Planning at the University of Utrecht

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The Dutch Universities are at present confronted with a reduction of means and a still increasing number of students. In this situation the need for planning and planning instruments arises. This paper gives a brief description of the planning model now used within the University of Utrecht. This planning model has a marked preference for the teaching process and does not determine independently the need and the consequent resources required with regard to the other tasks of the University. To describe the teaching programmes the method of curriculum-outlines is developed. A curriculum-outline is a representation of a teaching programme or a part of it, which enables us both to compare the organisations of the teaching programmes of the various fields of study and to determine the teaching load of the academic staff. First this method is used to discuss the organisation of the teaching programmes on the university management level and between this university level and the faculty management level. Second this method is used for allocation of academic and non-academic staff. Some figures of the results of this method within the University of Utrecht are given. In the last section of this paper some future developments in the planning at the University of Utrecht are briefly discussed.

1. Introduction

The Dutch Universities are at present confronted with enormous problems caused by developments which they cannot influence themselves. The Management of the Universities has to take into account, not only no increase but even a reduction in the provision of means and an ever increasing number of students in certain fields of study.

The University of Utrecht is especially hard hit by these problems, as this University is very popular with prospective students. Table 1 gives some figures of the prognosis of numbers of first-year-students in some fields of study.

Where staff is concerned, the University of Utrecht cannot expect any increase in the next few years, on the contrary, a small decrease in the number of staff (2%) is rather to be expected. At present the number of staff assigned to this University is about 5500 full-time staff-members. It will be clear that an increase in the number of students entails an increase in the teaching-load of the staff. There is, consequently, real danger that little will be left of the twofold aim of the University (teaching and research) and that research will be completely victimized. Measures to counter this situation, such as limiting university entrance, are unpopular in Holland and not easily taken.

In this situation the need arises to account for the way the money is spent to the world outside the University. This need to render account is also felt internally, between the various faculties. Moreover, some faculties expand more than others. During the last few years the Faculty of Letters and the Faculty of Social Sciences have had to take in ever increasing numbers of students. The Faculty of Mathematics and Natural Sciences, on the other hand, attracted less students than before. This ill-balanced expansion within the University and the external pressure demanding account, gave rise to the need for planning and stimulated the development of planning instruments.

The next sections contain a general description of the development of such planning instruments by the planning unit of the University of Utrecht. Section 2 contains a description of the planning system as a whole. Section 3 gives a more detailed description of the method used for the calculation of the teaching load. With this method it is possible to compare the organization of teaching in the various fields of study (Section 4) and to allocate staff to the faculties (Section 5). In Section 6 a short survey will be given of the future developments of the planning within the University of Utrecht.

2. The planningmodel

2.1. Introduction

The planningmodel used at the University of Utrecht is called TUSS (Total University Simulation System). It came into being as the result of the demand for planning and policy-making instruments.

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Table 1
Numbers of first-year-students

	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84
Law	687	715	715	715	715	715
Physics	167	225	230	230	235	235
Chemics	107	160	165	165	170	170
History	216	230	230	230	230	230
Psychology	318	320	320	320	320	320

Because of the problems of the ill-balanced increase in student numbers, there was during the development of TUSS a marked preference for providing more insight into the teaching process as well as a basis for discussing this process.

The diagram of Table 2 shows:
- the field to be covered by a total system (the whole diagram);
- that part of the field for which a model has been designed (x);
- that part of the field that has already been implemented (o).

The model does not determine independently the need and the consequent resources required with regard to either other tasks or management. Often data from the budgets of the faculties are used. Thus this diagram indicates that the academic staff required is largely dependent upon the teaching load. This will show up even more clearly when the system is used in (re-) allocating staff-members. Research is not yet dealt with by TUSS. Of course, when staff-members are reallocated on the basis of the teaching load, time available for research is automatically reallocated as well. There is however as yet no way of independently determining the need for research and the consequent resources required. Where facilities and other resources are concerned, it may be said that these variables have been defined in TUSS, but the model has not yet been implemented.

Table 2

	teaching	research	management	other tasks
Academic staff	x o		x o	x o
Non-academic staff	x		x	x
Facilities	x		x	x
Other resources	x		x	x

The model, which has many inputvariables, lends itself well to computer processing. This enables us to print large numbers of reports. The TUSS computer-programme has been programmed both in FORTRAN and in COBOL. In Section 2.2 we will give a description of TUSS. This description is not restricted to the computermodel, but is extended to the policy-making model of the University of Utrecht. Consequently Section 2.2 is not really technical, as might have been expected, but rather concentrates on the total planning, which is supported, at least in part, by the TUSS computerprogramme [3].

2.2. *Description of TUSS*

The TUSS model visualizes the results of decisions about tasks and resources over a period of four or five years. The data for the first cycle (year 1) serve as input to the model. The model generates the input data for the second cycle (year 2) and so on. For some data it is possible to indicate the trend in the course of the four years. A change or changes in the teaching programme introduced in the course of the period can also be incorporated.

In Fig. 1 the most important input data are grouped around a triangle with angles:
- the teaching programme
- the number of students
- the resources.

In other words, the variables of TUSS all belong to these main groups of variables. It will be clear that in this diagram every combination of two angles (two types of variables) may be regarded as given, thus determining the third angle (the third type of variable). If the teaching programme and the number of students have been established, then the level of resource requirement is completely determined. If the resources and the teaching programme are given, then the inflow of students is determined. In Holland the level

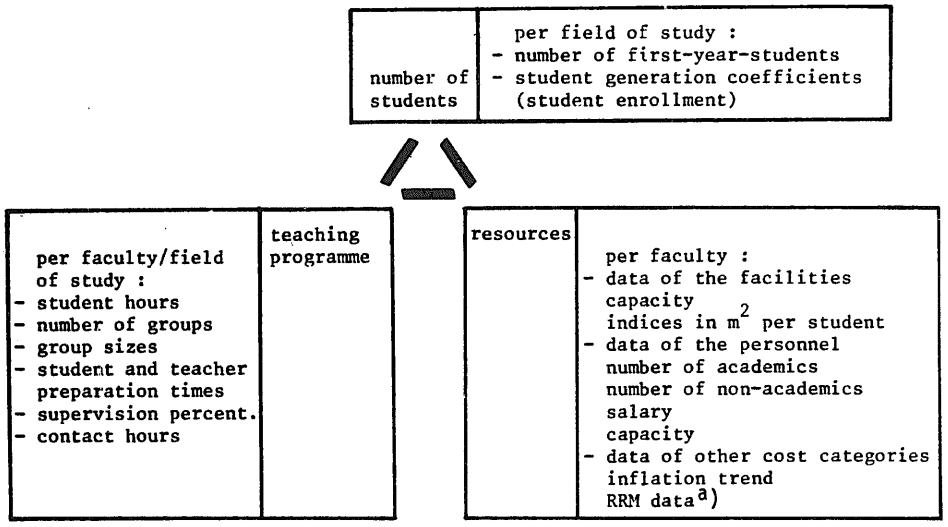

Fig. 1. Input data for TUSS.
a) Resource Requirement Model data

of resources for the Universities as a whole is kept constant at the moment. Moreover the inflow of first-year-students is an uncontrolled factor for the Universities. So the teaching load is determined and, if the organisation of the teaching programme does not change, as a result of the ever increasing number of students, the teaching load increases at the cost of research. The Universities in Holland exert themselves to make this system more flexible by trying to force a break-through in the rigidity of the level of resouces and the uncontrollability of the student-numbers (externally directed). Within the institutions there are efforts to make the organisation of the teaching programmes more flexible as well. By making the three angles variable, they can more easily be attuned to one another.

Fig. 2 represents a block diagram of TUSS. In this section we will concentrate on the RRM block, a number of other blocks being further worked out in the following sections. Determining 'other resources' is done in a submodel called 'Resource Requirement Model' (RRM). This is a submodel that has not yet been implemented (see section 2.1). In this submodel a number (one, two or more) of independent variables are defined for every variable that is to be determined. The relation between these independent variables and the dependent variable is a linear one.

In Utrecht an investigation into the variables determining the need for non-academic staff and the need for facilities is being worked on at present. This investigation may play a part in future decisions concerning the allocation of non-academic staff and facilities.

3. The method of curriculum–outlines

3.1. Introduction

To determine the teaching load of the academic staff, the method of curriculum-outlines was developed at the University of Utrecht as an alternative to on the one hand taking a complete inventory of the teaching done and on the other hand the very rough method of student/staff-ratios applied by the government. The disadvantage of student/staff-ratios is that they do not reveal anything about the organisation of the teaching. Specific and non-specific differences between fields of study cannot be discussed, as too little detailed information is provided. The method of taking a complete inventory of the teaching in order to determine the teaching load cannot be used, because collecting so much information in so much detail takes up far too much time. Too many details obstruct meaningful discussions about the teaching load in individual fields of study, both between faculties and between the faculties on the one hand and the university managerial level. The method of curriculum-outlines obviates these objections, so that the teaching load of all individual fields of study may be discussed without the discussion being confused by too many details. Moreover this method enables us to determine student/staff-ratios for national use.

3.2. Curriculum-outlines (Fig. 3)

A curriculum-outline is a calculation-scheme that enables us to compare the organisation of the teach-

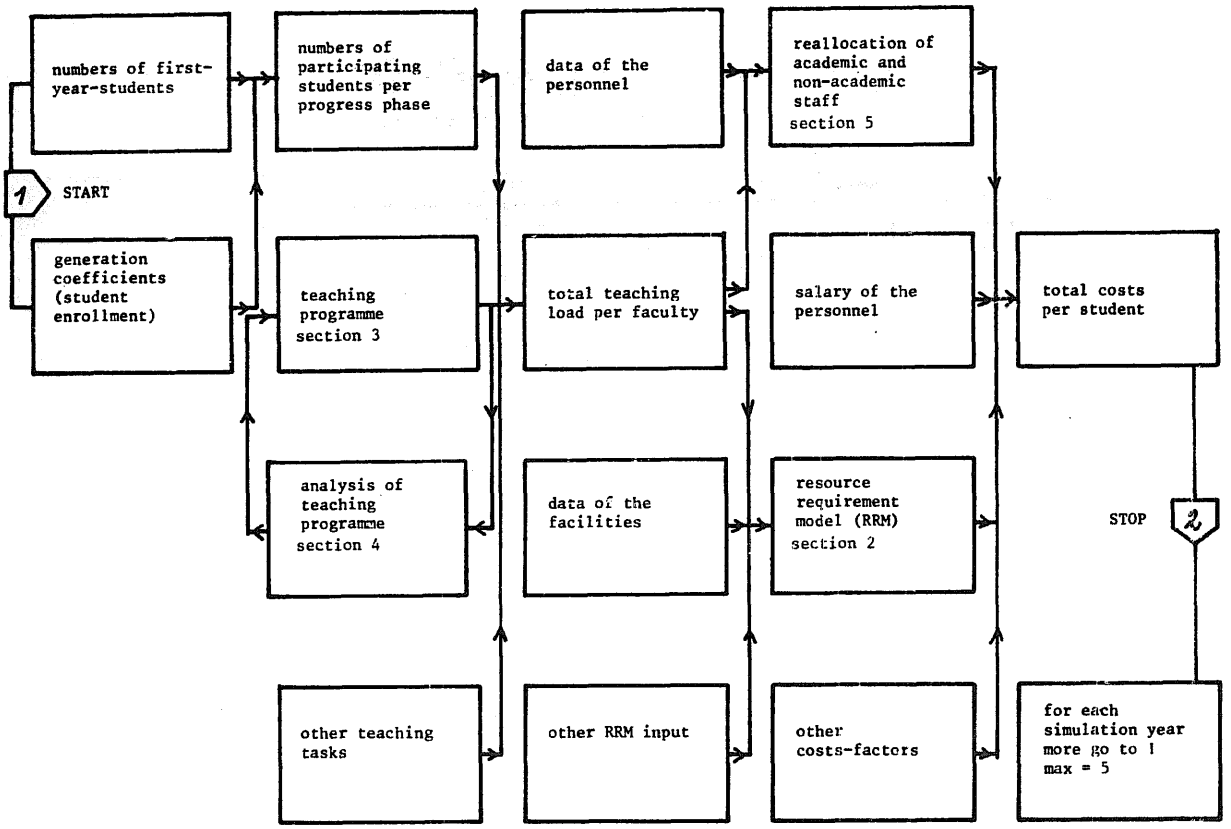

Fig. 2. Block diagram of TUSS.

ing programmes of the various fields of study, except for the actual contents of the curriculum. In the relation between the management level of the university and the level of faculties this is an advantage rather than a disadvantage. In this relation, the organisation of the teaching and the availability of means is of the utmost importance [2].

All individual teaching activities that take place at the University, such as practical training, excursions, talks by students, etc., are classified under one of five types of teaching methods:

(1) general lectures
(2) seminars/tutorials
(3) laboratory practice in small groups
(4) prelims/exams
(5) self-instruction

The calculation-scheme indicates for each one of the five types of teaching methods the relation between studenttime (SH), that is the time a student spends on a particular part of the teaching programme, and the number of students attending that part of the programme and the stafftime (TH), that is the time spent on it by the teacher [5].

The calculation of stafftime in the case of seminars and laboratory practice may be formally stated as follows:

$$TCH = SCH \times N/GS$$

$$SH = SCH \times (1 + PS)$$

$$TH = TCH \times (1 + PT)$$

$$= \frac{1 + PT}{1 + PS} \times \frac{N}{GS} \times SH$$

where:

TH = teaching hours,
SH = student hours per student,
TCH = teacher contact hours,
SCH = student contact hours per student,
PT = teacher preparation time in hours per contact hour,
PS = student preparation time in hours per contact hour,
N = number of students,
GS = group size.

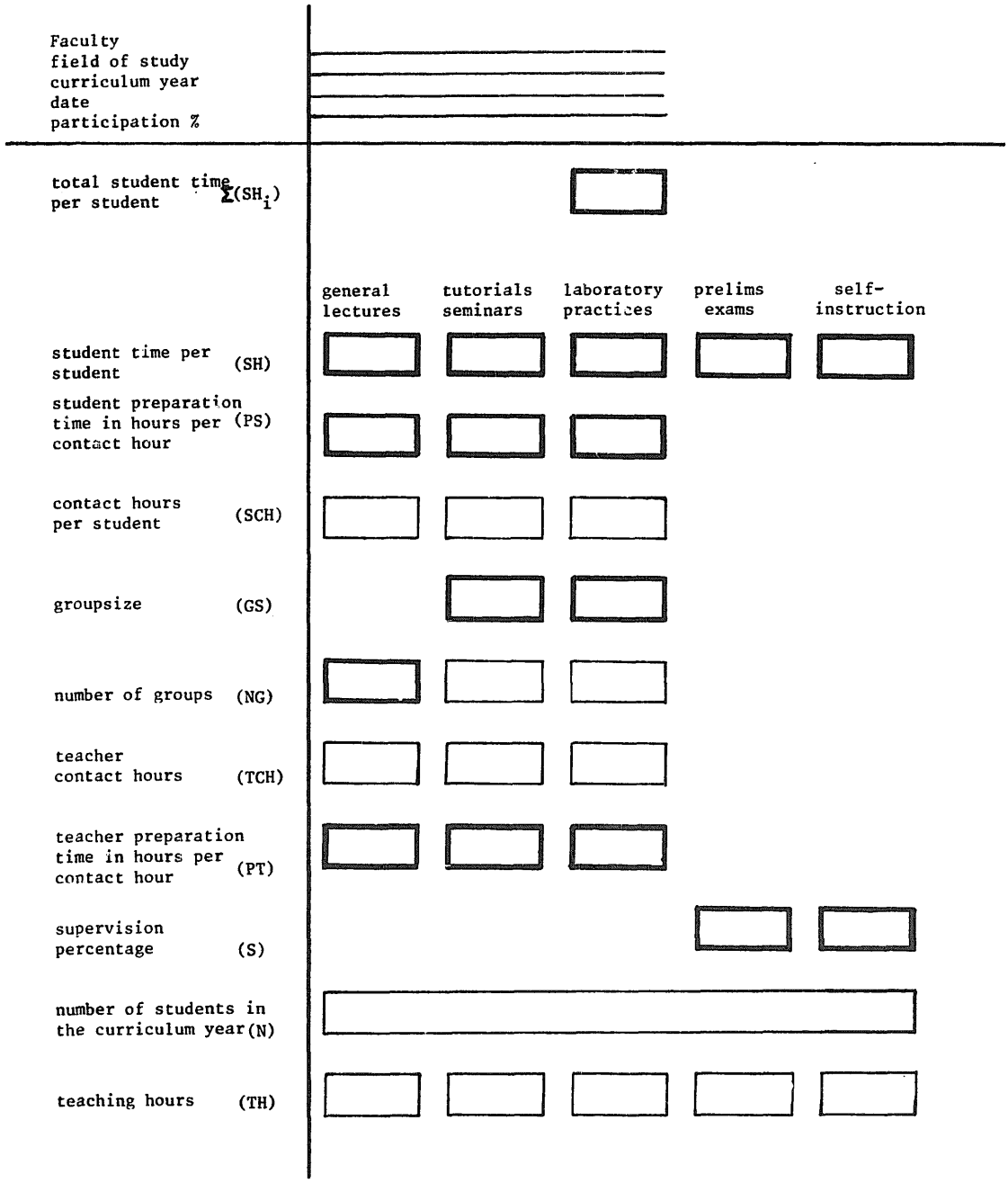

Fig. 3. Curriculum-outline form. Thick boxes: input provided by the faculty; thin boxes: results of calculations.

In the case of general lectures the group size is unlimited and so the number of groups (NG) is not the result of N/GS, but determined by the organisation of the teaching itself. Formally stated we get:

$$TH = \frac{1 + PT}{1 + PS} \times NG \times SH .$$

In the case of prelims and selfinstruction the supervision of the students by the staff is provided on an individual basis and may be expressed in a supervision percentage. This supervision percentage gives stafftime as a fraction of studenttime. Formally stated we get:

$$TH = N \times S \times SH,$$

where S = supervision percentage.

The stafftime taken up by all five types of teaching

activities can now be added up as follows:

$$TH = \frac{1 + PT_1}{1 + PS_1} \times NG \times SH_1 + \frac{1 + PT_2}{1 + PS_2} \times \frac{N_2}{GS_2} \times SH_2 + \frac{1 + PT_3}{1 + PS_3} \times \frac{N_3}{GS_3} \times SH_3 + S_4 \times N_4 \times SH_4 + S_5 \times N_5 \times SH_5 ,$$

in which the indices represent the various types of teaching methods (in the order in which they are listed above). Assuming that the same number of students (N) participate in the various activities the formula may be reduced to:

$$TH = \frac{1 + PT_1}{1 + PS_1} \times NG \times SH_1 + N\left[\sum_{i=2}^{3} \frac{1 + PT_i}{1 + PS_i} \times \frac{SH_i}{GS_i} + \sum_{i=4}^{5} S_i \times SH_i\right] . \quad (b)$$

In the case of seminars and laboratory practice, we can define S_i as the fraction teaching hours divided by student hours, which is also a supervision percentage for $i = 2, 3$:

$$S_i = \frac{1 + PT_i}{1 + PS_i} \times \frac{1}{GS_i} .$$

Hence the formula may also be written as:

$$TH = (a) + N \sum_{i=2}^{5} S_i \times SH_i$$

or

$$TH = (a) + N \times S \times SH,$$

in which (a) is the non student dependent teaching time and S represents the overall supervision percentage required by the four teaching activities (with the exception of general lectures).

At the moment this formula, in which stafftime is split up in a number of student dependent and a number of non student dependent hours, is often used for the distribution of personnel at a national level. So it turns out that the curriculum-outline provides not only information for the benefit of the educational institution itself, but also the information required at a national level. For this purpose, however, the information provided by the various faculties has to be aggregated first. In Section 3.4 the problem of the aggregation will be dealt with.

3.3. The course load matrix

Every field of study belongs to the responsibility of one and only one faculty, which does not imply that all teaching done within a field of study is provided by the responsible faculty. 'Service teaching' offered by a faculty to a field of study belonging to another faculty is by no means uncommon.

To be able to discuss the teaching in each field of study on the one hand and to determine the teaching load of each faculty on the other, all information should be labeled for each field of study and for each faculty. This enables us to define course load matrices for the various variables used in curriculum-outlines with the faculties (18) and the fields of study (28) as dimensions (18 X 28 matrix).

3.4. Aggregation

The information passed on to the university management level by the faculties varies a good deal as to degree of detail. Some faculties fill in one curriculum-outline for every individual teaching activity, others collect all information concerning a phase in the study on one curriculum-outline. For the university level this information has to be added up in such a way that the degree of detail of curriculum-outlines of the various fields of study is equalized, after which the curriculum-outlines have to be aggregated as well, for them to form the necessary basis of discussion between the university level and the faculties.

All information of a certain degree of detail can be aggregated to a higher information level (less details) without the calculation being affected by the information level. The stafftime hours are always added up directly. In the case of studenttime, however, the average studenttime of an average student is calculated. At the university level the analyses of curriculum-outlines (see section 4) is based on aggregated curriculum-outlines for each field of study. For the University as a whole this analysis is based on 28 curriculum-outlines. They form an average representation of the teaching programme of each progress phase in a particular field of study. The most extreme form of aggregation would be one curriculum-outline for all the fields of study and for all the institutions of higher education in Holland as a whole. The teaching load of

that curriculum-outline would be the teaching load of all teachers in Holland.

4. Analysis of curriculum-outlines

4.1. Introduction

Curriculum-outlines, it will be clear, play a decisive role in the planning of the University of Utrecht. Because of this the University Board decided to have the curriculum-outlines provided by the faculties further analysed [1].

This analysis took place on the basis of the aggregated outlines of each field of study (which means, that all the outlines of a particular field of study have been aggregated resulting in one curriculum-outline). The analysis was intended to determine which differences in the values of the variables of the outlines are fundamental (i.e., determined by the specific nature of the field of study) and should consequently be taken into consideration in reallocation of staff, and which are not. In the discussion between the faculties themselves and between the faculties on the one hand and the university level on the other, the following factors were involved:

- the duration of a course in student hours,
- the mix of teaching methods,
- the supervision percentage per teaching activity.

In the next sections each of these three types of variables will be briefly discussed and some details of results will be shown.

4.2. The duration of a course in student hours (Table 3)

The duration of a course in student hours is obtained by adding up the number of student hours of each teaching activity in that course. This total number of student hours is divided by the number of years required by the course.

The figures obtained from some fields of study (as shown in Table 3) indicate that the duration of three fields of study deviates more than +10% from 1700 student hours a year, a figure obtained as a result of national investigations. The duration of only one field of study deviates more than −10% from 1700 student hours a year.

The discussion about the course duration is not only of interest within the institution, but is very important in the negotiations between institution and government. The Dutch Government is intending to limit the student-enrollment in years, but also student hours within a year.

4.3. The mix of teaching methods (Table 4)

The mix of teaching methods is defined as the proportional distribution of the student hours over the various teaching methods. It has been assumed that

Table 3
Student hours

	curriculum-year:						Mean
	1	2	3	4	5	6	
Theology	1440	2090	2210	1870	1460	–	1810
Law	1420	660	1560	1610	1740	–	1400
Medicine	1460	1910	1810	1700	1910	–	1760
Dentistry	1610	1900	1820	1850	2100	–	1860
Mathematics	1340	1530	1560	1970	–	–	1600
Physics	2130	1960	660	1810	1880	1200	1610
Chemistry	1830	2050	1260	2620	780	–	1710
Geology	2480	2110	1080	2160	2440	1040	1890
Biology	2100	2230	650	2410	1700	360	1580
Pharmacy	1960	1350	1070	2710	2680	–	1950
Arts	1600	1600	1600	1600	1600	–	1600
Sociology	1690	1600	1620	1850	1830	–	1720
Psychology	1600	1640	1750	1660	1610	1200	1580
Philosophy	1760	1890	1680	1680	2080	–	1820
Social Geography	1500	1630	1660	1910	2090	–	1760
Physical Geography	1450	2120	1690	2460	2400	–	2020

Table 4
Mix of teaching methods

	General lecture	Seminar/ tutorial	Laboratory practice	Prelim/ exam	Self-instruction
Theology	25.5	16.2	–	45.1	13.2
Law	21.0	18.1	5.6	40.0	15.3
Medicine	34.0	10.0	14.3	27.8	13.9
Dentistry	20.1	3.5	48.9	26.2	1.3
Mathematics	25.8	18.4	1.7	38.9	15.2
Physics	19.6	15.8	13.1	25.1	29.4
Chemistry	13.2	13.8	20.2	26.2	26.6
Geology	12.8	2.7	29.7	31.5	23.3
Biology	14.4	1.5	25.7	24.2	34.2
Pharmacy	15.6	1.9	37.0	28.7	16.8
Arts	23.0	23.0	–	40.9	13.5
Sociology	13.2	34.4	5.0	23.8	23.6
Psychology	17.5	36.7	7.6	13.6	24.6
Philosophy	26.9	15.8	–	27.2	30.1
Social Geography	22.9	22.6	7.4	27.2	19.9
Physical Geography	14.6	11.6	25.8	22.5	25.5

the mix differs characteristically from one field of study to another and that the following patterns occur:
- the arts with an accent on general lectures/prelims,
- social sciences with an accent on seminars/self-instruction,
- sciences with an accent on laboratory practices/ self-instruction,
- medicine with an accent on general lectures/laboratory practices.

Apart from one or two exceptions the patterns predicted turn out to occur in the various fields of study Before these exceptions can be taken into consideration in the reallocation of staff, the question needs to be answered whether the exceptions can be accounted for, or not.

Table 5
Supervision percentages

	Overall value	Seminar/ tutorial	Laboratory practice	Prelim/ exam	Self-instruction
Theology	5.1	14.5	–	2.0	7.7
Law	5.1	11.9	3.6	1.2	6.4
Medicine	8.2	13.7	19.9	2.3	19.4
Dentistry	11.3	23.0	17.4	3.2	19.0
Mathematics	10.8	22.4	22.8	3.2	5.0
Physics	12.4	14.9	18.7	2.9	19.3
Chemistry	16.8	15.0	33.2	3.1	15.8
Geology	12.1	14.7	24.2	2.1	10.3
Biology	13.2	16.8	24.9	1.7	15.1
Pharmacy	10.0	27.8	16.5	2.3	10.9
Arts	5.0	11.1	–	2.0	9.9
Sociology	8.1	11.9	10.5	2.1	8.5
Psychology	7.3	8.7	15.6	2.2	8.5
Philosophy	7.1	11.9	–	2.0	4.8
Social Geography	8.6	12.6	31.3	2.0	10.1
Physical Geography	12.0	20.5	19.1	3.2	9.9

Table 6
Basic information for calculating the supervision percentages

	Student preparation time [a]			Teacher preparation time [a]			Group size [b]	
	General lecture	Seminar/ tutorial	Laboratory practice	General lecture	Seminar/ tutorial	Laboratory practice	Seminar/ tutorial	Laboratory practice
Theology	0.50	1.36	–	3.00	3.00	–	11.69	–
Law	1.09	1.21	1.20	5.02	4.39	1.56	20.50	32.32
Medicine	0.50	0.78	0.82	4.73	1.56	1.58	10.50	7.12
Dentistry	0.33	0.26	0.36	5.47	2.31	1.24	11.42	9.47
Mathematics	0.54	0.69	0.58	2.61	2.49	2.17	9.22	8.80
Physics	0.76	0.97	0.69	5.96	2.13	2.24	10.66	10.25
Chemistry	0.21	0.75	0.26	6.56	2.09	0.71	11.77	4.09
Geology	0.09	0.51	0.03	3.43	2.20	0.56	14.42	6.26
Biology	0.33	0.55	0.26	6.09	2.47	0.93	13.33	6.15
Pharmacy	0.40	0.17	0.17	4.23	2.00	0.83	9.22	9.48
Arts	1.00	1.00	–	3.51	2.25	–	14.64	–
Sociology	0.55	1.43	1.50	3.55	1.92	2.00	10.10	11.43
Psychology	0.95	1.77	1.80	4.67	1.98	1.47	12.37	5.65
Philosophy	1.01	1.97	–	4.00	3.86	–	13.75	–
Social Geography	0.57	1.73	0.17	3.05	3.30	2.15	12.50	8.60
Physical Geography	0.41	1.23	0.15	3.15	4.02	1.35	10.98	10.70

[a] In hours per contacthour.
[b] Number of students.

4.4. Supervision percentage per teaching activity (Tables 5 and 6)

The supervision percentage (S) per teaching activity has been analysed also for each field of study. As a result of this analysis the following conclusions have been drawn:

– In the case of seminars and laboratory practices an upper- and lower limit are defined for the various S-values. The fields of study that are too expensive or too cheap (outside the range of the limits), will have to demonstrate that the teaching cannot be organised in any other way, after which the University level will have to come to a decision whether this will have consequences for the number of available staffmembers or not.
– In the case of prelims/exams an S-value of 2% is unanimously accepted.
– In the case of self-instruction the figures showed up the following clustering of fields of study:
  – the arts with 7.5% as median,
  – sciences and medicine with 15% as median,
  – social sciences with 10% as median.

In the discussion that is still going on between the faculties and the university level, it has been proposed to take these medians as norms to be applied in all the fields of study.

5. Reallocation of staff (Table 7)

Up till 1973 an annual distribution of staff could take place in Utrecht, because the Dutch Government allowed the University an annual increase of the available staff. After 1973 the yearly increase became nil and the need arose for a system of reallocation of staff from one faculty to another. The reallocation takes place on the basis of the teaching load, calculated from the curriculum-outlines. The objective of this reallocation is to minimize the differences

Table 7
Reallocation of staff

Faculty	Number of staff			
	Assigned		Handed in	
	1977/78	1978/79	1977/78	1978/79
Chemics			8	7
Arts	1	1		
Social Sciences	2	1		
Philosophy	1	1		
Geography	4	4		
Total	8	7	8	7

between the average teaching load of one academic staffmember within the faculties and the average teaching load of one academic staffmember for the University as a whole. Complementary to this, the objective is also to arrive at a balanced distribution over all the faculties of the time available for research.

This criterion is slightly adjusted, as small changes in the variables may result in faculties being assigned staff one year and having to hand in staff the next year and vice versa. This consequence has to be suppressed and hence a range is defined around the average teaching load of a staffmember for the University as a whole. A faculty having an average teaching load per staffmember below the lower limit of this range, has to hand in staff till the teaching load has reached this lower limit (non-academic staff is handed in in the same proportion as the current academic/non-academic staff-ratio). A faculty having a teaching load above the upper limit of this range, is assigned staff till the teaching load has reached the upper limit. In a situation where there is no more growth in the total staff, it will be clear that no more staff can be assigned than is handed in. In reallocating staff organisational aspects have to be taken into consideration as well:

– A rapid increase of staff disrupts the organisation of a faculty and there is no way of properly preparing the newcomers for their work (expansion).

– A decrease in the staff can only be obtained by people leaving the University and the faculties should be able to do some reshuffling of staff as well (reduction).

6. Future developments in the planning at the University of Utrecht

When the planning process within the University of Utrecht was first set up there was felt an urgent need for management information about the teaching process and the teaching staff. It was not at all strange that the interest for information pointed at these subjects, because certain knowledge about these items was available (complete inventories of the teaching process).

At present the need is felt to extend the planning process to a broader range of subjects:

– Research budgeting, which implies that the faculties will have to account in some form for the research done and the resources required;

– Determining the need for non-academic staff as a result of the teaching and research process of the University;

– Manpower planning, which implies analysing the problems with respect to the prospective distribution of staffmembers over the various staff-categories, the prospective age distribution and so on.

These extensions of the planning process and the need for still more information have great consequences with regard to the provision of data. The information now used in the planningmodel TUSS, is collected exclusively for the university management level. But the faculties also have an increasing need for planning and planning information, which is often more detailed. Hence the University is developing an integrated management system for the faculties. Besides the faculties as the owners of the information, the university management level is permitted to have access to this system as a user of aggregated information. Parts of this integrated maganement information system are being constructed at the moment (the 'student'-subsystem and the 'teaching'-subsystem, which contains all the information about the teaching process); other parts will be developed at short notice (among others the 'personnel'-subsystem). In the future all these parts will be incorporated in one data base. Instead of one user of each source of information and as a consequence multiplication of data, there will be more users of the same data, the university management level being one of them [4].

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