure: After an introduction explaining the position of the subject within the legal educational task the minimum requirements on graduated common basic education will have to be named. Not till then will the school branch specific structured learning program follow.

The curricula must be made in a way that a sensible layman can understand them and can estimate their intentions and organisation.

In the last part of his speech Karpen explains the principles of the process. For each subject in each school stage a commission is made up.

Besides the teachers this commission will consist of representatives of parents and students, and experts from academic disciplines and teacher education. Parts of the new curricula will be tested. The results of the testing will be fed back to the commissions.

In the documentation of the curricula revision, there is an organisation scheme, which shows the participants and their role in the process (Figure 4)

In the further course of the conference, papers were presented referring to the core problems. The headings of the papers are:

meaning for school

2 Principles of education in regard of peace
3 Peace as an aspect of subjects, the example of sciences
4 Projects in peace education
5 Overdevelopment or surviving
6 Learning in a world which is a part of "One World"

Core problem 2: Preservation of the natural fundamentals of life, of personal and other people's well being.
1 Ecological education - shaping the man-nature relation as a guideline for pedagogy
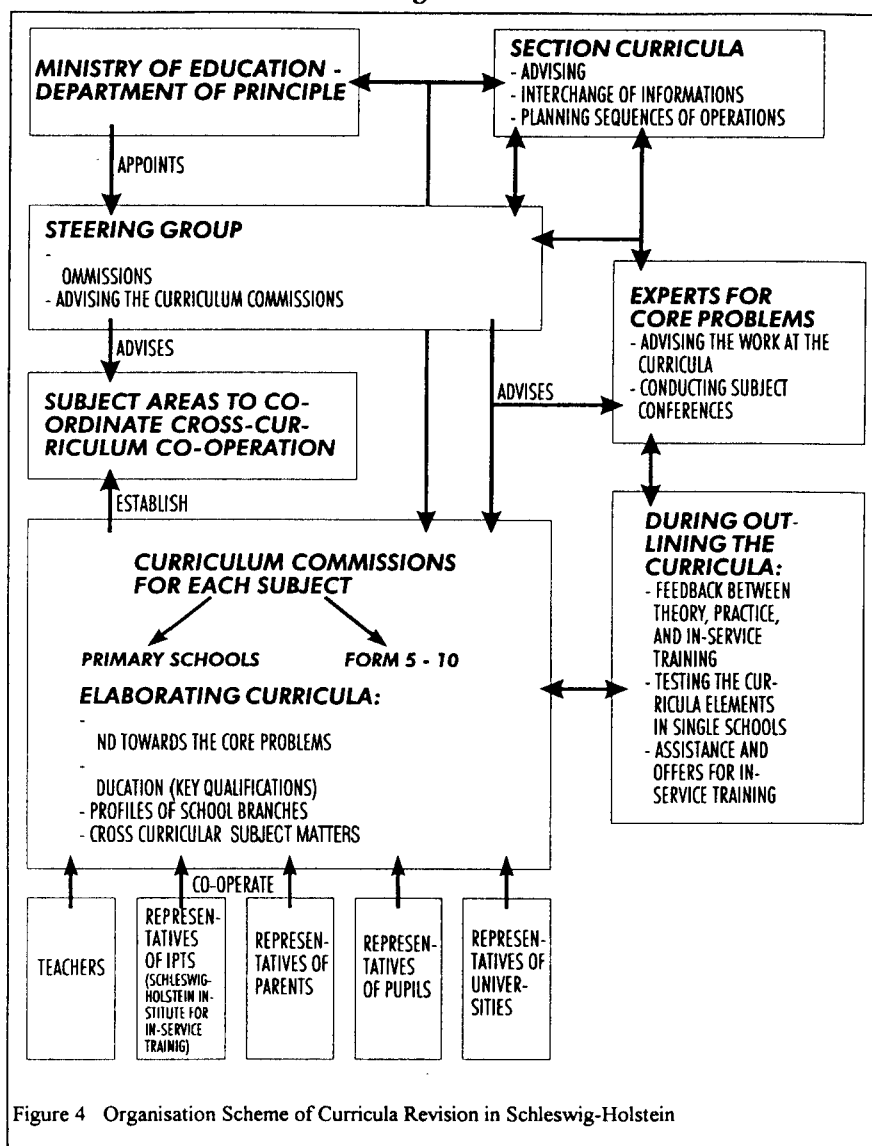2 From subject lessons to cross curricular ecological education

Figure 4 Organisation Scheme of Curricula Revision in Schleswig-Holstein

Core problem 1: Basic values of human living together, especially peace, human rights and living together in a world with different cultures, social systems, peoples, and nations to be an individual and global task.
1 Basic values of human living together and their

3 The future task of ecological education as a duty for all school subjects
4 Learning in a healthy way is more than learning health
Core problem 3: The future change in economic, technological, and social conditions of life and their

impact on shaping conditions of life.

1 Landmarks for curricula revision Schleswig-Holstein
2 Records of working group 1 (economics)
3 Records of working group 2 (social)
4 Records of working group 3 (new media)

Core problem 4: Equal status for women and men, boys and girls within the family, vocation and society.

1 Research outcomes relating to the gender issue - consequences for lessons and pre- and in-service training of teachers
2 Records of the working group "research outcomes relating to the gender issue"
3 Language aspects of inequality and equality of gender
4 Unequal conditions for girls/women and boys/men in the areas of science education and vocational orientation.

Core problem 5: The right of all human beings to organise their own political, cultural, and economic conditions of life, their participation and joint responsibility in all areas of life.

1 Social change and participation in society, economy, and politics
2 Intercultural education - charge and chance
3 Intercultural district schools - bilingual learning.

Key qualifications
- acquiring factual knowledge about technology
- acquiring ability to organise production in craftsman's or industrial ways
- acquiring safe ways of acting
- knowing fundamentals of order at a working place and in the workshop
- using appropriate ways of working with materials, tools, machines, and devices
- making objects in an accurate way
- acquiring sensitivity towards sparing resources, using energy, avoiding waste, and recycling
- preparing ability to use technology in safe and appropriate ways
- bringing creativity into the solution of problems
- acquiring technological sensitivity and awareness of problems/learning transferable strategies
- acquiring ability to comprehend complex connected situations
- acquiring ability to evaluate technology
- acquiring decision competence in the area of pre vocational orientation
- acquiring ability to experience
- acquiring independence
- discovering and perceiving one's own capacities
- acquiring ability to work in teams and to accept each other in different situations

Revising the Technology Curriculum

The commission for technology education consists of 6 teachers (two each from Hauptschule, Realschule and Gesamtschule), a representative of parents, and a member of Flensburg University.

The main problem in the first sessions of the commission was the fact that teachers stuck to the old curriculum, which was very clearly formulated. (Figure 5) In particular the structure following the fields of action was a help for teachers in structuring the lessons. The core problems were rather understood as a sort of political indoctrination than a help to make a curriculum. But with the discussion going into the depth of the problems, members of the commission began to recognise that the core problems were realistic problems for the students in the present and in future. In this phase of the work some of the members of the commission quit co-operation and new members were selected. Selecting new members happened in agreement with the existing commission, candidates were invited for 'test' sessions.

First the commission formulated key qualifications for technology education:

7	8	9	10
Work and Production			
- Designing and manufacturing a wooden object *Extensions:* - wood and wooden materials - technical drawing	- Designing and manufacturing an object from metal *Extensions:* - Standardisation of metallic materials and machine elements - Expanding the basics of technical drawing	- Manufacturing an object from plastic Labour divided industrial production *Extensions:* - Estimation and orientation towards the market for product planning and sale - Ways of organising industr. production	- Casting in moulds - Machines in production processes/ From simple tools to modern automata *Extension:* - Facilities for enhancing efficiency in production
Transportation and Traffic			
- Solving technological problems of lifting and conveying	- Bicycle and moped, proven means of moving: analysis and repair, maintenance and care *Extension:* - Function and structure of selected machine elements	- Analysing and comparing transportation and traffic systems	- Technological development: From the carriage to modern motor cars *Extension:* - Constructing and analysing different kinds of gearing
Building and Built Environment			
- Building simple load bearing constructions *Extension:* - Comparing load bearing constructions	- Concrete as a building material, Experimenting and manufacturing simple objects	- Planning and realising a simple real building project	- Comparing conventional and industrial ways of building *Extensions:* - Unit construction systems - Heat protection and using solar energy in passive devices
Supply and Waste Management			
- Basic house equipment for supply and waste management *Extension:* - Heating systems	- Examples of technological facilities to protect the environment	- Development of energy technology/ Reinventing a energy technological plant *Extension:* - Electric energy, using energy in a comfortable way	- Constructing and testing simple facilities to exploit regenerative sources of energy
Information and Communication			
- Constructing, testing and comparing simple devices to transmit messages	- Planning and manufacturing simple devices to solve control problems *Extension:* - Different systems of control technology	- Automating technological processes with control technology *Extensions:* - Constructing and using basic digital circuits - Using computers for control tasks	- Using computers to solve specific technological problems

Figure 5 The 1986 Technology Curriculum, Overview

Rough objectives

To show the connections of key qualifications with the core problems rough objectives were defined for each field of action.

The Student should be able to:

Work and production

- know the materials wood, metal, plastics, and ceramics as well as their main properties and determine their applicability for manufacturing planned work pieces.
- consider the problems of procuring and processing raw material under economic and ecological aspects.
- recognise the impacts of pollution in industrialised and non-industrialised countries and look for remedial measures in their own area.
- understand recycling/avoiding waste as processes with less harm to environment.
- understand school and household as avant-garde for a future oriented environment.
- know basic processes, materials, and tools in manufacturing and process technology and carry out simple processes.
- make and interpret technical drawings, mounting and operating instructions.
- outline, plan, and manufacture simple products.
- assess products and manufacturing processes.
- understand safety rules and apply them in every stage of the lesson.
- know fundamentals of organisation and automation of work processes in crafts and industry and transfer them to simple productions.
- recognise and assess impacts of labour division, mechanisation, and automation on working place, change of vocations and employment structure as well as the living-standard in an industrial society.
- test and assess technical products from a consumer's view.
- plan and use devices for multiple manufacturing.
- work appropriately and safely with selected tools, devices, and machine tools.
- know vocations from the areas material processing and manufacturing.

Transportation and traffic

- know and compare structure and function of selected systems for transportation and traffic.
- discuss the role of man as a part of the system.
- understand former and future development of systems for transportation and traffic.
- design and make models of conveyances.
- analyse real objects by dismantling and re-assembling.

- recognise and assess the interactions and interdependence of advantage, safety, economic factors and ecological damage.

Supply and waste management

- know, present and describe technological systems of supply and waste management and judge them with economic and ecological criteria.
- outline, make and assess simple models and real objects of systems for supply and waste management
- explain the interdependence of the employment of raw material and energy on the one hand and of pollution on the other hand.
- know and judge former and present problems of supply and waste management in an industrial society, cleaning of air, water, and earth.
- know and apply possibilities of saving energy, avoiding waste and recycling.
- know, apply and assess sustainable systems of energy supply.
- know vocations from the area supply and waste management.

Information and communication

- design, make, test, and compare simple systems of information and communication.
- know selected former and present processes of control and information technology and assess their meaning for man
- design and make devices to control technological processes.
- recognise and use controlling as a technological principle.
- automate simple processes with electric/electronic circuits.
- know assess and judge the impact of automation on man in different areas of life.
- realise basic electric and electronic circuits of different stages of development.
- solve technological problems with logic circuits.
- apply computers to control processes and for drawing.
- know and assess flexible applications of computers for solving specific technological processes.
- design simple programs and modify ready-made programs to solve problems.
- analyse the impact of computers on different areas of life.
- know vocations in the areas of information and communication.

Construction and built environment

- know the main properties of important construction materials and assess their suitability in different areas of application.

- know and apply basic principles of planning buildings under the aspects of the dimension and integration of rooms, cardinal point, sound-absorption and economy.
- read simple drawings and draw sketches.
- know basic principles of statics and construction.
- plan and execute simple construction projects in model or reality.
- recognise that the buildings must be both adapted to the need of man and environment friendly.
- know craftsman's and industrial ways of building, analyse and assess them.
- know basically the political planning processes as well as legislation.
- plan rooms under the aspects health, psychological effect, sociology, ecology, and economy.
- distinguish the "merchandise" dwelling from other merchandise.
- know vocations in the area of construction.

Reference to key qualifications/teaching intentions: The listed intentions connected with the subject matter are compulsory. They are oriented towards the key qualification.

Socio-technical field of action				
Work and pro-duction	**Responsibility of man working with raw mate-rial in craftsman like production. Basic course: Communication in technology. 7. - 9. form**	**Development and employ-ment of ma-chines change place of work and vocation. Interdependenc e of man and machine in pro-duction. 7. - 9. form**	Industrial pro-duction of article for daily use and its impact on conditions of life. 8./9. form	
Transportation and traffic	**Bicycle technol-ogy and appro-priate use of means of trans-port. 7. form**	**Car technology and its interac-tions with man and environ-ment. 9. form**	Technology con-ceptions for envi-ronment conserv-ing means of transport. 10. form/project	People develop technology (e.g. air craft engineer-ing) and use it in different ways. 8. - 10. form
Construction - built environment	Former and pres-ent ways of con-structing bridges- basic principles of static, select-ing materials, impacts on man and environment. 7. form	People protect and secure them-selves - safety systems of yes-terday, today, and tomorrow. 7. - 8. form	**Dwelling in changing times - ecologically beneficial, hu-man building and living to-gether. 8. - 10. form/ project**	
Supply and waste management	Wrapping is a burden for envi-ronment - dispos-ing and planning wrappings, avoiding refuse through abolish-ing, recycling relieves environ-ment. 7. -9. form	Supplying and disposing gar-bage of a house-hold under tech-nological, eco-logical and eco-nomic aspects. 8. - 9- form	**Using energy efficiently and sustainable en-ergies in house-holds. 9./10. form**	Man as consumer - discriminating dealing with the supply of techni-cal articles - analysing, testing, and purchasing products. 9. - 10 form
Information and communication	Basic electrical circuits and safety education. Basic course: Soldering. 7. form	**Impact of auto-mation technol-ogy on man, working place and vocation. From hand con-trol to comput-ers 7. - 10 form**	Interchange of information, de-velopment and impacts. From the drum to wireless tele-phones. 8. - 10. form	bold: compulsory subject matters

Structure of the teaching units

Figure 6   The 1994 Technology Curriculum, Overview

During the elaborating of the first units the way in which to integrate the reference to core problems was discussed. The following structure evolved:

Specification: the specification includes an orientation towards a target.

Reference to the core problems: the connections of the subject matter with the core problems are set forth.

Contribution of the subject matter to basic education: Here the multiple aspect view of the subject becomes clear. The commission developed a structure diagram to explain the fields of tension of the subject matter. This diagram also shows connecting points to cross curricular teaching.

Remarks referring to the subject matter / pedagogical remarks, cross curricular aspects: The subject matters should be understood as offers. The intentions can be worked out with other examples.

Once this preparatory work was done, the teaching units were worked out. The following overview shows them. (Figure 6)

The comparison of both surveys shows that the new curriculum is less rigid. It gives more freedom to the teacher to teach the matters in different ages. From the comparison is not visible that the new curriculum contains much more text to ensure the reference to the core problems. The large amount of text was the reason why the dissemination has come out to be more difficult than that of the old curriculum.

VALUE LEVEL
CONDITIONS AND IMPACTS
OF TECHNOLOGY

- TECHNOLOGICAL
- ECOLOGICAL
- INDIVIDUAL/SOCIAL
- ECONOMIC

FACTUAL LEVEL
STRUCTURAL KNOWLEDGE

- ELEMENTS AND SYSTEMS OF
TECHNOLOGY
- BASIC FUNCTIONS OF TECHNO-
LOGICAL SYSTEMS
- REGULARITIES

**FIELDS OF ACTION/
AREAS OF LIFE:**
PRIVATE/PUBLIC/VOCATIONAL

- WORK AND PRODUCTION
- TRANSPORTATION AND TRAFFIC
- SUPPLY AND WASTE MANAGEMENT
- CONSTRUCTION AND BUILT
ENVIRONMENT
- INFORMATION AND COMMUNICATION

METHODS LEVEL
WAYS OF THINKING AND ACTING
IN TECHNOLOGY

- REPRESENTING, OUTLINING,
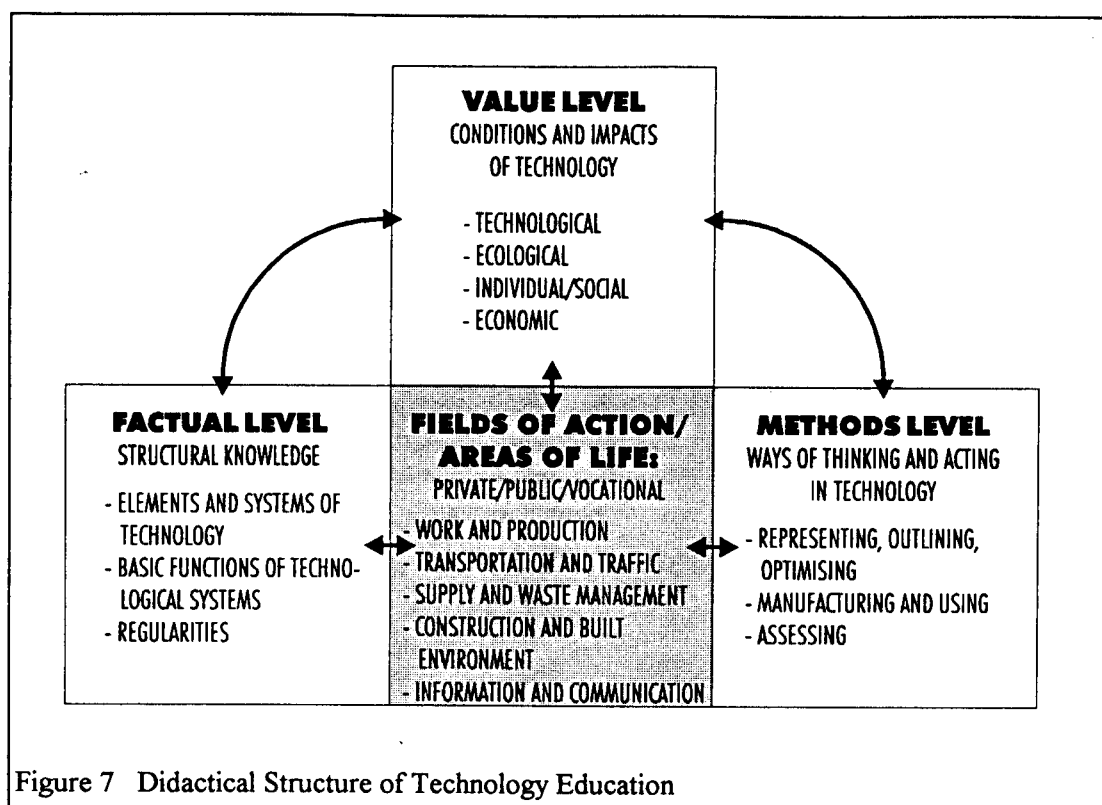OPTIMISING
- MANUFACTURING AND USING
- ASSESSING

Figure 7 Didactical Structure of Technology Education

Teachers had to be introduced to the curriculum in in-service training courses. To facilitate spreading the curriculum, the commission developed graphic representations to show the intentions.

The first presentation (fig. 7) shows the connections of the fields of action with the levels of technology education.

The second representation shows the interdependence of technological aspects with aspects affected by technology. Such a graphic representation was made for each teaching unit.

With these illustrations, the new curriculum grew again.

Main differences between previous and new curriculum

The previous curriculum had preliminaries explaining the targets of technology education, comments on methods and media of teaching, remarks on planning and carrying out lessons, and an survey of the curriculum. This part consists of 18 pages.

In the new curriculum, this part contains a lot more of information (e.g. core problems) and amounts to 30 pages.

In the previous curriculum, the representation of the curriculum units takes 72 pages. The

structure of these units is very simple: objectives, subject matter, and advice for teaching are presented in parallel.

The structure of the new curriculum is a little more complicated. As shown above, every unit has a preliminary note of its own. It contains a rather problem-oriented title than a short heading. The connection with the core problems is discussed, and references to the key qualifications are shown. After these preliminary notes advice for the subject
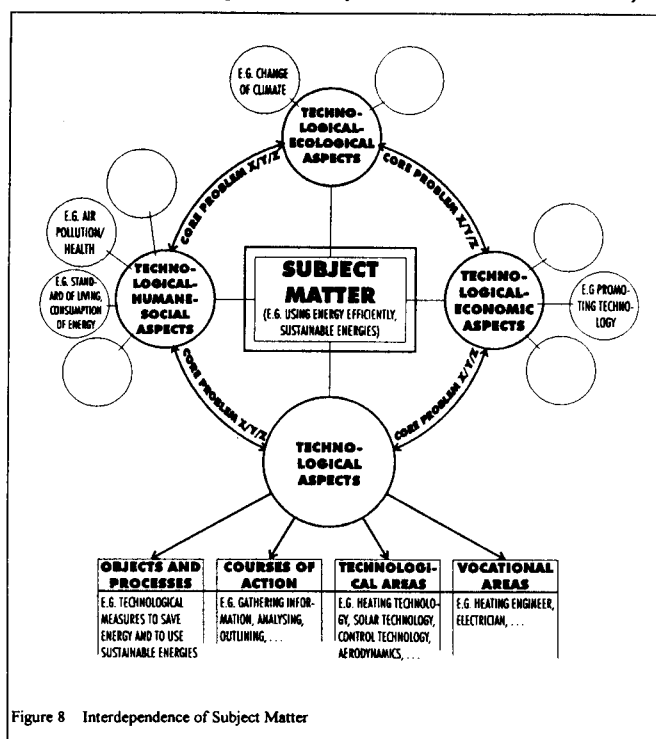

Figure 8 Interdependence of Subject Matter

matter proposals are given. The teacher is always free to select other matters to meet the teaching intentions! Parallel to these proposals, teaching hints are offered, combined with suggestions for cross curricular work. Though the size of the units differ, they at least cover 16 pages each. (Not all are finished yet.) So all 17 curriculum units will sum up to approx. 300 pages in addition to the 30 pages preliminary notes.

Conclusion

The new curriculum tries to show clearly the impacts and interdependencies of technology. With this intention they tend to become very complex. Teachers have problems translating them into lessons. They will need several courses of in-service training.

Attempts to integrate the new curriculum in pre-service training seem to be more promising.

The new curriculum will not be valid until the commissions for all school subjects have finished their work. So the Schleswig-Holstein government can take some time to decide about the new curriculum.

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