DOCUMENT RESUME

ED 313 000 IR 014 038

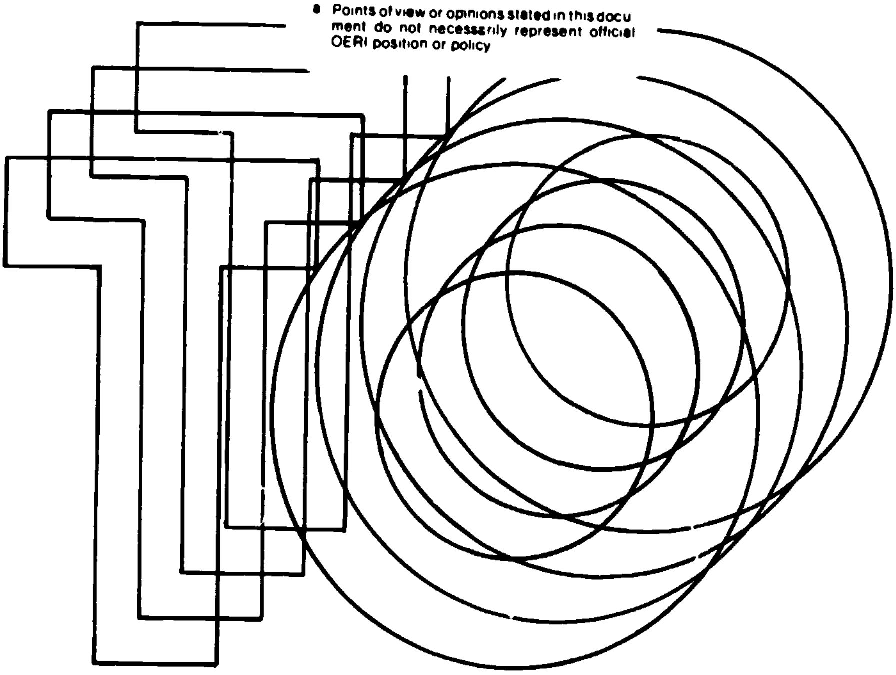
AUTHOR	Plomp, Tjeerd; Verhagen, Plon
TITLE	Building a Four Year Post-Secundary Curriculum in Educational Science and Technology.
INSTITUTION	Twente Univ. of Technology, Enschede (Netherlands).
PUB DATE	Sep 82
NOTE	50p.; Paper presented at the Annual Convention of the Association for Educational Communications and Technology (Dallas, TX, May 3-7, 1982).
PUB TYPE	Reports - Descriptive (141) -- Speeches/Conference Papers (150)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Curriculum Design; *Curriculum Development; *Educational Planning; *Educational Technology; Foreign Countries; Job Analysis; Models; Postsecondary Education; Problem Solving; Program Evaluation
IDENTIFIERS	*Twente University of Technology (Netherlands)

ABSTRACT

This report begins by providing background information on educational technology in the Netherlands, differences between a four-year program in the Netherlands and undergraduate programs in the United States, and the structure of Dutch university programs. The need for a Department of Educational Science and Technology at the Twente University of Technology and characteristics of the department are then addressed, followed by a discussion of the starting points and procedure of curriculum planning and a description of the structure of the curriculum. Activities involved in carrying out the plans--course construction, development of the TO-laboratory (a computer, audiovisual, and learning resource center), and student recruitment--are also discussed. The report concludes with an evaluation of the program at the end of the first year of operation. This evaluation focused on the effects of modular course construction, and the interrelationships of courses, study load, and number of possible drop-outs. Four appendixes provide: (1) the results of a job analysis of the tasks performed by professionals in the field that was undertaken as part of the curriculum planning process; (2) an outline of the department's curriculum; (3) a general model for structured problem solving; and (4) a floor plan of the TO-laboratory. (MES)

TO

Building a four year post-secundary curriculum in educational science and technology



by
Tjeerd Plomp
Pløn Verhagen

Building
a four year post-secundary curriculum in educational science and technology

by
Tjeerd Plomp
Pløn Verhagen
(Twente University of Technology,
Enschede, The Netherlands)

Paper presented at the AECT convention at Dallas (USA)
May 3-7, 1982

Final Draft, september 1982

Content

1. INTRODUCTION

..1. Educational Technology in the Netherlands

Educational Technology in the Netherlands does not have the identical meaning as educational technology in the sense of the Association for Educational Communication and Technologie (AECT). In the USA, educational technology has grown from the employment of audiovisual media and other technical means in education on the one hand, and the development of systematic (technological) methods to p'an and carry out instruction (like programmed instruction) on the other. One might say that the roots of educational technology in the USA are in the physical sciences. Gradually different field were interconnected and became aspects of a more general meaning of the educational technology concept. In the AECT definition, many aspects of education are more or less involved in the field of educational technology, with the systematic approach as an organizing principle to solve educational and instructional problems. Nevertheless, there is a lasting effect from the roots of the definition, which may be characterized by saying that many parts of American educational technology are still relatively product oriented.

In Europe, and in the Netherlands as well, the starting point was different. In the Netherlands for a long time there existed no separate curriculum to educate academics to be practitioners in the field of education. One could enter the field via pedagogical studies, which has a strong concern with ethics and philosophy, or via sociology or psychology with a concern about empirical research (e.g. for psychological testing of learners). Curricula in educational sciences have grown from the sociale science roots in some thirty years. Educational technology has become only one of the approaches to look at education and instruction following different psychological and pedagogical schools. Media and other technical means were never the main interest of people educated in a social science approach to educational problems, apart from the few people directly concerned with these materials and devices. In traditional educational theory, media were treated as step-children. A large professional organization concerned only with educational technology is yet unknown in the Netherlands. The effect of the educational technology environment in the Netherlands still makes it relatively difficult to translate or integrate philosophical arguments and empirical evidence from educational psychology into a systematic approach to solve educational problems.

The new Department of Educational Sciences and Technology (DEST) in Twente is in

fact the first department in a Dutch university where educational technology is explicitely a main interest in the curriculum. Other programs in which educationalist are prepared are still predominantly social sciences oriented. When the preparation for our program started, the Minister of Education expected from the planning committee a combination of the traditional approaches from the social sciences with the approach of the engineering sciences already present in Twente. The result is described below.
From the above it may already be clear that the origin of "our" educational technology is not quite the same as that of the American one, even if both in their definitions, may look much the same. With this in mind, it may be easier to understand some of the choices we made in developing our program.

1.2. Differences between a four year program in the Netherlands and undergraduate programs in the USA.

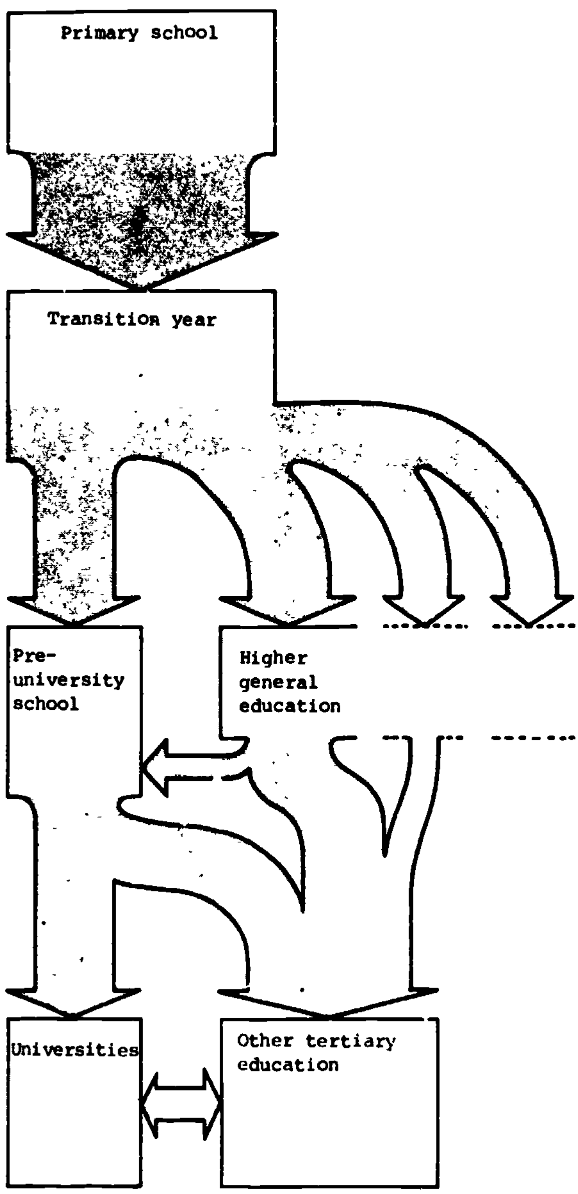
The Dutch education system can briefly be discribed by Figure 1.

Afther the primary school, students enter a transition period of one or sometimes two years (7th and 8th grade). After this time the students are divided into several school types. One of these types is the pre-university-school for which the "better" student apply. Some students enter this type of school at a later time, when results for higher general education show that they are able to make this change. The pre-university school has a centralized final examination. The students who enter the university are in general the better graduates from this school: the others go into other types of tertiary education.
From the above two things are clear:

a. The centralized final examination of the pre-university-school causes a more homogeneous group of students than college freshman in the USA.
b. The selection just after the transition year and the selection of graduates from the pre-university school to go into universities cause a higher average entrance level in universities in the Netherlands than the average entrance level of college freshman in the USA.

The Dutch four year university program permits students to graduate on a level comparable to a Master's degree in the USA. (To get a PhD, our graduates have to follow two semesters of courses plus a dissertation.) As far as we know a lot of undergraduate programs in the USA do not reach this level. There-

AGE — SCHOOLTYPE — EXPLANATORY NOTES



6

12 — 7th Grade, sometimes also 8th grade

Division of students over several schooltypes

13 (14) — One of the schooltypes is the Pre-University school:

. 7th - 12th Grade

. Centralized final exam

In the Dutch Tertiary Education a division exists between Universities and so-called Higher Professional schools (e.g. Teacher Training Colleges, Colleges for social workers and for highly skilled technicians)

19

Fig. 1: Part of the Dutch Schoolsystem showing path from Primary School to University.

fore, to prevent misunderstanding we prefer to speak about our program as a four year post secondary curriculum, rather than of an undergraduate curriculum.

1.3. Structure of Dutch University Programs

From September 1982 on the structure of the programs at Dutch universities will be changed by law. The new structuur is visualized in fig. 2.

The first years of each program is a preliminary year, which has several functions;

- Introduction to the program of the Department by laying a foundation for the rest of the program;
- Giving a perspective on the program as a whole and on the profession; and
- (Self)selection. On the basis of the study results and the other experiences either the Department or the student may express that continuation of studying (in our case: within DEST) will or will not lead to success for a student.

After the preliminary year, a period of three years follows resulting in a degree called "doctorandus', comparable to the Master's degree in the USA. As explained in 1.2. some of the students (DEST is planning for 50%) will be allowed to continue in an extra program of ½, 1 or 2 years to the so-called second phase, to specialize in some specific area like research or teaching. This phase will not end with a formal degree, but only with a certificate. A still smaller number will have the opportunity to continue within the university in a PhD program.

Fig. 2

PHASE I				PHASE II
1st YEAR	2nd YEAR	3rd YEAR	4th YEAR	EXTRA ½, 1 or 2 YEARS
PROPEDEUTICS (Preliminary year)	MAIN PHASE Ending up in the doctorandus degree (DRS)			for a part of the students specialisations e.g. researcher, teacher. no degree, but certificate

Fig. 2: Structure of the Dutch University programs

2. THE NEED FOR A DEPARTMENT OF EDUCATIONAL SCIENCE AND TECHNOLOGY

2.1. Twente University of Technology (TUT)

Twente University of Technology was founded in 1962 as the third State University of Technology with only Departments of Engineering.

The university started in 1964 with departments of mechanical, chemical, and electrotechnical engineering, followed in 1969 by departments of physics and mathematics. In the final phase of their study students can concentrate on engineering and sciences, and they can also choose an emphasis on business administration.

In September 1969, TUT published a report, entitled "Foundations for the Development of TUT" in which the desirability of expanding the university with Departments on the applied social sciences was stated. As a result of this new policy the Department of Public Administration started in 1976.

In 1976 the Dutch Minister of Education and Sciences invited TUT to prepare a proposal for a new Department of Educational Science and Technology*. He emphasized that in the new Department the University should combine the traditional social science approach of education (which can be found in Depts. of Pedagogy and Psychology) with the more technological, engineering type approach regarding (educational) problems.

As a result of this invitation the following preparatory activities were started:

- A preparatory committee was installed, which had to prepare the proposal to the Minister. The composition of this committee reflected the intended 'color' of the new Department. Besides two psychologists, a pedagogue, and an educationist (the Director of the Center for Research and Development of University Education), electrotechnical and mechanical engineers and a math educator were also appointed as members; and
- A large steering committee (ca. 30 members) was installed with many representatives from the educational field. The main function of the Committee was to serve as a sounding board for the preparatory committee.

* The Department decided to choose as its name in English: Department of Education. However, in North America this name may give some confusion because students within the department will not be educated as teachers (other than in educational science and technology). For reasons of clarity we use as name in English: Department of Educational Science and Technology (DEST).

- A early needs assessment was started mainly focused on an analysis of the existing job market and vacant positions announced in periodical advertisements during a period of half a year.

The purpose of all these activities was to draw up a report for which the minister of Education could give his approval to the new department and as a consequence of it, the personnel and other means necessary would be made available. This report had to contain (i) an elaboration of the philosophy of the department (i.e. combination of the social science and technological approach), (ii) the starting points, general goals and a first outline of the program, (iii) an estimation of the enrollment of students and (iv) a sketch of the structure of the department and the staff.
Starting in the Fall of 1976, after 1,5 year the Council of the University approved this policy statement. Then the Minister of Education asked for some additions, so that a final version was sent to him in December 1978. In June 1979 the Minister gave his approval to the proposals and allowed TUT to start the new Department of Educational Science and Technology in September 1981 with a group of 50 freshmen.

2.2. Some characteristics of DEST

In this section the main characteristics of the new Department of Educational Science and Technology (DEST), as stated in the formal proposal approved by the Minister of Education, will be summarized.

a. Aim of the Department

The aim of the Department is to educate students to solve problems arising from educational practice. Therefore, for several types of problems students have to learn to employ relevant scientific knowledge and to apply systematic strategies for problem solving using appropriate methods and techniques.
From this aim it can be concluded that DEST does not provide a teacher training program, nor that it considers as its prior task to educate for professions in fundamental research. But students in DEST will be educated for professions in which the solving of complex problems within the educational practice is central. From the above it follows that a graduate of DEST must (a) possess (applicable) knowledge from several disciplines, basic to education, (b) be able to apply

technological principles, methods and techniques appropriately, and (c) the aware of his/her societal responsibility, because in the use of technological approach, one must be aware of foreseen and unforeseen side effects of solutions.

b. Four subdomains

It is not desirable that an initial program should educate specialists for only a small range of professions in a small section of the Dutch educational system. So the program must contain elements which are necessary for (almost) all types of possible functions. Yet the preparatory and steering committee considered it as very important that every student during his/her education should go deeply into at least one subdomain of the field of educational science and technology and should be involved in complex problem solving activities in that subdomain. The final 1½ years of the 4 year program are spent in those activities.

This decision leads to a dividing of the DEST staff into four groups. Each group concentrates in their research and teaching on a rather specific subdomain of the field of EST. The criterion for this division was not derived from the professions of educationist (e.g. developer, researcher, evaluator), nor from the basic disciplines (e.g. psychology, sociology, economics), but (analogous to the engineering departments) to the type of problems educators face. The following groups were formed

- instruction: dealing with problems of designing and maintaining teaching-learning situations(-processes) and instructional methods;
- curriculum: dealing with problems of curriculum design, evaluation and implementation;
- instrumentation: dealing with the use of media (including computers) in education, and with the physical environment of teaching and learning; and
- administration: dealing with policy, planning and management problems in education.

In addition, a group for research methodology, methods and techniques was created. It is important to state that creating groups within the department does not mean that the field of EST will be divided into separate parts. The initiators stated explicitely, that these groups were created to give students identification points for the final phase of their study, and that many educational problems need an approach from several points of view, e.g. from instruction, from curriculum, from instrumentation.

c. TO-laboratory*

DEST has a central facility for all types of technical and support personnel which the department might need in teaching and research. The TO-lab is divided into three sections: a learning resource center, a computer section and an AV-section (see 4.2 for explanation).
It is intended that the TO-lab will be a central working place for all DEST members: staff, students,and supporting personnel. They will work together in instructional settings and (in the near future) in research and development projects.

d. Entering level of students

Because of the selective character of the Dutch secondary educational system, only students graduated from the pre-university school may enter the program. All these students will pass the same examinations in language arts (Dutch), and one foreign language (preferably English, which holds for 90% of the current students). A demand of the DEST is that all students will have mathematics (mainly differential and integral calculus) in their program. Students are free in choosing the remaining four courses of their secondary school program. Students with other preparatory education must demonstrate that they have the same entering level as the pre-university school graduates. Because of the centralized examination system in Dutch secondary education, the group of freshmen can be considered as a rather homogeneous group.

e. Early needs assessment

An analysis of the existing job market for educationist and of the announcements of vacant positions in the first half of 1977 resulted in the conclusion that the need for specialists from 1984 on will be somewhere between 190 and 250. Because of the unique position of DEST in the Netherlands (the only complete four year program for the study of educational science and technology, with the integration of social science and technological approaches) the preparatory group decided

* TO stands for Toegepaste Onderwijskunde, the Dutch name of the Department.

to plan the department so that every year a group of 50 students will graduate and enter the job market. Given an expected overall success rate of 65% the yearly class of freshmen may consist of 75 students. To facilitate the time consuming activities for developing the department, it was decided to start in the first three years with 50, 50 and 60 students respectively.

3. PLANNING THE CURRICULUM

3.1. Starting points

Curriculum development activities started in Fall 1978, before the final approval of the Department by the Minister of Education was obtained. During the period Fall 1978 - Fall 1980 a group of 6 academic people was available part time for these tasks (an equivalent of 3.6 man years). The starting situation of this group was in fact described in the document containing the proposal of the new department. Three main points relevant for the development of the curriculum were clear from this report:

a. The department should present a program in which the traditional social science approach of education should be combined with the more technological, engineering type of problems.
   The criteria for selecting the subject matter to be taught in the program should be derived from the analysis of the subdomains of EST (see 2.2). The character of the problems educators will be confronted with and the experience of skilled educators or employers offer additional sources for planning.
b. Besides these starting points the preparatory committee had already concluded from the general goals of DEST some topics and disciplines that must be taught to some extent in the new program, viz. educational theory, social sciences, educational technology, research methods and techniques, selective topics from natural sciences and engineering and, finally, reflection on the pedagogical and societal impact of acting as a professional.
c. Also indicated was that the four year program should contain a variety of practical learning experiences for the students, like laboratory work, cooperation with fellow students, internships and project work (at least one extensive project as a culmination of their study).

3.2. Procedure

Given the guidelines from the policy document the curriculum planners decided to translate them into two starting points for their planning activities:

(i) Use of a systematic approach for solving educational problems, and
(ii) Taking into account the tasks graduates must be able to perform. Educators have jobs within which they have to fulfill a variety of tasks. The word 'task' refers in this context to activities which are derived from a

complexity of subtasks (e.g. evaluation, development). Experts in the field may judge tasks educators are expected to perform. The department has to compare these judgments with its aims and must translate them into program goals and a curriculum, taking into account the specific situation at the Twente University. By choosing this starting point one may expect that the curriculum of DEST may prepare the graduates for their future professional life.

The procedure, followed by the planning group, can be summarized in four phases, each of them indicated below by the products which they must yield (see fig. 3)

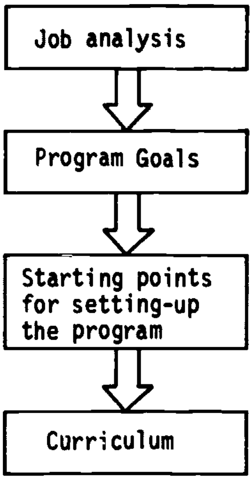


Fig. 3: Procedure for curriculum planning

1. Job analysis

Using the second starting point it was decided to do a job analysis i.e. to analyse the tasks professionals in the field are performing. Starting from the policy document, the available literature and our own experience a list of tasks and subtasks for educators was drawn up. By means of structured interviews 20 experts in the field were asked to judge from their position the relevance of the items on the list. The results of these interviews were submitted for comment to the members of the steering committee (see 2.1) for validation and legitimation. The final results of this job analysis were approved by the board of the department (see appendix 1).

2. Programgoals

The Dest "philosophy" was necessary for transforming the results of the job analysis into program goals, (Starting point 1). This operationalization gives the framework or the organizing principle within which job statements can be translated and ordered into sets of program goals. The results of the operationalization will not be presented in this section; it is used as organizer in the next section, for the presentation of the EST-curriculum. On the basis of a review of the job statements and after consulting documents (handbooks, other programs in the Nederlands and USA) the planning group drew up two lists with keywords, one referring to topics, which might be taught, the other referring to types of activities students must perform during their education (each activity resulting in a specific outcome, e.q. product, experience). The items of both lists were next converted into a first wording of program goals. Further, this set of preliminary program goals was discussed within the department and ordered according to the framework (Operationalization of the starting point 1). Finally, it was decided which program goals should be compulsary for each student and which optional. This last activity was an essential one, because: (i) the number of program goals was too large for a four year program, and (ii) it provided a basis for the division of the four year program into a part common for all students (2½ years) and a part of 1½ years within which students should be able to have a program reflecting their own interests.

3. Starting points for the set-up of the program and for the teaching methods

It was felt that the set-up of the program and the choice of teaching methods must reflect the DEST-philosophy. Using a brainwriting method, all people involved in the preparation of the department contributed in drawing up a list of starting points.

The main items of the list are:

- alternation between practical and theoretical parts.
- much attention in the curriculum on project work
- good spreading of students' study activities over the course year
- preventing arrears in study progress
- modular set-up of courses in the beginning course years
- variation in teaching-learning strategies.

4. <u>The curriculum</u>

The list of program goals contains references to possible courses. On the other hand, the step from program goals to an elaborated, coherent curriculum was too large to take in one time. Therefore, the planning group decided to insert an intermediate step by introducing so called building blocks. These building blocks must be considered as operationalizations of a small number of coherent program goals. They were different in size. Coherent building blocks were grouped together in so called streams (e.g. social sciences, educational technology, research methods). Later on within the respective streams building blocks were transformed into courses (e.g. small building blocks were combined to form a course).

This procedure is applied only to the set of program goals which are compulsary for every student. The results, therefore, is the common curriculum of about 2½ years (including the propedeutic year) consisting of streams of courses (see fig. 4)

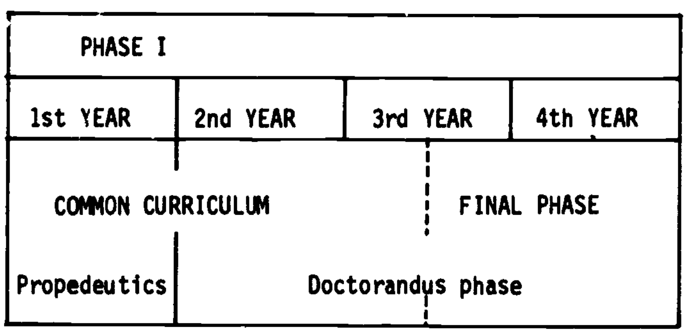


Fig. 4. Structure of the Curriculum

The curriculum for the final phase of about 1½ years is not the same for every student. The program goals referred to in this part of the program are translated into conditions and guidelines. For the students they will draw up their own curriculum for this period.

In the next section the common curriculum will be described, in section 3.4 the guidelines for the next phase of 1½ years will be outlined. An overview of the courses in the program is given in Appendix 2.

3.3. Common curriculum

The description of the common part of the EST curriculum is organized around the DEST main principle, viz. an emphasis on a systematic approach for sòlving educational problems. This EST-philosophy is visualized in fig. 5. The size of the parts of the curriculum is indicated in credits; 1 credit stands for a 25 hour study load for a student (for classes, selfstudy, laboratory work, etc.), while 68 credits = 1 course year.

Remark: In the remaining part of this section using a broad margin and a logo parts of the EST-philosophy are expressed. Each part is followed by an operationalisation into parts of the curriculum. So the marked parts can be read together as an explanation of fig. 5.

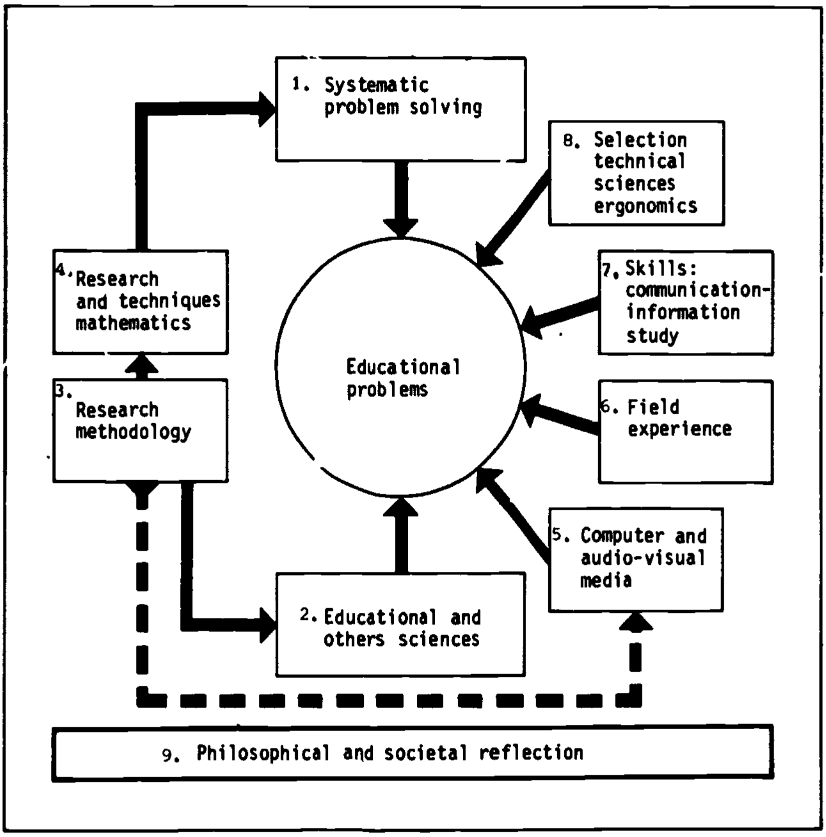
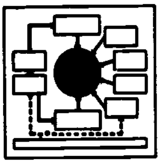
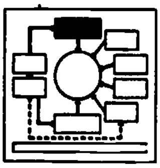


fig 5: Structure of EST curriculum



As noted earlier the EST-curriculum is aimed at educating people who are able to develop solutions for educational problems. The solutions will take the format of products, means, procedures, processes, techniques and/or systems, which are ultimately aimed at improvement of education in all its facets.

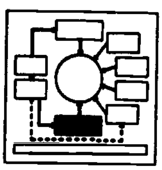


The way in which an EST-graduate will develop solutions is systematic and methodic. It can be described as a cycle with phases like needs-assessment, design and development of the solution, try-out/evaluation and implementation. We are talking about a general (educational technology) model for structured problem solving (see Appendix 3 for a short description). Each phase has its specific methods and techniques. Each class of problems has its own elaboration of the general model and, consequently, its specific choice of methods and techniques. Altogether we may talk about an educational technology, which can be used by educators and others as well. One of the aims of DEST is to improve and to extend educational technology. Courses in educational technology will be a substantial part of the common curriculum, viz. 30 cr., 17%. They are characteristic for DEST and in these courses DEST will distinguish itself from other programs in the Netherlands in which educators are prepared (e.g. within departments of pedagogy or psychology).

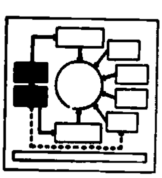
The first ET course (4 cr.) is in the very beginning of the first year. It introduces the students to the general model for educational problem solving (see Appendix 3). At the end of the first year, in a second course (ET 2, 4 cr.), the understanding of the general model will be broadened by demonstrating and experiencing how this educational technology approach is applied to a variety of educational problems. In the second year (ET 3; 12 cr.) the students will study in depth the general model. In this course methods and techniques, which can be used in the respective phases (needs assessment, design, develop, test/try-out, implementation) will be discussed and practiced. During the third year, as a closure of the common curriculum, application of problem solving skills will be central in the fourth course (ET 4; 10 cr.).

During these ET-courses the students will practice a lot; project work is a substantial part of each course. The fourth course will consist almost entirely of project work. As an extra feature, this course will give students a possibility of orienting themselves to the subdomains of DEST, within one of which they

will spend the final 1½ year of their study.
Typical for ET-courses is the attempt to make students familiar with application and ingetration of what tney have studies in the other courses of the curriculum. This does not mean that in those courses no attention should be paid to applications. But application in those (non-ET) courses means mainly application of specific knowledge and theory to specific problems.
The particular approach of ET-courses is that a problem is not situated in one of the disciplinary (sub)domains. This means for a student that in a given problem situation she/he has to ask her/himself, of all available knowledge and techniques, which parts may contribute to a solution. So the features of the problem are decisive for the choice of disciplinary (sub)domains.
The stimulation of such a problem oriented attitude and the development of design skills are main goals of the ET-courses.

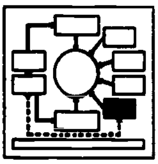


Besides technological knowledge the EST-graduate leans on specific knowledge necessary for solving educational problems. Therefore, educational, social and other relevant sciences will be an essential part of the common program.
Courses in educational sciences have a magnitude of 44 cr. (25% of the common curriculum), while for social sciences (esp. psychology) and others 22 cr. are reserved. (See Appendix 2 for an overview of courses). Depending on the student's topic of the project work during the completion of his study, the student will choose some extra courses in educational and social sciences.

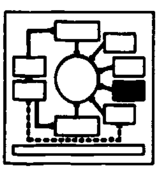


It fairly often happens that an educator concludes that this own knowledge or the available handbooks are not adequate sources in a given problem situation. In this case he/she must be able to generate this scientific knowledge him/herself either by doing research or by judging whether the results of research by others published in journals and reports is reliable and useful. Therefore the DEST-graduate has to have some knowledge of and experience in research methodology and the methods and techniques used therein.
Because educational research methods and techniques are largely rooted in statistics and probability theory, which in their turn are founded in mathematics, we decided to take into the curriculum mathematics (1st and 2nd year, 4 cr.) to bridge the gap with mathematics at the level of pre-university school.
In fig. 5 an arrow from block 4 to block 1 is drawn, because research methods and techniques are also important instruments in problem solving activities,

esp. in evaluation.
Altogether research methodology, educational research .ethods and techniques and mathematics .cover 33 cr. (is 19% of the common curriculum).



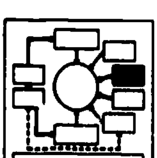
The character of the program indicates that substantial attention must be paid to media - the computer as well as the AV-media. In much educational problem solving, esp. with instructional and curricular problems, one may expect that media will play an important role, because of its potential in teaching and learning. In the common curriculum there are practica in the use of AV-media (1st and 2nd yr., 6 cr.). The applications of the computer not only as an instrument in the teaching/learning process but also as a tool for dataprocessing,is taught in several courses and practica (1st, 2nd and 3rd year, 15 cr.).



Graduates of DEST will cooperate as professionals with others working in educational practice, such as teachers and administrators. A condition for a useful and successful functioning is not only an understanding of the (Dutch) educational system (which will be part of courses in educational sciences), but also an intensive experiencing with and within educational practice. A DEST graduate must know about opinions, problems and traditions within the field.

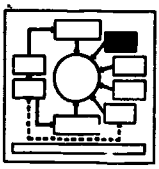
For the sake of clarity, it is repeated that DEST is educating educators and not teachers (except teachers in EST which may find jobs at e.g. teacher training colleges).

Some field experience will be acquired by means of field trips and projects in interaction with or located in schools or elsewhere in the field. In the common curriculum field experience is restricted, but in the completion phase of the study, especially in the final project more attention is given to it.



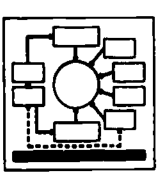
Necessary for effective functioning as a professional is not only knowledge of and experience with the field of education but also the possession of a variety of skills: communication skills, study skills and skills for making use of information systems (libraries, documentation systems like ERIC, etc.) Those skills are also important for being succesful during the study.

In the common curriculum some time is reserved for all these skills. Study skills are practiced in a small course (1,5 cr.) at the very beginning of the program, so that students may profit from it immediately. The use of complex information systems is taught in a small course (1,5 cr.) at the beginning of the 3rd year, when students have studied enough to understand the relavance of it. To be able to communicate with professionals and non-professionals in the practicum on communication skills (4 cr.), spread over all years, attention is paid to oral and written reporting and to functioning within groups (e.g. formal meetings, project groups).



During his/her study a student will not only study educational technology but will also be confronted with the material and technical aspects of educational problems and solutions. In courses on media, students will learn about the use and application of media. The department considers it important that DEST graduates also know something of the technical principles of the equipment they will use so that they are at least capable to communicate adequately with technicians.

In the common curriculum two small courses are included to attain these goals, viz. selected topics from science and ergonomics. Ergonomics or environmental sciences deals with problems concerning people and their work environment; for education emphasis is on problems about adjusting the physical teaching and learning environment for human beings.



Problem-oriented study emphasizes thinking in terms of goals/ ends and means. This involves some danger in that people are so fixed on searching for means to attain the stated ends, that undesirable side effects of solutions often occur (e.g. the problem of the waste in nuclear energy). DEST considers it very important that students will learn to reflect on their educational technological work. For this reason in the program a substantial place is reserved for courses on philosophical and societal reflection on educational R&D activities.

In the common curriculum there are two courses (each 4 cr.) in this domain, viz. philosophy of educational R&D and philosophy of education (conceptions and utopias of education). There are two extra courses (each 4 cr.) in the final phase of the study, culminating in an essay the student must write at the end of the study, in which she/he has to discuss the social impact of the work she/he did as a final project.

3.4. The Final Phase

The final phase of the four year program will take a little more than 1½ years. The curriculum for this part (96 cr.) is no longer common; every student may follow his/her own interest to a large extent.

It is not possible to educate a specialist in a four year program. Yet, because of the problem orientation within the program, the DEST considers it very important that every student will be active in complex problem solving at least once during his/her study.

Therefore, as a substantial part of this final phase, every student has to take part in project work in one of the four subdomains of DEST, viz. instruction, curriculum, instrumentation or administration. (See section 2.2. for a short description.)

The orientation of the project must be on educational technological problem-solving, i.e. every student has to be involved in developmental work and applied research. Because of the project's functions of more in-depth study of a sub-domain and careful application of theoretical knowledge to a concrete problem, part of the project work (9 cr.) has to consist of a literature study.

The project will (as much as possible) stem from a certain part of educational practice. Therefore, to get familiar with that sector of the field, a short internship (5 cr.) will be part of the project work.

Altogether, the project work will take almost half of the final phase (46 cr.). The remaining part of the final phase (50 cr.) is spent on course work. which will be largely chosen in connection with the project work. To attain that purpose, the total package of course work is sufficiently broad but some constraints are set. For example, every student has to choose two courses within the domain of philosophy and reflection on education and educational R&D, at least one course on educational research methods and techniques, and also at least one in educational technology. Besides, she/he may choose at least five courses according to his/her own interest and preference (see Appendix 2).

4. CARRYING OUT THE PLANS

In 1979 and 1980 the team which was preparing the new department consisted of six academics.Near the end of 1980 and in the spring of 1981 the staff increased to about twenty people. This induced some unexpected problems. It appeared that the interpretation of planning documents depended on the experience in former jobs to a larger extent than anticipated. Unfortunately, for several reasons, there was no sufficient time to discuss these matters thoroughly. One of these problems was that faculty recruitment was retarded to such extent, and we had less than one year for course development. Therefore there was hardly time to get the minds synchronized to build a coherent curriculum. But we managed to do so, although after one year of experience many things will have to be improved.

4.1. Course construction

The first year of the program consists of 16 courses. To develop these 16 course teams were formed. Every academic member of staff contributed to three or four of the teams. This was purposely done in the hope that this arrangement would automatically provide for sufficient communication between course teams. The whole operation was coordinated by the SCCA (Standing Committee for Curricular Affairs) which issued guidelines and a time schedule. The course teams had to carry out six tasks:

1. Elaboration of the goals and content of building blocks into keywords, literature specifications, etc.;
2. Elaboration of building blocks with regard to instructional procedures, exercises and evaluation procedures;
3. Consultation with other course teams and allocating building blocks into courses or course modules;
4. Altering the content of different building blocks in consultation with other course teams insofar as these blocks depend on each other;
5. Developing and producing course materials; and
6. Making a course management plan.

Most course team- had trouble keeping on schedule and delivering information in time for the study guide, getting manuscripts ready in time, and so on. As a consequence, the course teams were inclined to stay on their own track. Consultation of other course teams was less than was planned for. On the other hand, information exchange did occur on an informal basis because of the fact that everyona was involved in more than one course team. In the section on evaluation of the program we will return on this subject.

4.2. TO-laboratory

In the technical universities in the Netherlands, and so in Twente as well, it is usual that every division in a department has its own non-academic personnel (technicians, etc.). In variance with this approach DEST has pooled all non-academic personnel, technical and spatial support for instruction and research in the department. This was done for reasons of efficiency, and to facilitate cooperation between divisions.

TOlab has six tasks:

- Building up the necessary hardware and software configurations;
- Setting up and maintaining laboratory spaces;
- Supporting instruction and research projects;
- Training staff and students on the use of lab facilities;
- Developing and maintaining hardware; and
- Managing in the TOlab.

TOlab is divided in three sections:

1. Learning Resource Center, which offers facilities for individual study as well as facilities for the viewing of audiovisual materials in small groups. The larger part of the collection consists of book materials. Recently the non-book collection was started.
2. Computer section. In this section one will find terminals which are connected to a central mainframe computer, a minicomputer system with peripherals, and a microcomputer network.
3. AV-section. Here one has a graphics workshop, photographic equipment and darkroom facilities, and facilities to produce audiotapes, tape-slide-series, videoprograms and super-8-films. Further one finds presentation equipment for the use in conference rooms and lecture theatres.

TOlab is meant to be the heart of the department, where TOlab personnel, academic staff and students work together in instructional settings as well as on research and development projects. TOlab is still developing, but as far as one can see from the way it is starting and the devotion of the people who do the job, it is likely to be successful. See Appendix 4 for map of TOlab.

4 3. Student recruitment

The success of DEST depends on whether enough students who graduated from pre-university schools are interested in the program. The possibility of studying educational sciences right from the first year in university was completely new, and notwithstanding two information days for prospective students in the fall of 1980 and the spring of 1981, the distribution of a brochure to school deans and prospective students, an extra information day for school deans, and articles in a journal for school deans and in a information journal for prospective students, it was quite uncertain how many freshman we would be recruited. We could not take the risk to get too many students, which would have been disastrous for the development of the rest of the program and the start of research and development projects. DEST was planned for 50 students, and in the end we got 42. The financial scheme is based on the entrance of 50 students in 1981, 50 in 1982, 60 in 1983 and from there 75 students each year. From now on we will pay more attention to the recruitment of students. This year we organized a campaign in cooperation with the public relations department of our university, including the distribution of written materials as well as a videotape and visits to pre-university schools. Slightly more than 60 students have matriculated into the 1982 class.

4.4. Prognosis

This paper is about the four year post secondary program which is phase I in Dutch university education. There is also a second phase, as described in 1.3. Dest plans to offer programs in both phases. To give an impression of the size to which DEST is supposed to grow this chapter ends with an overview of numbers of students and personnel:

Table 1

dest	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90
students:										
1 st. yr	43	64	60	75	75	75	75	75	75	75
2 nd. yr		35	52	48	60	60	60	60	60	60
3 rd. yr			33	49	45	56	56	56	56	56
4 th. yr				32	46	44	55	55	55	55
5 th. yr					19	28	26	32	32	32
6 th. yr						7	9	8	11	11
total	43	99	145	204	245	270	281	286	289	298
personnel:										
academic	24	31	37	39,5	47	45,1	45,1	45,1	48,6	48,6
non-acad.	13,5	14,5	17,5	20,5	25,5	27,5	27,5	27,5	30	30
total	38,5	45,5	54,5	60	72,5	72,6	72,6	72,6	78,6	78,6

Table 1: Prognosis of numbers of students and personnel during the first 10 years.

5. EVALUATION OF THE PROGRAM

The first year program was developed with the utmost exertion of the available personnel. The result has to be considered as the first approximation of the propedeutic curriculum. Evaluation will produce the necessary data for further development. In principle the evaluation within DEST is planned for the whole curriculum. But, as we just finished our very first year, we can only show the results of the evaluation of the first year program. The main aim of the evaluation is to gather information for the improvement of the program. Next to this, the evaluation is organized in a way that provided possibilities to make adjustments during the year, to protect students from consequences of less successful parts of the program. Finally, the set up of the evaluation procedure is such that after one or two years we expect to have a standard procedure which costs students and staff minimal time to execute.

5.1. Evaluation procedure

There are several sources for getting evaluation data about the program. First of all, every course is or will be evaluated with a standard procedure:

- The evaluation is managed by an evaluation coordinator, one of the members of the DEST academic staff.
- For every course four students are involved and one teacher of the course team. (This means that during the first year, with 40 students and 20 courses, every student was called on two times.)
- As soon as a course has been finished the appointed students come together for a preparation meeting. During this meeting the evaluation coordinator explains the aims and the procedure of the evaluation. Next the given course is discussed using a checklist. In this checklist attention is paid to:
  - goals and objectives;
  - methods and media;
  - content;
  - study behavior and teacher help;
  - assessment;
  - study satisfaction; and
  - the preparation of the evaluation session.

- Next the evaluation session is organized. During this session only the students meet with the teacher who represents the course team. One of the students acts as chairman, another as secretary. The evaluation coordinator may be present on request. Using the results from the first meeting the students discuss their conclusions about the course with the teacher. At the end of the session the discussion itself is evaluated.

  The secretary writes a report on the session which - at the same time - is an evaluation report of the course. Both positive and negative points are stated. As far as negative points are concerned one tries to work out proposals for possible measures during the evaluation session.
- Copies of the evaluation report are made available to the teacher, to the SCCA, and to the evaluation coordinator. The teacher informs the SCCA, students and coordinator whether he agrees with the report or not. If not, he makes a written statement on his objections.
- Emergency alarm.

  It is possible that during a course students or teachers feel that certain points cannot wait for action until the termination of a course. In such a case they will of course first of all approach each other to try to find a solution. If that does not work out one may raise the alarm. The evaluation coordinator will than try to manage the problem.

To make the standard procedure effective it is necessary that relevant information becomes available in due time for taking action. Therefore the evaluation was planned on a tight time schedule, and staff and students were briefed for maximum cooperation.

The standard procedure is not the only information source in our evaluation method. There are three other sources:
- The student administration, where all the collected credits are registered, gives information about the individual progress of the students.
- Every group of about twelve students has a member of the academic staff as tutor. The tutor advises the individual student about his or her studie plans. In this function he learns much about the students perception of the program and about apparent problems.
- For the end of every course-year a questionnaire is planned to ask about the students opinion on the year as a whole.

5.2. Results of the first year

It appeared that the standard procedure produced information less quick than was planned for. The meetings of the student evaluators with the evaluation coordinator and most of the teachers did take place on time, but after this it took some time before the students deliverd their written evaluation report. Here there appears to be a close connection with the study load. The students were very busy with their study, and were understandably inclined to postpone activities for which they cannot earn credits. (At one time this study load increased to such a level that the alarm was risen, as will be described below.) Via the standard procedure, the tutors, a letter signed by 26 students, and the questionnaire there is altogether enough material available to tell something about the success and the appreciation of the program.

First of all there are many points on details of teacher behavior, course organization, course content and logistics. Although of course important and worthwhile paying attention to, these points are not to be mentioned here. But there are two points that are closely related to our instructional approach worth mentioning:

- The effect of the modular set up of the program, and
- The interrelation of courses

Two further relevant points are:

- Study load, and
- Number of possible drop-outs.

Modular course construction

All first year courses are built of modules with a study load of about 40 hours each. At the close of every module there is a test, or a task to carry out. As much as possible one applies the principles of mastery learning. For the testing this means that quick feedback is provided for, that students who failed get involved in some remedial activities, and that retests take place after a short time, generally within fourteen days.

The rationale for this modular approach is that in this way first year students are helped to make the transfer from the pre-university school to the university. The idea is that guidance of study behavior in a system consisting of short modules will bring students in a work pace which help them to survive later on where they gradually have to plan their study activities more and more independently.

The effect of this approach however appears to be that a visible minority of students feel that they live from test to test in a never ending hurdle-race. After a discussion with students, the SCCA concluded that the ideas behind our modular format are sound, but that its realization has to be improved.

Interrelation of courses

A problem for DEST was that the recruitment of personnel took more time than expected. Different course teams were therefore only complete on a relatively late date. Moreover, it appeared that the original planning group endorsed a philosophy about DEST that was not enough explicit to serve as a guide for the introduction of new staff members.

New personnel with their own experiences and beliefs less easily adapted to the approach that on paper seemed to be appropriate, due to the fact that more interpretations appeared to be possible than expected. To be clear about this it is necessary to state that the differences are rather subtle, and that there is no question about conflicts. As said earlier, the staff is working hard to make DEST a success. But the fact is that subtle differences in approach, combined with time pressure to construct courses, obviously lead to a curriculum where the interrelation of courses is far from perfect. The students appear to detect this faultlessly. And it is one of the more important points to work on while preparing the next round of our first year program.

Study load

According to the Minister of Education the academic year has to consist of at least 42 study weeks, the other weeks being for holidays around Christmas and Easter and the Summer holiday. In Twente we use a system where there are three weeks without instructional activities within the 42 week periods that are meant for:

- recovering from the efforts of the preceding period,
- working off incomplete work, or
- doing extra work for enrichment.

Further, the very first week is spent in the general introduction of first year students to the university and campus life.

Most of the next week is spent in introducing students to the department.

Part of that week is spent on actual coursework. The final week of the course : is divided between course work and meetings of the examination board.

As a result, there are 64 credits to earn in 37 weeks. This assumes that every student tries to be free from obligatory activity in the three extra weeks without instruction. The actual workload in the 37 weeks however is the equivalent of 66 credits due to library instruction and fieldtrips. These activities do not directly influence the examination results. This makes a work load of about 44 hours per week during 37 weeks (including everything: seminars, self study, tests, etc.) For the first year this was planned as illustrated in figure 6.

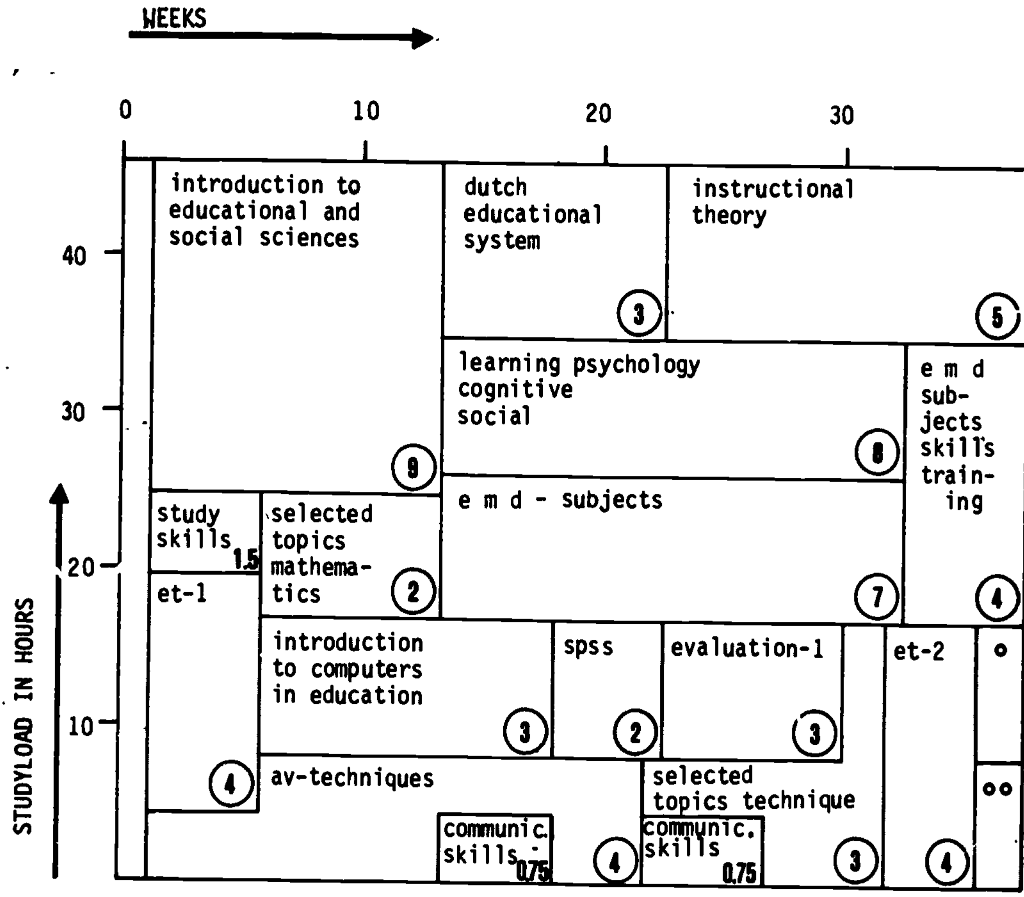
Figure 6 relates the period from September including instruction-free-weeks and holidays until the second week in July. If we round off that period to 10,25 months, the mean study load per month ought to be the equivalent of 6,4 credits. This was not the case, as should be clear from figure 7.

In february, with March ahead, the alarm was risen. On behalf of the SCCA and in concern with the teachers involved there were some necessary adaptations made in the program insofar as that was still possible. Here, the main issue is: how could a curriculum that is planned for an even study load suddenly appear to show a peak?

1°. In a sense, many courses were still under development while the first year had already started. Decisions about content and treatment led to changes in points of time for testing, and to (homework) tasks that were not foreseen.

2°. Some staff members were experienced in making courses for students on a graduate level, and showed difficulties in handling the entering behavior of freshman coming from the pre-university schools with the ability to read a limited number of pages per hour. This resulted in a study load in the very first months which was too heavy from the point of view of many students.

3°. These two points combined led to a peak in March while the students were already tired from a slightly non-planned overload in the autumn of 1981. Here we find also one of the reasons that certain students perceive the modular cour e structure as a hurdle-race; being overloaded kills every individual initiative, and what remains is an attempt to reach the finish of the next module in time. This does not apply for all students. A minority that found itself in trouble included a general uneasy feeling in the class. But there were also students who had no problems with the program offered. One circumstance that caused trouble here is that the modular system seduces the weaker students to try to stay in the prescribed pace, in stead of making realistic study plans according to their capacities.



o meeting examination board
oo declaration of results
et - educational technology
emd - educational measurement and data-analysis

Number in circles = credits

(4) = 4 credits (4 x 25 hours of study load)

not included: fieldtrips and library instruction
(together 2 credits)

fig. 6: (clusters of) courses scheduled throughout the 37 studyweeks in the first year.

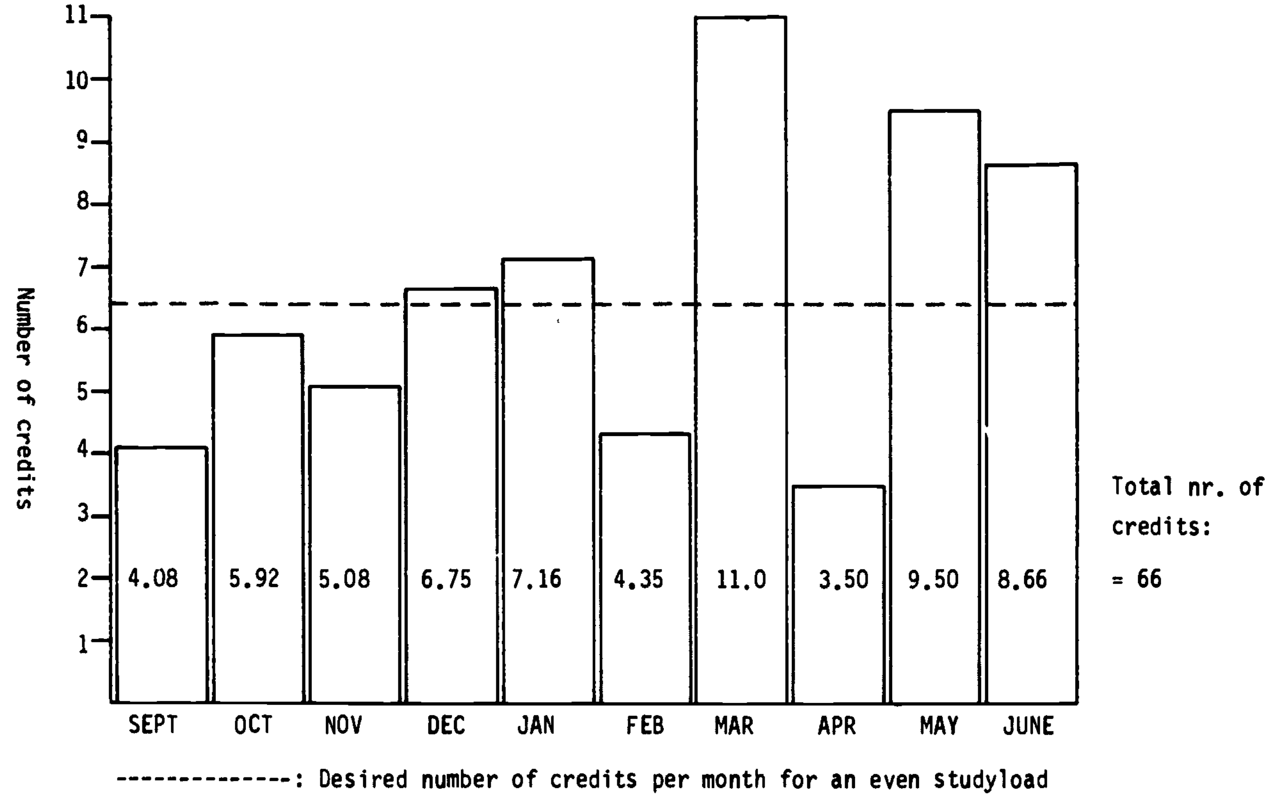


Fig. 7: Number of credits to earn in each month of the academic year 81-82

Another observation is that the study load in general appeared to be such that students did not study extra materials for enrichment.

The lessons learned on this point are twofold:

- On a central level more attention has to be paid to scheduling of tests and tasks, and
- The estimation of how much work can be done by freshman has to follow explicit rules.

Number of possible drop-outs

Figure 8 shows the state of the art at the beginning of september with respect to the completion of the propaedeutic program (64 credits).
Two students left the program after four months. They are the numbers 42 and 43 in the figure. Twenty-five students (or 58%) completed the one year program within the shortest possible period.
Every student has two years time to round off his or her first year courses. We suppose that it is not too optimistic to expect that at least another eight students will round of the first year program on time. (This number is equal to the number of students who only need another five or seven credits). The total number of students that completed the first year program will then be 33, or 76.7%. According to the planning, the first year program should yield 75%. We think it to be possible that the very first group of students will do slightly better than that.
Although these students are generally doing well, it is at this moment not possible to know whether we may be satisfied or not. The first group of students is rather special. They know it. There is plenty of attention from the staff. They have reasons enough to feel themselves the pioneers of DEST as well as the present staff does. We need some years of experience to find out about the efficiency of our program. Notwithstanding this, the present results are hopeful.

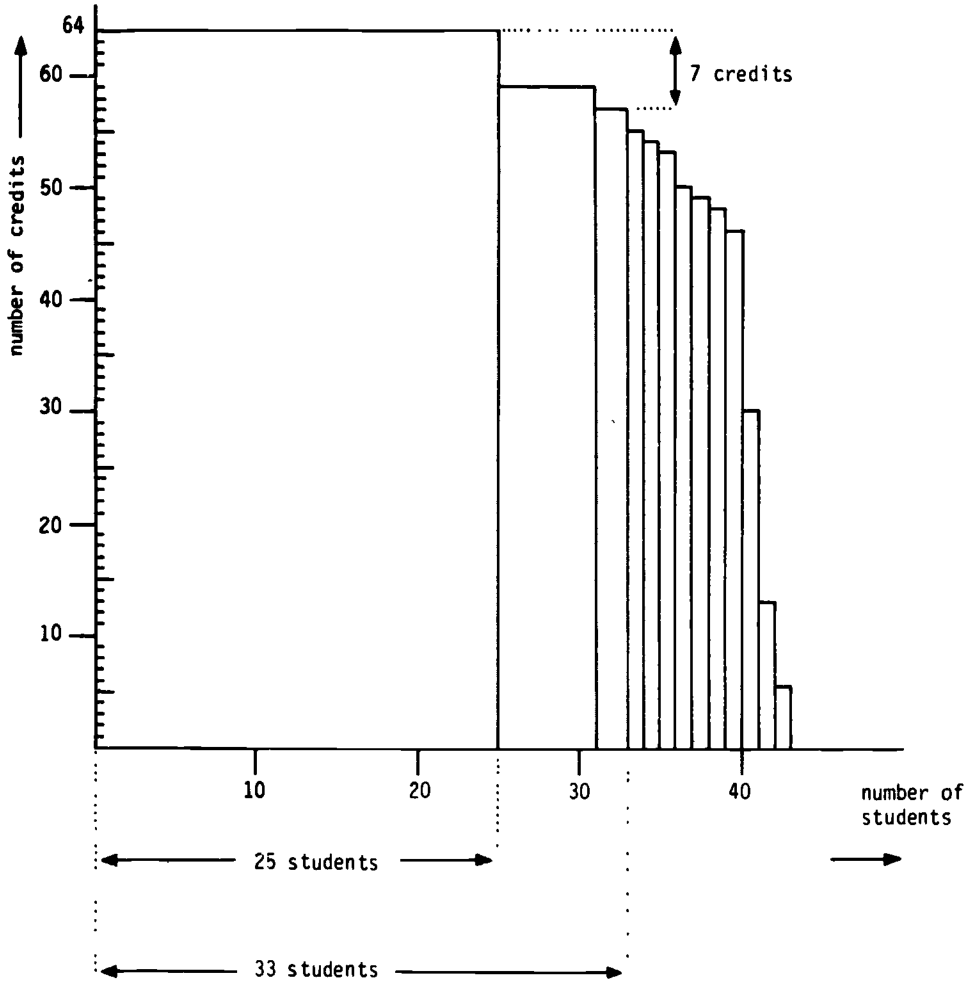


Fig. 8.: Earned credits on the 8th of september 1982 (explanation: see text)

6. CONCLUDING REMARKS

Looking back we dare to say that after three years of full-time preparation of DEST, first with a small staff and later on with a growing one, we managed to install a new university program within a university, where for the first time in the Netherlands, educational sciences and the engineering approach are explicitely combined in a curriculum. The result is a complete (from the first year on) program with a heavy accent on educational technology. Now, shortly after the first year, for the first time we are able to evaluate some aspects of program success.

The conclusion is positive, but we have learned a lot about how to improve our first year courses deliberately.

The main points are:

- To provide for more freedom for the students to plan their studies within the limitation of the modular set up
- To be more realistic about the capacity of freshman to assimilate (abstract) information after just leaving the pre-university school, and
- To make clear the functions and interrelation of the different courses, with the future professional functioning of the students in mind.

This last point may be the most difficult one, due to the different views on educational technology, and so in DEST as well. The range of the problem was last year unconsciencely underlined by Ely. In a videoprogram which was produced when he stayed in Twente, Ely presents the definition of the field of Educational Technology. In that program he warns against ill-defined terms, for, as he states (with a wink at Confusius), when terms are ill-defined judgement becomes arbitrary, and when judgement becomes arbitrary people don't know how to move hand or foot. With DEST is is not só bad. But one might say that our program still lacks coherence. This is partly due to different opinions about content and role of several courses, especially of the courses in educational technology.

But we are aware of this, and initiatives have already been taken to discuss those problems on the departmental level. In concert with this recognition we planned our second year and were already adjusting the first year program. Further we already started to offer the EST program to part-time students.

A consequence of the multitude of tasks is that it will take several years to attain a stable program. But from the experience so far we are convinced that we are on the right track.

Appendix 1

Results of the job analysis

As part of the activities for planning the curriculum in 1979 a job analysis was performed*. The procedure used for this analysis is summarized in 3.2. (under job analysis).

The function of the job analysis was not to get a complete and validated overview of tasks and subtasks which educators in general may perform. The function was just to serve as a step in developing the DEST-curriculum. This means that the preparatory group has not strived for complete agreement and validation of the elaboration of tasks and subtasks. The members of the preparatory group were satisfied when they reached the point that they had the feeling of being able to analyse sufficiently what DEST-graduates must know and be able to do to function adequately as a professional.

The results of the job analysis are discussed within DEST. It was concluded that within the constraints of the department (e.g. duration of the program) it is not possible to translate all tasks and substasks fully into program goals for all the students. Of certain tasks one must be content with program goals on an introductory level (e.g. 1B). In other cases one decided to offer students as an option to go further than an introduction (e.g. 6A-D).

The results of the job analysis are divided into the following seven groups of tasks and subtasks.

1. ADMINISTRATION, MANAGEMENT AND POLICY MAKING

   This task indicates activities facilitating the functions of a work unit in such a way that other tasks can be done. The work unit differs in size; for example a project team or an institute.

   The subtasks have been grouped in three cagegories:

   - A. Management and administration a project
   - B. Management and administration an institute/agency
   - C. Policy-making in the field of education.

* This jobanalysis is contributed by Dr. Robert Harris (College of Education, Indiana University, Bloomington IN and Dr. Dennis Herschbach (College of Education, University of Maryland, College Park MD), who spent 1979 as Fulbright-Hays fellows at DEST.

1A. Management and Administration of Projects

1. Plan and monitor project
2. Recruit and manage personnel
3. Prepare and administer budget
4. Maintain and contact with relevant agencies and groups

1B. Management and Administration of an Institute/Agency

1. Interpret laws and regulations
2. Formulate institutional aims and goals
3. Formulate and implement procedures for the operation of the institution
4. Prepare and administer institutional budget
5. Establish and maintain lines of communication
6. Manage personnel and conflicts
7. Manage resources, facilities and equipment

1C. Policy making in cooperation with external agencies and other institutions in the field of education

2. DISSIMENATION, IMPLEMENTATION AND INNOVATION

This task refer to activities for bringing about in individuals, groups, institutions.

- innovation; activities related to the planning and construction of changes
- dissemination: activities related to the scattering of changes;
- implementation: activities related to the inducting of changes.

1. Apply, adapt or develop a model or strategy to facilitate innovation
2. Diagnose elements of the problem or intended innovation
3. Analyze capabilities of the resource system
4. Institute and carry out a strategy
5. Feedback outcome of the dissemination/innovation effort.

3. EVALUATION

This task points out the empirical inquiry activities to be distinguished from research activities because the main purpose of evaluation is not the advancement of topical knowledge but the generation of crucial information for making judgments and or decisions.

In educational settings, evaluation can play diverse roles according to the type of information it has to yield for making judgements or decisions concerning a special issue. These diverse roles have been given different names,

such as formative or summative evaluation.
Central in all these roles are concepts such as 'value' or 'worth' and 'optimality', concepts closely connected with the acts of judgements and decision making.
Broadly speaking, evaluation as an inquiry activity plays its strongest role in change processes, such as innovation or developmental activities, because determination of the 'value' of a given state and decisions based on this determination can influence directly and strongly the course of events.
The description of task statements here given however is not directed as specifying a special evaluation role, rather aimed it at tasks and subtasks that are common to most evaluation problems.

1. Clarify evaluation purpose
2. Clarify the pattern of the 'value' aspect in the evaluation problem
3. Explicate the structure of the evaluation problem and design the workplan
4. Develop data collection and monitoring procedures
5. Construct evaluation instruments
6. Locate, select and/or adapt evaluation instruments
7. Apply instruments for data collection
8. Analyze and interpret data
9. Implement evaluation conclusions
10. Make decisions based on evaluation conclusions
11. Quemac evaluation activities (what Question, Event-object, Method, Answer, Concept).

4. COMMUNICATION

On the one hand these task elements refer to the management and control of communication, on the other hand to communication itself

1. Prepare communication documents
2. Develop and maintain communication system
3. Develop and conduct public relations
4. Develop an archive system
5. Participate in communication processes

5. RESEARCH

This task points out to activities to enlarge knowledge and understanding of educational disciplines and educational technology. Research will have different modes, such as experimental or "field based".

1. Prepare proposal
2. Prepare research designs
3. Execute research (experimental, developmental, fieldband)
4. Verify and to report the results
5. Interpret and to apply the results to the problems
6. Conduct research activities
7. File the literature on the field in study

6. DESIGN AND DEVELOPMENT

This task refers to activities of analyzing educational problems, designing and developing solutions to these problems and assessing its effectiveness and efficiency. Three areas of focus will be distinguished:

A.: Curriculum problems: designing, concretizing and implementing of curricula. Curriculum is u [illegible] in the meaning of a plan which indicates the goals, content element, [illegible] structional procedures and media and the connection between these components.

B.: Instructional problems: designing improvement of teaching/learning situations.

C.: Media and instrumentation problems: instrumentation of education, development of media and designing of learning environment.

In the following for each focus an elaboration of the task Design and development, will be given in terms of subtasks and task elements.

6A. Curriculum problems

Remark: this analysis will not go into the aspect of implementation of curricula. This aspect will be covered in the elaboration of task 2: Dissemination, implementation and innovation.

1. Adapt or develop a model or strategy for curriculum development or revision
2. Determine aims and goals
3. Analyze resources and constraints
4. Select, organize and structure curricular context
5. Legitimate curriculum
6. Prepare and write curricular materials

6B. Instructional problems

1. Formulate learning outcomes
2. Develop assessment procedures
3. Develop teaching-learning strategies
4. Assess learner characteristics
5. Determine instructional sequence
6. Determine the need for and select materials and media
7. Develop instructional management procedures
8. Diagnose teaching/learning problems
9. Evaluate teaching/learning process

6C. Instrumentation and media problems

The subtasks below refer to what might be expected from an media specialist. A DEST-graduate might be expected to describe and prescribe desired actions, but will usually not perform them him/herself. (Media includes, besides AV-media, computers and other electronic media.)

1. Advise and assist in media production and purchase
2. Design a multi-media system
3. Design a physical learning environment
4. Analyze instructional problems on the use of media
5. Participate in media supply system
6. Train people in media application

7. TRAINING AND CONSULTATION

This task refers to activities for bringing about the adoptions of new insights, skill, attitudes and changes in taskfullfillment or the operations of an organization.

1. Provide consultations
2. Present workshops
3. Provide trainings

Appendix 2

Curriculum of Educational Science and Technology

The four year curriculum of EST consist of a propedeutic year and a doctorandus phase of 3 years. The propedeutic year and about half of the doctorandus phase constitute the common curriculum. In the final phase of 1½ years the student will choose one of the four subdomains within DEST (instruction, curriculum, instrumentation, administration) in which he will complete his study. Summarized: we have (1 credit = 25 hrs. study load; 1 course year = 68 credits):

Propedeutics	68 credits
Doctorandus phase:	
- common part	108 credits
- final phase	96 credits
Total	272 credits

A. COMMON CURRICULUM

The courses in the common part of the curriculum are divided into "streams' of interrelated courses.

COURSE	credits	year
1. EDUCATIONAL TECHNOLOGY	(30)	
Ed. Tech. 1: introduction	4	1
Ed. Tech. 2: broadening	4	1
Ed. Tech. 3: deepening	12	2
Ed. Tech. 4: application	10	3
2. EDUCATIONAL SCIENCES	(43)	
Introduction	4	1
Dutch Educational System	3	1
Instuctional theory	5	1
Curriculum theory	5	2
Instrumentation theory	5	2
Educational Administration	5	2

Course	Credits	Year
Introducation to evaluation	3	1
Theories of evaluation	4	2
Learner assessment	3	2
Theories and models of innovation	3	2
School curricula	3	3
3. SOCIAL AND OTHER SCIENCES	(22)	
Introduction	5	1
Learning and cognitive psychology	5	1
Social psycho:ogy	3	1
Developmental psychology	3	2
Educational sociology	3	3
Systems theory	3	2
4. METHODOLOGY OF EDUC, R&D	(33)	
Introductory module	1	1
Mathematics: selected topics calculus	2	1
Probability theory	5	1
Educational measurement (incl. lab)	5	1
Methodology of empirical research (design, statistics, etc)	8	2
Psychometrics and scaling	5	2
Mathematics: s lected topics matrix algebra	2	3
Data analysis	5	3
5. COMPUTER AND-AV MEDIA	(21)	
Educational computing: introduction	3	1
SPSS	2	1
Introduction to programming (PASCAL)	3	2
CAL: programming + applications	3	2
Educational computing	4	3
Audio-visual practicum	6	1,2
6. COMMUNICATIVE SKILSS	4	1,2,3

Course	Credits	Year
7. TECHNICAL SCIENCES	(6)	
selected topics technique	3	1
Ergonomics (environmental science)	3	3
8. PHILOSOPHICAL & SOCIETAL REFLECTION	(8)	
Philosophy of educational R&D	4	3
Philosophy of education	4	3
9. OTHERS	(9)	
Introduction to university and campuslife	1,5	1
Study skills	1,5	1
Field experience	4	1,2,3
Information resources skills	1	3
Evaluation of scientific publications	1	3

B. FINAL PHASE

In this phase of 1½ years, two parts can be distinguished. All activities will take place in the second half of the third and in the fourth course year.

1. FINAL PROJECT	credits
Field experience	5
Literature study	9
Project work	32

2. COURSE WORK

Optional coursework is limited by the following constraints:

Courses within subdomain of projectwork	8
Educational Technology	4
Methodology of educational R&D	4
Practicum instructional skills	3

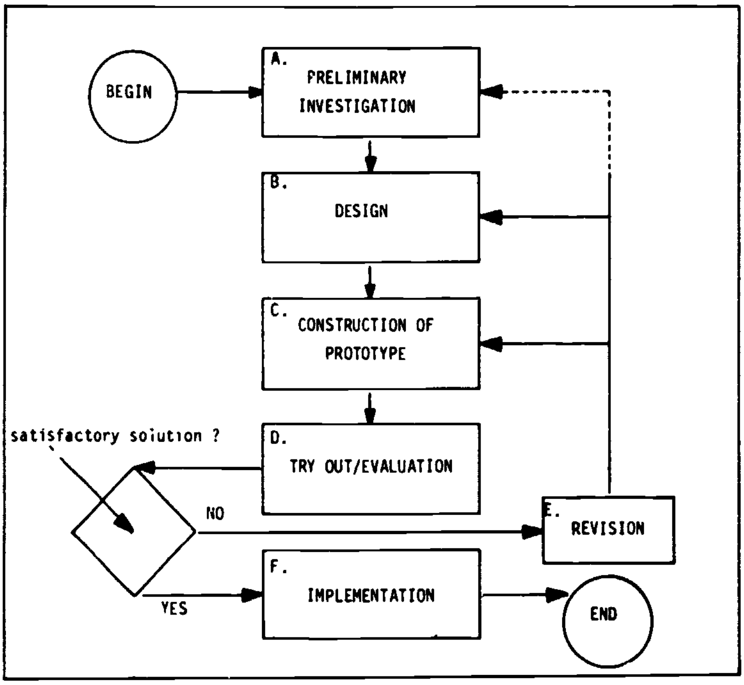
Philosophy & societal reflection	8
Free choices within DEST	15
Free choices outside DEST	8

Appendix 3

General model for structured problem solving

In section 3 is talked about a general model for educational problemsolving.
In this appendix a short description of this model for a systematic or structured approach for solving educational (and other) problems is given.
We speak of a problem if there is a difference between an actual and a desired situation, which is so large that people concerned to it are willing to diminish this difference.
Solutions of problems bridge the gap between the actual and the desired situation.
Solutions will take the format of products, means, procedures, processes, techniques, systems, etc.

The general model is schematically represented in the figure



Explanation:

a. Preliminary investigation

This phase is divided up into three subphases:

Problem orientation, resulting in a tentative problem definition and the decision whether the problem will be solved (an by whom).

Problem analysis and definition, resulting in a more definitive problem definition, also including a context analysis and a consultation with persons concerned with the problem.

Planning of problem solving activities resulting in a managementplan, including timelines and tasks and responsibilities of persons involved in problemsolving proces.

b. Design

In designing a solution for a problem, the following subphases are distinguished:

Determination of design goals starting from the problem definition, resulting in an overview of design goals and subgoals, including a list of constraints and facilities which have to be taken into account.

Generation of possible solutions resulting in an overview of possible solutions within the given constraints and facilities.

Evaluation of solutions resulting in the choice of a solution. Usually the endproduct is a plan or a blueprint containing all elements and specifications; for constructing a first version or prototype of a solution for the problem.

Remark: possible conclusions of the design phase might also be that no acceptable solution can be found, because e.g.

- the problem is not solvable at the moment,
- it is not useful to solve the problem at the moment, because its context will change too rapidly,
- the costs of an acceptable solution do not balance its benefits.

c. Construction of a prototype

Starting from the results of the design phase a first version or prototype of the solution will be constructed. Depending on the character of the problem the solution may have different formats (see above).

d,e,f. Try out, evaluation, revision, implementation

In a try out one may examine how far the prototype meets the criteria for the solution: Without evaluation no valid conclusions can be drawn. Therefore evaluation is one of the essential characteristics of structured or systematic problem solving.

Based on the evaluation, one may conclude to revise either the prototype (or parts of it) or the design of the solution. One may even conclude to supplement the preliminary investigation, e.g. to sharpen the problem definition.

Often a number of iterations will be necessary before it can be concluded that an acceptable solution is developed. Only then the solution can be implemented.

From the preceding it is clear that implementation can only take place if there are sufficient guarantees that the solution will be accepted by the people concerned and that the desired situation will be attained.

Warning: the schematizing of the general model suggests that the phases of the general model must worked through in a linear order. Expressly we pointed to it that this is not necessarily the case in structured problem solving. Very often, during a certain phase incompleteness will be found in the results of a preceding phase; these must be worked off. These changes may in turn influence results of other phases; etc. This means that there are usually more feedback loops, than the one drawn in the figure.

Appendix 4

TO-laboratory: Floorplan