DOCUMENT RESUME

ED 383 032 EA 026 217

| | |
|---|---|
| AUTHOR | Visscher, Adrie J. |
| TITLE | Design and Evaluation of a Computer-Assisted Management Information System for Secondary Schools. |
| REPORT NO | ISBN-90-9005529-0 |
| PUB DATE | 92 |
| NOTE | 270p. |
| PUB TYPE | Books (010) -- Reports - Research/Technical (143) |
| EDRS PRICE | MF01/PC11 Plus Postage. |
| DESCRIPTORS | Attendance; Computers; *Database Management Systems; Foreign Countries; *Information Management; Information Systems; Information Technology; Information Utilization; *Management Information Systems; Records Management; Secondary Education |
| IDENTIFIERS | *Netherlands |

ABSTRACT

This book describes the design and evaluation of a computer-based information system for secondary schools in The Netherlands. It reports on three studies: (1) a pilot study; (2) the SCHOLIS project, which designed a computer-assisted system for school administration; and (3) the evaluation of the implementation of a computer-assisted Absentee Registration System (ARS). Following the introduction, chapter 2 discusses the rationale for the SCHOLIS project and describes a pilot study that examined available administrative software, new developments, and the effects of introducing computer-assisted school administration. Chapters 3 through 6 describe the goals and project activities of SCHOLIS, the design strategy, and design results. The sixth chapter reflects on the merits and demerits of the design strategy. Chapters 7 through 9 evaluate implementation of one of the SCHOLIS modules, the Absentee Registration System. A summary of results and their implications are included in the final chapter. Educators who wish to replicate the system should also consider the school decision-making processes and organizational features unique to their school. Program success would also be enhanced by government support, further research, and training for school administrators in the skills necessary for computer-supported policy formation. Twenty-five tables and nine figures are included. Appendices contain diagrams, information on the activities of absentee registration, interaction of the school system with the environment, an overview of the diagram hierarchy, glossary, and list of variables/indicators. The book concludes with a Dutch summary. (Contains 116 references.) (LMI)

# DESIGN AND EVALUATION OF A COMPUTER-ASSISTED MANAGEMENT INFORMATION SYSTEM FOR SECONDARY SCHOOLS

Adrie J. Visscher

CIP-GEGEVENS KONINKLIJKE BIBLIOTHEEK, DEN HAAG

Visscher, Adrie J.

Design and evaluation of a computer-assisted management information system for secondary schools / Adrie J. Visscher. - [S.l.: s.n.]. - Ill.
Proefschrift Enschede. - Met lit. opg.
ISBN 90-9005529-0
Trefw.: computerondersteunde management informatiesystemen; onderwijs / systeemontwerp.

# DESIGN AND EVALUATION OF A COMPUTER-ASSISTED MANAGEMENT INFORMATION SYSTEM FOR SECONDARY SCHOOLS

**PROEFSCHRIFT**

ter verkrijging van
de graad van doctor aan de Universiteit Twente,
op gezag van de rector magnificus
Prof.dr. Th.J.A. Popma,
volgens besluit van het College van Dekanen
in het openbaar te verdedigen op
vrijdag 22 januari 1993 te 13.15 uur

door

**Arend Jentinus Visscher**
geboren op 6 april 1956 te Genemuiden

Dit proefschrift is goedgekeurd door de promotoren: Prof.dr. W.J. Nijhof
Prof.dr. J. Scheerens

## ACKNOWLEDGEMENTS

This thesis could not have been written without the support of many others. I know it is a cliché, but all the same it is true. Therefore, I would like to express my gratitude to a number of people who assisted and encouraged me when carrying out the work this thesis reports on.

In 1983 when I started to work in the Department of Education, Wim Nijhof supervised the group of Educational Administration to which I belonged. He encouraged me in exploring the new area of computer-assisted school administration and in preparing and carrying out the SCHOLIS project. As chair of the steering group of the SCHOLIS-project he invested much time and energy and played a crucial role in its management. Finally, he gave valuable feedback on my dissertation in draft form which improved the quality of the thesis.

I would also like to acknowledge Jaap Scheerens' input in the steering group of the SCHOLIS-project, for supervising the ARS-project and for his positive criticism of the draft versions of this dissertation.

Thanks are due too to Wilma Vloon with whom I enjoyed working in the pilot study.

To work with Leo Essink in the SCHOLIS-project was a special experience. Together we obtained SCHOLIS-project funding and collaborated over a long period of time. His knowledge and energy were impressive and the fact that our personalities and working styles did not always converge, did not prevent us from a fruitful cooperation and from becoming friends.

I am indebted to Klaas Bos for his input in the ARS-project in which he worked in a skilful and accurate manner.

Carola Groeneweg's assistance in producing the text of this thesis was tremendous. She corrected the draft versions many times and did this accurately, quickly and, surprisingly, always with good humour. She was also closely involved in creating the lay-out and text of this thesis. Carola, thank you very much for all your help.

I am very grateful to the schools that participated in the projects and that invested so much of their time. Most cooperated in an enthusiastic way and thereby made it possible to develop and evaluate SCHOLIS.

Thanks are also due to Sebie Oosterloo who gave much advice on the methodology for the ARS evaluation study and who positively criticized chapters 8 and 9. I thank Roel Bosker for his advice regarding cluster analysis, and Ferd van der Krogt is appreciated for his advice with respect to the use of Marx models in the ARS study.

My colleagues in the educational administration division are appreciated for the pleasant atmosphere they provided to work in and for creating the possibility to work on my thesis.

Fortunately, I could benefit from Carla Holsheimer's knowledge of the English language, her suggestions led to several textual modifications. Esther Gielen is acknowledged for her critical comment on the Dutch and English version of the summary.

Finally, I am grateful to the Dutch Ministry of Education for funding the projects and thereby fulfilling the most important precondition for making the research and design activities and the writing of this dissertation possible.

Adrie J. Visscher
Enschede, October 1992

**CONTENTS** **page**

## CHAPTER 1 INTRODUCTION

This thesis deals with the design and evaluation of a computer-assisted information system for secondary schools. Studying the state of the art in this field in 1985 showed that computer use for school administration was growing, but was not free from problems. A better exploitation of modern information technology was considered possible. As a consequence of initial exploration, recommendations were formulated with a view to optimising the situation. Designing and developing high-quality school information systems was considered to be a complex activity requiring know-how from several academic disciplines as well as considerable manpower and other resources. Therefore, a joining of forces to develop a professional information system was recommended. Moreover, a thorough analysis of schools concerning their activities and information needs as a basis for information system design and development was considered necessary. All useful forms of computer support at clerical and school management level were to be determined and included in a school information system framework that represents the architecture of the system to be developed. It was also considered important to develop systems that were suitable for use in as many schools as possible. That is, to enable schools to benefit from the general forms of support such a system offered, but also to adapt it to specific needs. Another recommendation concerned the role of the government in financing the design, development and maintenance of the required information system. To gain a better insight into the conditions for, and consequences of, implementing computers in schools, and to improve on these, the importance of studying the process and effects of school automation was stressed.

Chapter 2 explains how the situation with respect to school administrative computing at the time of the pilot study led to SCHOLIS-project goals (which were directed at designing and developing the required school information system). In the third chapter the SCHOLIS-project goals are formulated and explained and the project activities are broadly described. The characteristics of the design strategy are detailed in chapter 4. Subsequently, chapter 5 presents the design results and reflects on these. It is also explained how the design results were used in the follow-up project stages. Chapter 6 reflects on the features, merits and demerits of the design strategy. Chapters 7-9 are devoted to evaluating the implementing of one of the designed SCHOLIS-modules, the Absentee Registration System. The research framework for this evaluation is presented in chapter 7, the research method in chapter 8, and chapter 9 reveals the results of the evaluation study. The final chapter summarises the contents of this thesis and presents some concluding observations, by comparing the SCHOLIS-project goals with the results of the project, by discussing the requirements for such projects, the role of SCHOLIS in more autonomous schools, the ways in which schools can develop computer-assisted policy-making, the role of the government in encouraging computer-assisted school administration and the required future research.

# CHAPTER 2 BACKGROUND TO THE SCHOLIS PROJECT

## 2.1 Introduction

In this chapter the reason for the so-called SCHOLIS-project will be described. This is done by discussing the information needs of researchers (section 2.2) that led to a pilot study on:

- available school administrative software,
- international experience and developments in the area of school administrative computing,
- effects of introducing computer-assisted school information systems.

The pilot study results concerning these three areas are subsequently presented in sections 2.3.1, 2.3.2 and 2.3.3. On the basis of the results of the pilot study, recommendations were formulated with a view to optimising computer-assisted school administration and management in the Netherlands. These recommendations can be found in chapter 2.3.4.

## 2.2 The need for a pilot study

This thesis has its roots in 1983, the year when a start was made with the research programme of the then recently established division of educational administration of the Department of Education of the University of Twente. The use of the computer within educational settings was at that time being studied within the Department of Education from several viewpoints, such as an instructional, curricular and testing line of approach. Although it was noticed that many schools put a lot of energy into introducing and using computers for their administration, almost no academic work was carried out in this area. It was expected that the computer would become an important school administrative tool. The impression existed however that many problems accompanied its introduction and use; the reason therefore to explore this field and investigate which research and development problems required attention. The first orientation was done by studying literature on the subject and by visiting schools that were known as pioneers in this area, to gain an impression of the possibilities and problems. When literature on this topic was gathered, it was discovered how new this subject was to educational science. Hardly any scientific literature existed on the school administrative use of the computer. What could be found were descriptions of how practitioners developed computer applications and which support these applications offered (e.g.

Schmidt-Belz, 1980; Brands, 1983; Bird, 1984). Most schools were 'first time users' and unable to introduce the computer properly into their organization: they had no idea which decisions to take to exploit the computer fully. Neither did they have a clear picture of the possible intended and unintended effects of computer use. As a result of this, the accent in literature lay on very practical information for practitioners who wanted to purchase administrative software (Marshall, 1982; Pogrow, 1983; Spuck & Atkinson, 1983; Talley, 1983).

A first orientation thus gave a picture of the computer being used intensively in all kinds of organizations for administrative purposes, but that this type of computer use was still in its infancy in education. Nevertheless many practitioners were very interested in this area and worked hard at developing applications. More general literature on automation also showed that where administrative information systems are introduced, these are closely linked to the organizational characteristics and problems of institutions (Scheepmaker, 1964; Bosse, 1978; Van der Vlist, 1978; Hedberg, 1980; Van Weenen, 1980; Buchanan & Broddy, 1983; Völlmar, 1985). The implementation of the computer often proves to be accompanied by partial use and unintended and undesirable effects (Hammink, 1979; Mumford & Weir, 1979; Bjöm-Andersen, 1980; 1986).

The first broad orientation on school administrative computer use led to the desire for a more accurate picture of:

a. available or possible school administrative computer uses and their characteristics;
b. developments in school administrative computer use in other countries;
c. effects of the introduction and use of the computer for school administrative purposes.

The first field of interest was meant to gain an impression of the way in which the computer was, and could be, used as a clerical and management instrument in school settings. The field was dynamic at that time, many applications were developed for, and introduced into, schools. A clear picture was required of which activities in schools were supported and which were not, nor were planned to be supported. Also information on the characteristics of the available software was desired.

Since school administrative computer use in the Netherlands was in its infancy, it was expected that a lot could be learned from developments in other countries, so information was gathered on foreign developments.

The third area of attention was based on the fact that automation is meant to realize certain effects. Frequently, desired effects are savings in time and manpower, but one can also try to realize more far-reaching goals like a more effective organization. It is striking how much speculation exists on the positive effects of computerization on the one hand and how little empirical research on the other hand is carried out in this respect. Thus a pilot study was planned on how administrative computing was introduced, and the results in terms of efficiency, effectiveness and labour quality this led to in schools. The pilot study was carried out from February 1985 till February 1986.

A general remark should be made here on the results presented later of the three aforementioned research areas. They should not be considered as giving an up-to-date picture of realized computer applications and of developments abroad at this time, but of the situation in 1985. When presenting the research results in section 2.3, first the state of the art in this area is described at the time plans were developed for designing a new generation of school information systems. Moreover, the implications will be stated for the state of the art regarding computer use for school administration at the time the project was started in terms of, for instance, the way in which school information systems should be developed, the desired characteristics of the system to be developed etc. (section 2.3.4).
This thesis will often refer to the use of computers for school administrative purposes. In order to avoid the continuous use of this cumbersome phrase, the acronym CASA (*Computer Assisted School Administration and Management*) will be used.

## 2.3 Results of the pilot project

### 2.3.1 School administrative applications

#### 2.3.1.1 Data collection

Information on school administrative applications was gathered by studying general descriptions of applications in educational literature (Brands, 1983; Breiling et al., 1983; Huntington, 1983; Jones & Dukes, 1983; Spuck & Atkinson, 1983; Splittgerber & Stirzaker, 1984), software package descriptions (Malmberg, 1984; Van Herk, 1985; Miniware, 1985) and by analysing applications used in seven secondary schools, known as pioneers in this area. Furthermore experts were interviewed on specific applications (computer-assisted testing, timetabling and career counselling) to gain an impression of the possible use of computers in these fields. It was impossible to make an inventory of all Dutch school administrative applications because some schools had developed their own special applications, and it would have meant that they all would have had to be contacted. Therefore, it was intended to get a more global picture of the characteristics of applications as used by corporations or researchers, as well as those used by schools generally considered to be forerunners in this field. On the basis of information found from these various resources an overview was made of existing Dutch school administrative applications and software package. Applications developed by teachers or that were still in a developmental stage were also described. A detailed description of these applications is given in Visscher & Vloon (1986a+b). Here the focus will be (2.3.1.2) on the conclusions drawn after analyzing the applications.

2.3.1.2 Some conclusions on school administrative applications

The investigation showed that the computer could be seen as a new important educational administrative tool. Although it was not sure that every possible application had been listed, the impression was that the possible areas of computer-assisted school administrative support were covered by the stocktaking quite well.
All kinds of applications had been developed by enthusiastic teachers, administrators and software houses, including management support and clerical ones to assist the teacher with clerical work. However, there was the impression that the various developers cooperated very little. One problem was that everybody was developing software on the basis of limited resources (finance, time, know how). Moreover, since developers hardly exchanged information, these limited resources were used very inappropriately. The wheel was often reinvented.
The pilot-study showed that the way in which two different software packages with the same name (e.g. pupil administration) can differ enormously with regard to the data that can be entered, how data can be manipulated, etc. In other words one attendance registration system offers more possibilities, is more user friendly than another.
Moreover, it was observed that the quality of software differed enormously. Some information systems offered possibilities that were admirable given the conditions under which they had been developed, others clearly violated standards for modern information systems. The support the software offered was limited; too often solutions to enter, manipulate and retrieve data were inefficient. The maintenance (included the expansion) of software was often very difficult because of the use of inflexible, so-called third generation languages (e.g. BASIC) and the little attention given to software-documentation.
The applications had almost always been developed for one particular situation (own school or a specific school) by the school staff or by a software house. From this it will be clear that developed systems often did not fit the situation in schools that had not been involved in their development. Sometimes software could only be used if one

possessed the hardware of a certain brand (with a specific operating system). Available software was written in third generation programming languages which were inflexible and therefore made it difficult (read expensive) to adjust the software to specific situations and/or wishes of schools.
If the developed software had become a commercial software package, it depended on how general occurring problems were and how difficult it was to solve them whether developer(s) decided to adjust the software or not.

After this exploratory study, the view was taken that to be able to judge the degree to which all possible support was given by the available software, an analysis would have to be made of all the activities that are carried out in schools, as well as the degree to which the computer might be able to assist school staff in carrying out these activities.
The available software was considered to be a partial computerization of all school administrative activities. What had been done especially was to computerize directly visible, mainly clerical activities: automating routine activities, previously done manually, that are well-structured and labour-intensive (e.g. marks-, absentee-, financial administration). This form of automation is very valuable because it improves efficiency. However, the accent had been on computer-assisted clerical work, whilst the support of the school managers had received comparatively little attention. The strong accent on clerical automation was understandable. All other organizations had initially automated routine clerical activities, because these can be well-defined and the returns gained from automation were clear. Since it was noted that no attention had been given to what information is valuable for those who have to run schools and how the computer can assist them in obtaining this information, it was concluded that an investigation was needed on how far the computer could be used to assist school managers.
Another problem with the available software was that it had been developed for use in a single-user environment (one user works with a stand-alone workstation) and not for a so-called multi-user multi-tasking environment (at various points within schools several staff members work with the information system at the same time by means of their terminal or computer). When records exist at more than one location (e.g. the records of the student counsellor, the clerical staff, the caretaker or various managers), a multi-user multi-tasking environment is a prerequisite for an efficient and effective school administration. The single-user option probably only works in a situation in which a specific activity (e.g. the processing of data about a particular group of students) is only done at one location and when all mutations of these data are only carried out at that same spot. However, in all organizations a trend could be observed

away from the use of stand-alone computers to the use of computers that are linked-up within a local area network and whereby each computer/terminal has access to a central database, and that more schools would need this kind of distributed system. The future was seen in terms of school staff having access to a central database by means of their own terminal, with the terminals of this network being able to operate individually and simultaneously without conflict or interference.

On the basis of the information collected on, it was concluded that school information systems had to be designed that:

- were based on the use of professional know-how and modern tools for information system development;
- were a result of the combination and efficient use of required educational and computer scientific knowledge, as well as of various facilities;
- were suitable for use in every school of a specific type;
- gave all possible useful clerical and management support;
- were appropriate for a multi-user multi-tasking environment.

Since the nature of some applications is very complex (e.g. timetabling, computer-assisted testing, manpower planning), fundamental research in these areas was considered necessary in order to support these activities in a computer-assisted way. Concerning the process of timetabling, one can think for instance of the analysis of this activity (relevant variables and activities) and the designing of algorithms for a computer-assisted construction of timetables.

2.3.2 Developments abroad

2.3.2.1 Literature study results

In this section a picture will be presented of developments in some other countries relating to CASA at the time that the project was initiated and what was learned for the Dutch situation from studying literature on projects in the U.K. (Scotland), West-Germany and Canada. More detailed information about these projects was also obtained by contacting those involved. The reason for selecting these countries was that literature on projects intended to stimulate the development and use of school administrative computer applications was limited to information on these nations. More information about projects, for instance, in the United States had been hoped for, but unfortunately only American descriptions could be found of how the computer can be used for activities like marks processing, student administration and the like. The nature of these applications was similar to Dutch applications.

The information presented here about the three countries has been selected on the basis of what was deemed relevant to the Dutch situation.

In 2.3.2.2 only conclusions drawn as a result of studying foreign CASA activities are presented. Readers interested in more detailed information on developments abroad are referred to Visscher & Vloon (1986a+b).

#### 2.3.2.2 Some conclusions on developments abroad

In this section CASA trends observed in the three countries studied will be elaborated upon.

A common trend noticed was that CASA was still in its early stages. There was a lot of activity in this area; schools in each country were discovering and exploiting the potential of the computer. Everywhere it was observed that using the computer as an administrative tool began with the design and development of applications by teachers or school administrators (sometimes even in cooperation with students). These teachers worked very enthusiastically but usually independently of each other; therefore they often repeated activities that had already been executed before and produced a large loss of capital. This way of producing software had the following consequences:

- software was mostly produced for the specific situation of one school and for specific hardware and therefore was inappropriate for use in other schools;
- developers were burdened too much by the development activities when they also had to take care of their normal duties;
- because information system development is a very complex activity that requires know-how from several academic disciplines (computer science, educational administration) and from administrative expertise (school management, clerical), the amateurish software development resulted in a product quality that did not meet the professional standards for information systems. It was not very user friendly, software was often not structured (also because of the use of programming languages like BASIC and the limited information analysis) and documentated well and therefore hard to maintain and expand. Many systems were not integrated fully, which led to repeated data entry and laborious computer use;
- schools were vulnerable because development work was often done by one or two staff members and software was not well documented, so the departure of developer(s) caused problems for schools.

In all countries reported on, initiatives were undertaken at a level beyond the schools to stimulate school administrative computing. This was done because experience showed that schools cannot solve current problems concerning CASA on their own and since the financial resources of schools are very limited and costs of professional software development are high, industry does not consider the educational administrative market an interesting one. It was observed that the government (sometimes in combination with industry) often financed research and development activities in this area in order to investigate the full potential of new information technology for school administration. Governmental support made it possible to use the required technical facilities, to combine know-how from relevant disciplines and to exploit the required manpower for realising high quality systems.

Government assistance was not only given to develop systems, but also to maintain them. Maintenance proves to be always necessary because software is never perfect and the situation changes continuously. If a country wants to assure continuity of system use in schools, an organization for maintenance has to be realized, as well as arrangements to support schools financially.

From the foreign experiences it was learned how important it is to involve practitioners in software development in order to be able to take care of their needs and to make them 'owner' of the system. The importance of 'ownership' for the acceptance and use of an innovation is also mentioned in educational innovation literature (see e.g. Fullan, 1982). Too often developers paid too much attention to the possibilities of modern software and too little to the characteristics of the user-environment. An intensive dialogue between professional developers and practitioners is needed to decide carefully to what extent and how the computer can be used, and to develop systems accordingly.

Concerning hardware, the trend was noticed that initial administrative forms of computer use were based on a mainframe environment, but later on the stand-alone microcomputer proved to be more appropriate because it makes schools more flexible when using modern information technology. Moreover, it became clear that appropriate computer use requires a local area network that offers various school employees the possibility to use software simultaneously.

Another aspect of the hardware that needs to be mentioned is that the first steps of schools taken in the field of CASA are accompanied by the use of different computers and operating systems, which limits the usability of the software on different computers. The limitations of the hardware used also led to user-unfriendly software. Another reason for hardware standardization is the mutual exchange of data between schools

and between schools and other external bodies. This is only possible if various computers can communicate with each other.
With regard to introducing (parts of) information systems, foreign experience showed that the assimilation of a system into the administrative system of the school takes some time and therefore requires a step by step approach. Another important finding is that even when the system is very user friendly, intensive training of the user is necessary.
There was a call for systems that are flexible enough to take account of the unique characteristics of each school. Schools differ also concerning the characteristics of the information housekeeping and the information systems they need. Systems developed were often built for one school, and later on, after some minor adaptations, sold to other schools too. Since the developmental basis was usually restricted (programming languages that hamper changes and a limited organizational analysis) adaptations were unlikely. On the other hand the Scottish Schools Computer Administration and Management Project (SCAMP) showed that some standardization as a consequence of automation does not always have to be a disadvantage. Probably it is more a matter of finding a compromise between standardization on the one hand and taking into account the uniqueness of a school on the other.
To be able to give each school the system it requires, a modular architecture of information systems is needed, since that enables each school to choose only those parts of the total system it needs. Moreover, a modular structure simplifies the maintenance and expansion of the system. System adaptation only has to be made in one or a few modules/parts of the total system thus reducing complexity (see also 2.3.4 on this subject).
Another aspect of information system flexibility is related to the output it can produce. In general a growing need was noticed for systems that can give tailor-made information. Available systems were not very flexible, they could only produce standard reports.

It is remarkable how few empirical evaluative data are available concerning the introduction and use of the computer. In fact only speculation about the effects of automation and some positive impressions from those involved on projects are available. This is a pity because a better insight into the implementation process and its consequences can help improve the overall quality in this area. A better insight into the consequences of implementing computers for the organization of schools is especially important. The SCAMP experience (Tomasso, 1982, 1984, 1985) has shown that this is a critical factor for success, but empirical evidence on this topic is still lacking.

A careful information analysis of the school is usually not carried out, or if an analysis has been executed it is incomplete, although such an analysis is at the same time one of the prerequisites for well-considered information system development. Studying foreign CASA activities showed that the accent of developed applications was, just like in the Netherlands, still on clerical functions and relatively little attention had been given to supporting school management. A detailed analysis of the school as an organization (what happens there and which information can make schools more effective) would make a comprehensive automation of clerical and management activities possible.

The way in which the information analysis of schools had been carried out was regarded as too restricted because the basis for software design had been the directly visible, clerical activities that had always been done manually, or stocktaking the wishes of practitioners. Since the latter only give a partial view of what might be automated, these activities usually lead to partial automation. What was missing was a very detailed analysis of schools that answers questions like 'which activities are taking place there?',' what information is needed to execute these activities properly?' and 'how can the computer support the production of this information?'.

Such a fundamental analysis of the school as an organization would have to be the basis for constructing an information system that contains various subsystems. The picture of the information system as a whole enables developers to take relations between subsystems into account and to construct integrated subsystems.

### 2.3.3 Automation and its effects in schools

#### 2.3.3.1 Introduction

There is a lack of solid empirical studies of computer impact. Björn-Andersen, Eason and Robey (1986) stated that ".....most of research conducted in this area makes little attempt to assess the effectiveness of the system under investigation, let alone relate their findings of computer impact to overall effectiveness". It has already been mentioned that CASA does not get much attention in educational literature and almost no research is carried out on its effects.

In fact what is available is not much more than considerable speculation, especially on the positive impact of the computer on the functioning of organizations. For this reason part of the pilot study was directed at the introduction of CASA in schools and its positive and negative effects.

2.3.3.2 Selection of schools

In February 1985, when the pilot study started, seven schools were selected that could be seen as leaders with regard to the kind of computer use this thesis focuses on. The goal was to investigate the impact of far-reaching administrative automation in schools. When selecting schools, apart from being leaders in school administrative computing, another criterion was the way in which they had automated:

(a) solo automation: the school introduces the computer independent of other schools and on the basis of its own authority. Schools that automate their activities in this way will be called independent schools (n=3);
(b) decentralized: the school automates together with its school board and with other schools that belong to that board (n=2);
(c) centralized: the computer is located in the office of the school board and schools send their completed forms to the office for data processing; computer output is sent back to schools (n=2).

Schools that automate in a decentralized or centralized way will be called dependent schools, since they innovate in cooperation with their school board.
The names of the schools were found in literature (descriptions of how and what they automated) and/or were mentioned in contacts with people who were active in this area.
Generalization of the findings is unjustified because of the select character of the schools studied. The results give an impression of the impact and problems of school administrative computing in seven pioneer CASA schools.

2.3.3.3 Data collection and processing

Half-structured 90-minute interviews were carried out with those who were (or had been) involved with introducing and/or using a computer. In every school, where applicable, the person who coordinated the automation process, a school management member and a clerical staff employee were interviewed. If schools belonged to a school board that actively coordinated the automation process, people from that board were also interviewed. Table 1 shows which persons were interviewed.
All interviews were recorded on tape and summarized on the basis of the questionnaire. The next activity was to describe each school (Visscher & Vloon, 1986a+b) in relation to each interview-question. The final step concerned analysing the

answers of all schools to each interview question in order to gain a more general picture of the process of automation and its effects.

| | Interviewed staff | | | |
|---|---|---|---|---|
| School | automation expert | managers | clerical staff | others |
| A | 1 | 4 | 4 | |
| B | 1* | 2 | 2 | 1~ |
| C | 1 | 1 | 2 | |
| $D_I$** | | 1 | 1 | 1 and 2+ |
| $D_{II}$ | | 1 | 1 | |
| $E_I$*** | | 1 | 1 | 1^ |
| $E_{II}$ | | 1 | 1 | |

*Legend:*

* interviewee was also manager

** school $D_I$ and $D_{II}$ were part of the same school board

*** school $E_I$ and $E_{II}$ belonged to the same school board

~ interviewee was a teacher

\+ interviewees coordinated automation activities at school board office level of schools $D_I$ and $D_{II}$

^ interviewee coordinated the automation process of the schools at school board level

*Table1: interviewed staff*

2.3.3.4 Some conclusions based on the study of the pioneer schools

Since the detailed results have already been reported in other publications (Visscher & Vloon, 1986a+b; Visscher, 1988), only the main conclusions drawn will be presented here. The limited basis for generalizing the findings due to the limited number and select character of the schools studied, and the fact that the findings were based on the perceptions of the interviewees, is obvious. However, one should be aware that the number of schools studied is always small due to the fact that a group of pioneers represents a small group of schools. Moreover, the degree to which pioneer schools are representative for other schools may be questioned. Nevertheless, the tendencies observed in the seven studied schools are presented here.

*the change process*

The change process had usually not been designed and executed very systematically. The most important reason for this was that the pioneer schools could not benefit from the experiences of others and therefore had no overall picture of automation.

Most of the schools did not know exactly what they wanted to realize and what kind of activities automation demanded. Within the three schools that automated independently, the change process demanded a lot from the automation expert, an administrator or teacher who took care of the automation activities. The compensation he received did not correspond with the time invested and the mental pressure accompanying such activities. Moreover, the clerical staff and the school as a whole became very dependent on him because he had developed software that was usually not well-documented.

The schools that automated independently, in general were rather satisfied with the software developed because it was made-to-measure. The experiences of the foundational and associative schools were somewhat more negative because the standard software did not always fit very well into the working methods and specific desires of each school. Despite the advantage of developing tailor-made software in independent schools, the general opinion was that individual schools cannot develop software on their own.

The protection of software and especially of entered data had been a matter of trial and error in the independently automating schools. With regard to this the foundational and associative schools had the advantage that at the school board office recent back ups of data files and software were always available.

Participation of clerical staff and teaching personnel in the automation process could have been better in most schools. They often had not had enough influence on the automation process. A general problem in all schools was that the training of clerical personnel, and the supplying of a good manual did not meet with expectations and as a result strengthened or created computer resistance at that level. Transfer of the required know-how was given too little attention. The work of clerical personnel during the introductory phase was often severely disrupted, especially within the independent schools.

**the effects**

*productivity*

When the computer was introduced, according to the schools executing regular activities required more time than formerly because sometimes double records were kept or the carrying out of normal activities was threatened due to the automation specialist being unable to solve the problems at once.

The automation initiative at clerical level had, according to employees, finally saved time as a result of the disappearance of activities like copying lists of classes, students etc. Time saved was used for other activities; in other words new activities substituted old ones.

Respondents thought the time-saving improvements had a positive influence on school effectiveness. The improvements concerned especially the quality of the information supply within the school: more and more reliable information, information made available more quickly, and better service by the school office. The impression existed that computer-assisted support of school management could be improved, if various kinds of analyses could be carried out.

Within the schools the computer was hardly used systematically to evaluate and improve classroom teaching, for instance, by analysing teacher and student achievements and developing a subsequent policy.

Using new information technology did not result in information pollution; in the opinion of those interviewed, staff members did not receive more information than they needed.

*quality of labour*

<u>labour content</u>

Interviewed clerical staff were of the opinion that much monotonous work (e.g. producing lists, reports) had disappeared as a result of computer use.

The introductory phase had threatened the independence of clerical employees: their territory had been encroached by automation specialists and the procedures they were used to had been analyzed and changed. However, later on they had reconquered their area.

Automation also resulted in expanding the activities of clerical employees, work formerly done by school administrators within some schools had been transferred to clerical employees.

labour circumstances

The quality of the apparatus, software and accompanying manuals varied. Clerical tasks, during and after the change, had frequently been severely disrupted by software mistakes, trouble with the apparatus, the continuous changing of software and the lack of a sound manual. However, in general these problems had in time been overcome.

The introduction of the computer proved to require practical organizational activities like deciding on its location, avoiding noisy printers and a false incidence of light on the computer screen, and finding a quiet place to work with the computer. Not every school had arranged this to everyone's satisfaction. The availability of the apparatus did not cause problems in general, provided that the apparatus was only used for clerical work.

labour conditions

It can be concluded from this investigation that the position of clerical employees had not changed to such a degree that job re-grading was necessary.

However, a regrading could become necessary if clerical personnel were to be given more tasks which until then had been carried out by school management, or when computer maintenance and administration become part of their task. At most schools applicants for clerical functions with experience with computers were preferred.

labour relations

Clerical personnel thought that relations between clerical workers had not changed as a result of introducing and using a computer.

School management and clerical employers felt dependent on internal or external automation expert(s). Dependent schools were vulnerable because when developer(s) left the school it would be impossible to expand and maintain poorly documentated software. Clerical workers were dependent on the software or hardware not causing trouble. Because of other obligations the automation experts at independent schools did not always have the opportunity to solve problems immediately.

*the organizational structure*

The expectation that automation would not lead to the creating or disappearance of divisions within schools was confirmed in independent and dependent schools. At the school board office of the foundational school board some employees developed software and supported their schools involved in automation activities. Although these activities resulted in a slight expansion of personnel, a new division was not created.

At the level of the associative school board a new division had been created to take care of software development, maintenance and processing of data sent in by schools.

Changes in the functioning of the school organization can be summarized as follows. The possibilities to analyze teacher results or to compare school results were not exploited thoroughly. Lists of student marks were supervised more tightly but not the quality of the teaching process. The school manager of one of the associative schools checked the work of his clerical employee closely in order to avoid mistakes in the data sent to the school board office. Correcting these mistakes took a lot of time as a result of the postal exchange of information.

The decision-taking area of those interviewed had not decreased or increased significantly.

The degree to which staff members could decide how they carried out their activities, according to one school manager, had only changed for clerical personnel, because the use of software requires a specific sequence of activities.

Although a teacher or administrator at the dependent schools supported the automation process in his/her school, computerization had not resulted in the creation of new positions (specialization).

Some of the foundational and associative schools had 'an automation specialist' who fulfilled an advisory role, giving for instance advise on expanding computer usage and the usability of commercial software offered by software houses. Automation proved to be so complex that school management liked to be advised by an expert on the subject. The general opinion was that this advise had a positive impact on automation results. Although these people did some work in this area, no new position was created here either. At school board level some specialization was observed: staff members who developed software, supported schools and the like.

Computer use had led to more structuring of various activities, because agreement had to be reached on when, and in which way, marks, mutations and the like had to be handed in at the school office. The increased structuring of working methods and procedures was seen as a positive development by the schools, because staff members worked more systematically.

### 2.3.4 What was learned from the pilot study

This section reflects on the results of the three parts of the pilot study: the inventory of school administrative applications, the exploration of foreign experiences and the study of automation processes and their effects on pioneer schools.

It was observed that many schools expected impressive and immediate gains in productivity could be gained from administrative and management information systems. The AG-REPORT (1985) showed that about 75% of Dutch so-called AVO/VWO (general secondary/pre-university) schools used one or more administrative computer applications. Of course there was a lot of variation between what each school did with CASA. Most of them had probably only automated part of their student administration. Nevertheless, the use of the computc. ˜rew. Since it was noticed that CASA was not free from problems, some recommendations for the optimization of CASA in the Netherlands were formulated on the basis of what had been found in the pilot study. These recommendations will be discussed now.

*To combine forces in developing high-quality systems*

The investigations had shown that the development of high-quality school information systems is a complex activity that requires know-how from several academic disciplines. Considering the conditions under which information system development for schools had been carried out, impressive results had been achieved. Nevertheless, if these results are compared to modem standards for information systems it must be concluded that the activities had been ad hoc and often amateurish. What was needed was an organization above school level that would combine manpower, know-how and facilities to develop and maintain professional school information systems of a high quality.

The information systems would have to be well-designed and user friendly, suitable for a multi-user multi-tasking environment and for different brands of powerful computers, provide broad security (among others checking entered data) and be integrated (single entry and multiple use of data), well-documentated and accompanied by a clear manual. Such systems would have to be based on current knowledge and modem tools for information system development. An approach like this would prevent loss of capital by everybody reinventing the wheel and would not burden practitioners in schools with activities they are not equipped to do, that are not part of their job and that hinder the execution of their normal duties.

Since schools themselves are not able to develop the required computer-assisted systems and the market seems to be too risky for commercial software houses, the Ministry of Education, possibly in combination with industry, would have tc take the lead in this. Such an organization at the supra school level could also guarantee the continuation of the use of school information systems by taking care of maintenance, modification (necessary as a result of changed legislation) and expansion of software. At the time of the pilot study the prolonged use of these systems was too often endangered by the fact that software was not well structured and documentated so that maintenance and expansion were almost impossible if the developer left the school or school board office.

*A thorough analysis as a basis for constructing information systems*

A basic analysis of schools with regard to their organizational activities and corresponding information needs was considered a very important prerequisite for the development of high-quality information systems. Such an analysis could not be limited to the inventory of practitioners' desires and needs; the analysis should make clear what kind of activities (by whom and for which purpose) are carried out, how they are interrelated (especially from a data processing viewpoint) and what information enables the efficient and effective execution of these activities. If such a picture were available for the school organization as a whole, it would be possible to determine all useful forms of support that computers can give at administrative, school management and teaching (clerical side) levels. Since some of the organizational activities concern complex work (for instance timetabling, computer-assisted testing, forecasting next school year's manpower capacity), fundamental research and development activities were recommended on how these activities could be assisted by means of the computer.

An area that should receive special attention when developing information systems is that of communication between schools and external agencies (Ministry of Education, Inspectorate etc.). Schools have to send quite a lot of information to these agencies and vice versa. The availability of computer-assisted communication facilities like electronic mail, access to external databases and transfer of lists, reports and the like between sites would make for an efficient school organization. One should however be aware of the fact that this not only demands a technical infrastructure from both mutually communicating organizations, but also fine-tuning between several organizations about the contents of what is being communicated and how this is done. From experience this fine-tuning is much more difficult to solve than acquiring the technical facilities.

Finally the analysis should result in a school information system framework for one type of school (because each school type probably has its own specific characteristics). The framework would have to represent the architecture of the information system and contain all subsystem descriptions like, for instance, the financial administrative one. If the architecture of the total system is well thought-out before it is developed it is possible to realize an integrated system (with the advantage of single entry and multiple use of data).

*The construction of widely usable systems*

It was observed that many schools experienced problems when they had to work with standard systems that did not completely fit their situation and needs because they were developed for one or a few schools. It was proposed to try to design systems that were suitable for use in as many schools (of one type) as possible, which means that schools could use the general forms of support but also fulfill their specific information household needs. However, the Scottish SCAMP-project (Tomasso,1985) pointed out that paying too much attention to the peculiarities of each school should be prevented because not every deviance is necessary and positive. Some standardization can be very useful and efficient. One should try to achieve a compromise between honouring the specific characteristics of a school and allowing them the positive effects of some standardization.

The realization of systems that can be used in as many schools as possible starts with carrying out a broad analysis of several schools, in order to draw attention to their mutual differences. Also flexible programming languages would have to be used that enable a fast adjustment of software prototypes, thus allowing for the differences between schools. The use of less flexible programming languages of the third generation made an adjustment of developed software almost impossible and therefore only led to software changes that were unavoidable.

The use of relational databases might also be a tool for realizing information systems that give each school the information that it needs. Such a database should be constructed on the basis of a careful analysis of schools and as such contain all the relevant entities of a school, as well as their characteristics. When this is realized it is possible to relate everything within the database to everything and thus satisfy all the information needs of every school (made-to-measure information). The importance of a detailed analysis of schools is shown here again.

A last means to realizing the goal of each school having its own specific information system is to construct modular systems. If a school information system is built as a total of modular subsystems constructed around one database it is possible to let every school choose only the modules it needs. This can also be cheaper for schools and moreover makes system maintenance much easier: adjust only part of the total system or connect a new subsystem with old ones, without having to change the old software.

*Government support of schools is needed*

The government can also play an important role in promoting CASA by supporting the schools. External support of schools proves to be very important for successful automation (see e.g. Kempen, 1976; Mumford & Weir, 1979; Visscher & Vloon, 1986a and 1986b). Schools have to be informed about the possibilities of CASA, on the different ways of automating, on the prerequisites for successful automation, the problems that may arise, and the ways in which they can be prevented etc. External support is not only important during the orientation phase, but also when schools are actually becoming automated, e.g. solving all kinds of problems with the hardware and software (technical problems, learning how to handle it) and interpreting and using new information produced by 'the machine'. In the Netherlands quite a lot of assistance is given to schools with regard to improving teaching processes; relatively little attention is given to improving administrative and management processes. When a school information system is bought by a corporation, that organization will probably take care of part of the required support to schools, e.g. technical assistance with regard to hard- and software and some training in how the system works. Nevertheless this form of help is usually very limited, especially concerning non-technical aspects of computer use. Since the average normal school does not have financial resources to pay for this help, part of the required support will always have to be given by a non-commercial, government financed institute.

To finance this support is not the only reason why financial injections from the government are necessary, because developing, maintaining and expanding the system at the supra-school-level and purchasing these information systems will require investments over and above school level. An average school will not be able to buy or replace the system, which means that if in the opinion of the Ministry of Education the way in which schools function is influenced by high-quality information systems and there is value in attempting to offer high quality education, then the government should be aware of and prepared for the financial investment required.

*The need for an empirical study of automation processes and their effects*

Another recommendation concerns the empirical study of the process and effects of automation. It was observed that automation as an innovation process demands many activities and conditions from schools and that this process can be improved upon. In order to get a better picture of the conditions for, and effects of, introducing computers into schools a more systematic approach is called for. The insights that such studies might produce are not only valuable from a scientific point of view but can also improve the way in which automation in schools is carried out and its effects.

*Software evaluation*

Finally, an objective evaluation of available school administrative systems was recommended since many schools do not know how they should judge these and the evaluation results would probably lead to an improvement of evaluated software and to the development of new and better school information systems.

The aforementioned recommendations show the complexity of trying to achieve a situation in which new information technology can be exploited fully at clerical, management and teacher levels. Only if all these described prerequisites have been satisfied might it be possible to reach that goal.

As a result of the recommendations, the Dutch government asked the researchers to develop an information leaflet for schools considering the use of the computer for administrative purposes. The leaflet (Vloon, 1986) was sent to all Dutch secondary schools. The recommended evaluation of school administrative software was not financed and therefore could not be carried out.

The pilot study moreover led to the so-called SCHOLIS-project. This project was directed at developing a high quality school information system according to the recommendations presented here. The goals of this project are presented in the next chapter.

## CHAPTER 3 PURPOSE OF THE SCHOLIS PROJECT

### 3.1 Introduction

In this chapter the initiative taken as a result of the pilot study is described.
A general impression after the pilot study was that a growing number of administrators in schools were convinced of the benefits of the computer as an administrative tool. On the other hand many schools did not, or only very partially, take advantage of the possibilities of the computer. If the use of computers in schools was compared with its use in many other types of organizations, then it had to be concluded that schools lagged far behind.
Richard Nolan (1975, 1977) developed a theory conceming growth stages that each organization has to go through when it automates its data processing. Zisman (1978) translated this theory to office automation, an area that bears many resemblances to a school administrative context. When Zisman's view is applied to school administrative computing, this produces some interesting ideas for the growth and promotion of school administrative computing in the Netherlands. Zisman distinguishes four sequential automation stages: initiation, expansion, integration and stabilization.
At the time of the start of the SCHOLIS-project most educational institutions were considered to be in the initiation or in the expansion stage. In the former, schools had started with the isolated automation of a few clerical activities, while in the latter the automation-need had grown and more and more computer applications were realized for labour-intensive activities (e.g. student- and financial administration). However, in these two stages isolated, separated applications were developed and they resulted in systems that consisted of several loose modules. Systems in these stages were developed by enthusiastic teachers and - especially in the expansion stage - by software houses. The goal of automation in these phases was to improve *efficiency* of clerical activities: various texts and lists that had previously been made manually were now produced by computer.
Thus, clerical automation is what schools work on during these stages. When this form of automation progresses well, on the basis of the work of Nolan and Zisman, one may expect that school management during the integration stage will start to pay attention to the possible support they can receive from the computer. Their attention shifts from the management of computerization to the management of information. Managers are then in want of information systems that support their planning-, decision making- and control-functions.

The existence and price of Relational Database Management Systems (RDBMS) and Local Area Networks (LAN) at the same time makes new forms of computer use possible. As a result of the relational database, a school manager has at his/her disposal an important decision-making tool. Moreover, the availability of local networks means that all authorized staff (e.g. head, secretary, timetabler) has access to the information system from one of the decentralized terminals within the school, and the system can be used at any time.

The highest degree of computer use is achieved when expert systems (artificial intelligence) are used that contain school staff knowledge and can help school managers diagnose problem situations and to generate and evaluate various forms of action. These computer applications might become the school management tools of the future.

In the third stage, the integration stage, automation and data processing are approached in a completely different way than in the earlier stages. Information now is considered an important tool for school organizations to function and it is realized that a good information system requires money. Automation takes place on the basis of a holistic approach: people work on integrating all the various kinds of clerical and management support that the computer can give to schools into one system.

During the fourth stage of automation, the stabilization stage, the assimilation of information technology and system maintenance by the organizations is central.

When the state of school administrative computing in the Netherlands after the pilot study was compared with Zisman's theory, the awareness grew that a number of conditions had to be fulfilled to allow schools to reach higher levels of CASA. To enable schools to enter the integration and stabilisation stages, the possibilities of modem information technology would have to be used better and a new generation of school information systems was considered necessary. Using CASA more intensively was considered valuable because school administrative computing was supposed to have two potential advantages: 1) improving school efficiency 2) improving school effectiveness.

<u>re. school efficiency</u>

The amount of data registered in schools during each school year is huge: among others, data on students, personnel, finances, timetables and subjects. Every school often has several partial registration sets (one for the caretaker, the school office, the counsellor, the deputy heads), that often overlap. Moreover, the same data often have to be transferred to various internal or external forms, which means that if data are registered manually these forms have to be completed frequently.

If the computer enables the single entry of data (at one central spot) and the multiple use of data for various purposes, enormous efficiency improvements are possible. Clerical personnel can then take care of the entry and updating of the database, the software can take care that the required lists, reports, labels, etc. are produced automatically. Also, it can be predicted that data required for external bodies will not be delivered by means of official forms, but by means of diskettes that are mailed or delivered by means of direct data communication between school computers and those of external bodies. When this is realized, efficiency improvements are possible at both school level and at the level of the external body.

In general it can be stated that because the computer can take over a number of clerical tasks and because data can be registered at one spot by this means for subsequent use at various locations, the computer makes it possible to produce the same amount of, or more, information with less manpower and in a shorter period of time.

re. school effectiveness

The computer might also contribute to a more effectively operating school, that is, to a better realizing of school organization goals by providing better preconditions. Improving school efficiency might, for instance, result in more time for non-clerical (e.g. the development of instructional material, additional training) activities.

Another imaginable effect is that job quality and satisfaction of clerical workers and school managers (who also carry out many clerical activities) are improved because the computer takes over monotonous work.

Another potential advantage of CASA is related to the already discussed single-entry-multiple-use of data. If data are kept up to date at one location within the school everybody can make use of this. It is plausible that this will affect the quality of activities (e.g. better decisions) based on these data and as such their effectiveness.

When computer-assisted allocation processes are executed, the computer makes it possible to explore several alternative problem solving activities, to evaluate these and to choose the most desirable alternative. This means considerable progress in comparison with the old manual situation in which one mostly had to be satisfied with one solution that was found. The quality, for instance, of timetables and lesson groups (the allocation products) during every school day influence the functioning of students and staff. For that reason one might expect that finding high-quality solutions for these allocation problems would improve the functioning of schools.

Moreover, the computer can support the control of school organizational activities by timely observing problems and making any necessary adjustments, either by 'itself' or

with the help of school management. It is likely that a timely (and adequate) reaction will lead to a more effective school organization.
Finally, on the basis of computer-assisted production of information a school policy can be developed and evaluated. The computer can, for instance, show the student results in comparison with other school years. If student achievement proves to be lower than expected, one might analyze via the computer whether a relation exists between the achievement level of students and other variables such as the schools they attended, the advice given with regard to school type and subject choice, the teachers that taught them, the degree to which they play truant, etc. If as a result, policy measures are taken to improve student achievement, then the computer can also analyze later if these policy measures have been successful.
It seems likely that improving the conditions for decision making will affect the quality of policy-making in a positive way and as such the effectiveness of the school organization.

Put briefly, it was expected that developing school information systems of high quality would utilize fully the potential of new information technology within schools.
The findings of the pilot study, in combination with Zisman's growth stages theory, resulted in the SCHOLIS (School Information System) research and development project. The Department of Computer Science, the Department of Education of the University of Twente and the Centre for Education and Information Technology joined together in this project, which was partly financed by the Information technology Stimulation Project (INSP), a Dutch government initiative to stimulate the use of computers in Dutch society. The other part of the personnel costs of the project was financed by the University of Twente. The SCHOLIS-project started in October 1985 and ended in December 1988.
In section 3.2 the SCHOLIS-project goals are described in detail. These are strongly related to the findings in the pilot study. In fact the project goals should be regarded as attempts to change the shortcomings of CASA as observed in the pilot study. As a result, there may be some overlap between the description of the pilot study findings (chapter 2) and the definition of the SCHOLIS goals in section 3.2. After the SCHOLIS goals have been defined the chosen project strategy is given in section 3.2.1 to give an idea of the various project phases and their mutual relations.

### 3.2 Goals of the SCHOLIS-project

Generally stated, the SCHOLIS-project attempted to investigate the extent to which administrative computer use at clerical and management levels can support the supply and use of information within so-called AVO/VWO (general secondary and/or pre-university education) schools, the preconditions for and the effects of this type of computer use.

In detail the following objectives were aimed for:

a. to carry out a **fundamental analysis** of one secondary school type by an **interdisciplinary** team, in order to be able to develop a school information system that gives **all possible administrative support** and that has **a long life**;
b. to develop **prototypes** of SCHOLIS <u>sub</u>systems by means of **modern tools** for information system development that meet **current standards** for information systems and that **fit** with the desires and characteristics of any school;
c. **to test** and **optimize** SCHOLIS prototypes and to **implement** end systems with a **high probability of acceptance**;
d. to study the **use, conditions** for use and **effects** of use of developed systems.

<u>re. fundamental analysis</u>
In section 2.3.4 a *fundamental analysis* of schools was regarded as a prerequisite for better information systems. Such an analysis should result in an accurate picture of a school and the organizational activities required to run a school well, the mutual relations between these activities and the information needed for their execution. When this information is available one can then analyze how a computer can be of assistance. The detailed school analysis should include the interaction of the school with its environment (many data flow between a school and outside persons and bodies) *from the viewpoint of the school* (and not vice versa). The SCHOLIS-project staff was aware of the fact that it would not be possible yet to realize electronic data communication between school computers and those of external bodies. Therefore support was restricted to other forms of information exchange, like printing the official forms of external bodies by computer or producing computer output that has the lay-out of official documents.
Moreover, the analysis of schools should not be restricted to describing activities carried out in schools and the information available, but should also investigate <u>new</u> possible activities when a computer is used. This proposed careful analysis of the school as a whole prevents partial automation as observed in the pilot study. On the

other hand it makes a well-considered step-by-step development of a comprehensive computer-assisted school information system possible. The analysis also had to make clear which subsystems had to become part of the total school information system and what links have to be made between these subsystems. In the so-called School Information System Framework (see chapters 4 and 5) the school has to be depicted from the viewpoint of information collection, processing, and use, in terms of its constituting subsystems and the contents of each subsystem (the support the computer can give). As such the framework can be the basis for developing SCHOLIS, when the developer specifies software characteristics and develops the SCHOLIS software. The desired type of information systems would have to *support the whole range of clerical and management activities* in schools. The computer should not only be able to register and process large quantities of administrative data but also assist the school manager with operational, tactical and strategical planning, decision-making and control activities. School management requires information about the state of the organization and its environment and an accurate prognosis of the consequences of alternative actions. The computer can be a powerful tool in accomplishing this. One can for example think of computer assistance for the following activities:

- constructing timetables, allocating students to classes, analyzing school and teacher results;
- developing a new student guidance and counselling policy as a result of analyzing student progress through school;
- analyzing the relation between actual intake and potential intake and developing an appropriate marketing strategy;
- recognizing developments that require school management action (e.g. overspending of a department, high truancy figures, poor results from a class or a teacher);
- evaluating the effects of school policies (for instance policy measures to reduce truancy).

Although an as broad as possible support from the computer was aimed for, some restrictions were made with regard to the planned support of certain activities. From the start it was decided not to analyze testing and career counselling activities, because these areas are complex and other projects had already been started to investigate ways in which the computer could be of value here.

Direct support for the teaching process would be limited to the clerical duties of teachers, so no analysis or development programmes for computer-assisted instruction (CAI) and computer-managed instruction (CMI) were undertaken.

Although an information analysis of timetabling, financial- and personnel registration was included in the plans it was determined not to attempt to develop software for these activities because this would make things too complex. Moreover, quite a lot of packages were available that assisted this work quite well (especially financial activities). Information analysis with respect to these areas was meant to provide criteria for deciding which of the commercially available software packages offered the best support. The idea was to offer the owners of selected packages the opportunity to connect their software to the SCHOLIS database.

The pilot study had shown that developing information systems is a complex activity that requires know-how from both the computer science field as well as from educational administration. The initiators of the SCHOLIS-project were convinced that only the combined input of these two disciplines, and the availability of required manpower (analysts, designers, developers, implementers, researchers and project managers) and facilities (hardware and software for developing and using the system, financial resources etc.) would make possible the development of a school information system that enables modern information technology to be used optimally. Therefore the know-how of the aforementioned disciplines was drawn together into an *interdisciplinary* information analysis team.
Because of the differences qua information household between school types, analysis and design complexity were reduced by choosing only general secondary and/or pre-university schools, a common secondary school type in the Netherlands.
A thorough analysis, in combination with the use of modern information system development tools (especially the so-called fourth generation programming languages; see also re. b.) and a modular system architecture, should provide the information system with a *long life* span. The in-depth analysis of schools would also prevent frequently adding new parts to the system, resulting in 'spaghetti structures' which hamper system maintenance and use.
The detailed analysis would also have to enable the construction of a database that contains the relevant entities of schools, as well as their attributes. If, in the future, information demands were to change the chances of this causing problems would be small. This would only be the case if the required information was related to an organizational activity, entity or attribute that had not been found when the information analysis was executed, which might for instance be the case when future developments took place that resulted in new activities, entities or attributes. An example might be the result of a governmental decision that parents under certain

conditions should pay school tax for children of sixteen years and older, which results in a new student attribute (do his/her parents have to pay school tax or not).
Moreover, the use of the fourth generation language makes the adjustment of software much easier than when this had to be done with third generation languages like COBOL, BASIC and the like. The modular architecture of SCHOLIS was regarded as another characteristic that facilitates maintenance and expansion: where this is necessary only one module has to be changed or added.

re. prototype development
The purpose was to design and develop *prototypes* for SCHOLIS subsystems that had been defined in the information system framework. The so-called prototyping strategy is an approach for information system development that was introduced in the eighties. Many different definitions of prototyping exist. Witsenboer (1985), on the basis of an evaluation of several definitions, defines it as follows:
"Prototyping is in all stages of information system development, a usable, iterative modelling process, where an executable model of a part of the information system is built in a quick way and in interaction with the user, to reduce specific uncertainties, in order to make the development process more effective and to realize better accepted and more effective results."
Witsenboer (1985) also mentions some reasons for prototyping that will be discussed now. The prototype is built and shown to the user who can evaluate to what degree this 'proposal' corresponds to his desires. As such the user participates in the design process. (S)he sees the results of the first information and design activities very clearly (in former days often written or oral system descriptions were presented to the user) and can influence system characteristics by submitting proposals for change. For developers this form of user participation has the advantage that user desires and demands with respect to the system can be better determined. The user has the possibility to formulate his desires and can do this more carefully since (s)he can react to a visual prototype and as such indicate where this corresponds to his/her wishes. One may suppose that such a strategy results in information systems that agree with the ideas of the user.

The development of prototypes is closely connected with the use of *modern tools* for information system development. The software for each subsystem of the information system framework was planned to be generated by a fourth generation programming language. The use of such a language enables the characteristics of the needed software to be defined and lets the programming tool generate the required software itself, whereas the use of third generation programming languages requires that the software be written by the developer himself. It is probably clear that the use of a fourth generation language enables the fast development and adjustment of prototypes.

Two other tools that were planned to be used to realize the desired information system are those that are especially important to the user if (s)he uses the final system (the 'end system') within the organization: the relational database and the query language. The relational database offers the possibility to relate every data element in the database to another one in it. This is important for the school manager who is interested in relations between different data elements (e.g. between student marks and absentee figures). The so-called query language can be used to manipulate data in the database and if the database contains the relevant data (as a result of the information analysis) one can operate very flexibly. Every information need of a school manager related to the database content can then be satisfied. Some of these questions can be answered by means of developed standard software, for others (less frequently formulated questions) the query language will be the tool to generate the desired information.

The prototypes that were planned to be developed would have to meet *current standards* for professional information systems that proved to be so important for success in the pilot study: user friendly and well-structured in design (among others integrated subsystems), carefully documented and with a clear manual and facilities for checking entered data, designed for use on powerful computers with generally accepted operating systems and appropriate for use in a multi-user multi-tasking environment.

Developing an integrated system was seen as important because it would enable the single entry (included mutation) and multiple use of data by authorized users and offer school managers the possibility to investigate relations between all kinds of data that are used within various subsystems. Moreover, it provides the possibility for everybody to work always with the same up-to-date data. The software available before the start of SCHOLIS had been developed by means of an evolving strategy (gradually developing new subsystems without having a picture of the total system to be built) and thus had resulted in information systems requiring for certain activities (e.g. timetabling) the repeated entry of data, and did not allow the linking-up of all data used within various subsystems.

Designing software for a computer environment of distributed databases was one objective, because the pilot study had revealed the trend away from mainframes via stand alone microcomputers (data entry, manipulation and retrieval at one location) towards using local area networks. Problems of working with stand alone computers in schools had been observed. It was expected that the school information system for the near future would consist of an octopus-like hardware structure (Tomasso, 1985) and software suitable to operate within such a distributed computer environment. The terminals/stations were expected to be distributed strategically throughout the school and to be connected with a central database. Several persons coulo use the same system at the same time. In other words, the developed system should be appropriate for individual and simultaneous operation without conflict or interference.

Developers of commercially available software had proved it was possible to change a stand-alone system in such a way that it could be used at the same time by more than one user. However, since such a system had not been designed for a 'multi-user multi-tasking' environment, these adaptations have their limits and never lead to results that would have been possible with a 'multi-user multi-tasking' design basis, which for SCHOLIS would be used from the start.

Research has shown that a 'standard' school does not exist (Rutter et al., 1979; Van der Krogt, 1983; Van Marwijk-Kooy, 1984). Every educational institution has its own specific organizational characteristics, also in respect to its information household, thus schools probably make different demands on information systems. One school might especially be interested in clerical modules of the system while another needs management support system elements. Moreover, methods of registration might differ: one school registers more student data than another and/or registers these data in a different way. In fact each school probably desires its own information system as a result of these differences, thus an information system was planned that has enough flexibility to permit a school to impose its own identity on it on the one hand, yet had enough common ground to be developed and maintained at a national level, on the other.

The analysis of various schools with different characteristics, in combination with the use of the described modem tools to adapt the system quickly, and the thorough testing of developed prototypes in a number of schools (see also re. c.) should be considered as activities intended to develop systems that can be used in as many schools of a certain type as possible.

A final way to try to realize systems that *fit with the desires and characteristics of each school* was to build the system on a modular base. Each school would then be able to purchase only those parts of the total system it needs. Moreover, this might give schools the opportunity to expand the general system with specific modules. The latter however requires that those schools possess the know-how for these activities, or that the additional software is developed in a different way.

re. prototype optimization and end system implementation

*Testing* and *optimization* of every developed prototype in project schools was planned after prototypes had been tested internally by members of the SCHOLIS-project team. Prototypes would be introduced to schools and the user would be informed about their possibilities. On the basis of experience with the prototype the user would report positive and negative characteristics to the prototype-developers. The purpose of this was to improve prototypes until a stable prototype was realized that satisfied both users and developers.

However, a stable prototype still does not have the characteristics of a software package that can be sold to, and used in, every arbitrary school, without long intensive user support. The latter is only possible with an 'end system'. Since the translation of prototypes to end systems was not considered to be the work of people in a research and development environment, the idea was to hand over the final prototype version to industry where the end system version could be produced, sold and maintained. Such a strategy would fulfill the condition of an organization at the supra school level that takes care of required maintenance and expansion activities with regard to SCHOLIS.

The end subsystems were meant to be *implemented* step by step in the project schools. The pilot study had shown that schools need some time for the introduction and incorporation of each subsystem, so a gradual approach was followed. It was thought that if this could be accomplished, the *chance of the system being accepted* and used would also be high. More user 'ownership' was attempted by offering the user the opportunity to participate in prototyping activities and thus contribute to the design of the first prototype.

To be able to design and develop a system that fits the characteristics of schools and therefore will probably be used intensively, the aim was to involve practitioners in the analysis and development activities. The pure expert approach whereby the 'expert' makes an analysis and autonomously defines how the information system will look has all too often led to undesired results (see e.g. Mumford & Weir, 1979, 980; Schmidt-Belz, 1980). Systems developed on the basis of an expert strategy quite often prove to be technically sophisticated but at the same time have a very low level of use. A participative strategy was chosen for the SCHOLIS-project, aimed at creating a dialogue between user and developer in order to combine technical expertise on the other hand with knowledge concerning how schools operate and 'what will work' on the other. In concrete terms, the following forms of user participation were planned: to provide information on the organizational processes and information needs in schools, to verify the results of the analysis and to let users react on proposed (written) forms of computer support and on developed prototypes. The SCHOLIS analysts decided to act independently up to a point and to design the database and subsystem software in such a way that future changes in information needs would not cause modification problems. This was done so that if users at one moment did not consider a specific form of support valuable but later change their minds the system could be easily altered.

Pilot research showed that a successful introduction of the information system required user coaching and training, so intensive information was planned for practitioners in project schools on the system's possibilities and the way in which software (applications and the query language) and hardware could be used.

re. (conditions for) use and effects

In chapter two it has already been pointed out that there are few studies on the effectiveness of computer-assisted information systems. For that reason a study was planned of the degree to which developed subsystems are *used* in schools, which *conditions* promote or hinder system use and what the *effects* of computer use are. It will be clear that SCHOLIS designers and developers were eager to investigate the intensity of use of various systems. Since there could be quite a lot of variety in the way in which a system is used (e.g. only for registering or only for policy-making) this would also be studied. As far as conditions for use are concerned, of special interest is how the general characteristics of school organizations relate to the possibilities of computer-assisted school information systems. One might for instance think of the following questions. Will the capabilities of information systems indeed result in more efficient and effective schools? Will it become possible to evaluate functioning of schools better and to develop well-founded school policies on the basis of the information computers provide? What can be done with the information about the functioning of, for instance, students and teachers - to what extent can it be used to improve their functioning? As well as the relation between school organizational characteristics and computer use a general goal was to investigate to what degree differences between schools influence system use. Which characteristics for example do schools have where the computer is used intensively, in terms of their organization and/or support received (coaching, facilities)?

3.2.1 Project strategy in broad terms

The project goals described in the previous section imply a number of activities directed towards realizing the planned information system. To give the reader a broad picture of the planned project activities their sequence is described here.
The following five project stages and their output are distinguished:

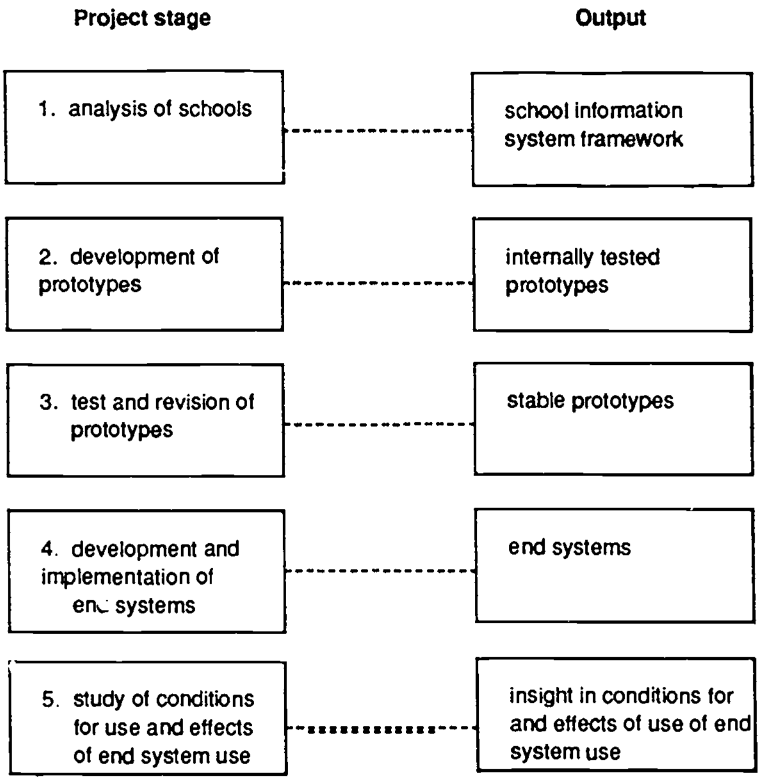



*Figure 1: Project stages and their output*

The first stage was meant to analyse and describe information household characteristics of general secondary and/or pre-university schools in detail and to determine all activities within a school that could be computer-supported. This analysis results in a School Information System Framework (SISF), the meaning of which is fully explained in chapter 4. For that reason only a brief description of this type of output of the schools analyses is given here. The SISF contains a definition of the organizational activity subsystems a school for general secondary and/or pre-university education consists of, their input and output, as well as their mutual relations (sequence of activities, information, material and mixed flows). An activity subsystem should be regarded as interrelated organizational activities such as those concerning personnel registration, financial planning, timetabling, student guidance and counselling registration. Each activity subsystem in the SISF is elaborated in activities of a lower abstraction level and for each of these activities the role the computer can play has been determined.

Activities that can be automatized are the starting point for computer programmers that begin their activities during the second stage when prototypes of information subsystems are developed. Before computer programmers can begin they translate the definition of activities which can be automatized from the SISF in stage one into 'functional descriptions', that is, descriptions of computer functions that have to be developed. When first versions of prototypes have been developed these are first tested internally by project members in phase two.

After the internal testing of the prototypes they are introduced to the project schools. When schools have learned how to work with a prototype, the second test can start. The user then provides feedback for the developers about software bugs and the degree to which the software corresponds with his/her needs. The prototype is revised when bugs have been observed and/or when it is decided that software characteristics have to be changed as a consequence of other user feedback.

In stage four stable prototypes are transferred into so-called end systems, that is, into software that can be introduced to, and used by, any school, without having to be afraid of huge problems or having to support and train users intensively. Subsequently end systems are implemented in project schools.

In the fifth stage end systems are used so that in project schools the conditions for system use and its effects can be studied.

# CHAPTER 4 STRATEGY FOR DESIGNING A SCHOOL INFORMATION SYSTEM FRAMEWORK

## 4.1 Introduction

This chapter describes how the school information system framework was designed. The aim was to obtain a clear picture of activities carried out in Dutch schools for general secondary and/or pre-university education, relations between these activities and information needed for carrying out each activity. When this knowledge was available, a so-called School Information System Framework (SISF) could be developed. A SISF comprises all organizational activity subsystems of schools (in this project schools for general secondary and/or pre-university education) and shows their input, output and mutual relations (in terms of information and/or material flows between them). Moreover, within each SISF subsystem (e.g. financial registration or student registration) the activities that constitute it are described and the role the computer can play in their execution is also determined.

## 4.2 Design strategy stages

### 4.2.1 Constructing hypothetical reference models

Designing a school information system framework (SISF) for schools for general secondary and/or pre-university education requires knowledge of what goes on in schools, why, and what information is valuable where and when. Therefore a detailed analysis of schools was undertaken.
The first activity concerning the analysis of schools was the designing of so-called reference models. These models provide temporary, hypothetical pictures of information dependencies between school organizational processes, and are meant as a basis for analyzing schools. When designing them an attempt was made to form images of (relations between) school organizational processes and of information needed for them, before schools were analyzed empirically. The reference models were developed on the basis of available knowledge about schools, including literature study. What was required were descriptions of what happens in schools, from the moment a student applies for a school, till he/she leaves the school. What activities for instance are carried out regarding the admittance decision, allocating students to classes, counselling and guidance? Attention was not only given to student-related

affairs but also to areas like personnel, finance, timetabling, and resources, both at clerical and management levels.

Literature research showed how little information was available on the activities involved in running a school. This type of literature when compared to literature on profit organizations is scant. Literature about companies comprises various ways to organize marketing, financial, clerical, personnel and other activities. However, specific information on activities outside the classroom intended to create good conditions for the teaching-learning process could hardly be found in school organization literature. This mainly consisted of abstract theories about school characteristics and the way in which these influence school functioning. Processes taking place in schools are discussed more generally. As a result literature did not provide the detailed information needed, like how are timetables constructed? How are financial, personnel and other resources planned for the next school year? What information is important regarding registration, financial administration? For this reason an attempt was made to translate what was known about processes in companies in relation to schools and to form an image of the way in which similar processes take place in schools.

When developing reference models the school was divided into organizational activity subsystems according to content. For instance these included financial registration, financial planning, educational planning, and personnel planning.

The approach was to distinguish meaningful activity subsystems and then unravel their contents at lower levels. Activity diagram 'The school' in Appendix 1 comprises six subsystems that were considered to constitute school activities: 1. Planning, 2. Resources, 3. Pupil administration, 4. Teaching-Learning process, 5. Financial registration and 6. Personnel administration. The subsystem input (e.g. buildings and facilities, information and rules from the government/board of governors, completed personnel forms for the 'Planning' subsystem) is shown in the 'School' diagram, just as the subsystem output (e.g. payment orders and external financial correspondence from subsystem 5 'Financial registration'). Moreover, the interrelations between subsystems are portrayed in the 'School' diagram, in terms of the information and material flows between them. In subsequent diagrams these subsystems have been elaborated upon. For instance, Pupil administration has been elaborated upon in A-schema 3 (see Appendix 2), which shows that this subsystem consists of nine component activities (= groups of interrelated activities), namely: 1. Enrollment, 2. Grouping pupils into classes, 3. Administration of principal pupil data, 4. Absentee registration, 5. Pupil guidance and counseling, 6. Test scores registration, 7. Internal Examination / National Written Examination (IE/NWE), 8. Deletion of pupil names out of school register, 9. Producing pupil reports.

These component activities have been elaborated upon in A-schema 3.1 (Enrollment) upto and including A-schema 3.8 (Deletion of pupil names out of school register). Enrollment schema 3.1 (see Appendix 2.1) for example details the component activities involved with Enrollment as well as the information and material flows between component activities. A-schema 3.1 shows the Enrollment subsystem consists of four component activities (1. Recruiting, 2. Handling applications, 3. Admittance and 4. compose pupil files). The second component Handling applications proves to have eight input sets (including result of psychological test, withdrawals, filled in application forms) as well as nine output sets (e.g. application form to be filled in, influx prognosis reports). Finally the elementary activities that comprise the component activities have been formulated. An elementary activity is an activity that cannot be divided further into subactivities. The person carrying out the activity possesses all required information without being dependent on the results of other processes of which (s)he has no control. For instance, the elementary activities comprising 'Absentee registration' are presented in Appendix 2.2. The component activities of Absentee registration (see A-schema 3.4 in Appendix 2.1: 1. approval of absence requests, 2. administration of absence data etc.) together seem to consist of 28 elementary activities.
It should be stressed here that the diagrams as presented in Appendix 1 to 3 portray the final results of the analysis activities. So, therefore they are not exactly like the hypothetical reference models the analysis commenced with and which were altered frequently until the diagrams as shown in the Appendices were available. Nevertheless, from the Appendices the characteristics are shown of the hypothetical reference models the analysis of schools began with. The diagrams are shown to explain the features of the design strategy. For more information on the contents of the diagrams (e.g. on the input and output sets) the reader is referred to Essink and Visscher (1989a+b)).
When trying to obtain a realistic picture of a school, concepts like root class, lesson group, profile improvement, score improvement, examination resits, pooling, the first final examination period had to be defined. These definitions were necessary to make organizational life in schools clear and to prevent communication within the project team and between analists and school staff becoming confused.

#### 4.2.2 Testing reference models in three schools

To verify the constructed reference models, three schools for general secondary and/or pre-university education have been analyzed. Criteria regarding content as well as contingency criteria were relevant for selecting the schools to be analyzed, namely:

- the administrative body of the school (three alternatives: the local municipal authority as a public-authority governing body, a private governing body, and a Ministerial governing body);
- the structure of the school in terms of the types of schools available;
- the way in which students are selected (among others a transition form of one or of two years and separated* or unseparated* VWO);
- the degree of willingness to participate in the SCHOLIS-project (very important because a great deal of effort would be demanded from schools);
- the distance between the University of Twente and a project school.

It was impossible to spread project schools neatly across all these criteria. Three schools were found that were willing to participate in the SCHOLIS-project, that were close to the University of Twente and also valuable with regard to other selection criteria. These schools had the following characteristics concerning the contents selection criteria:

| school | form of administration | school type | student selection method |
|---|---|---|---|
| school A | local municipal public-authority school | MAVO/HAVO/VWO** | - two year transition form<br>- separated VWO |
| school B | ministerial public-authority school | HAVO + VWO | - one year transition form<br>- unseparated VWO |
| school C | private school | HAVO + VWO | - one year transition form<br>- separated VWO |

*Table 2: Characteristics of the scnools analyzed*

* Separated means the school has a separate Gymnasium and a separate Atheneum division, each having different criteria regarding subjects offered. Unseparated means an almost free choice of subjects after grade four when students are 16.

** VWO = pre-university education; HAVO = senior general secondary education; MAVO = junior general secondary education

It was planned to involve a fourth school in the analysis (a private school with only an AVO, or only a VWO school type), after the first three schools had been analyzed. However, financial restrictions hindered the realization of this goal. Differences between schools have been analyzed in order to develop a general model of AVO/VWO schools that does justice to each variation.
The strategy was to start with analyzing the most complex school, namely school A which consists of MAVO, HAVO and VWO education, on the grounds that when the most complex school has been analyzed, it would be relatively easy to analyze less complicated schools.
The analysis consisted of interviews based on reference models with staff members intensively involved in certain school organizational activities (e.g. admitting new students, registering absentees, devising timetables).
Interview questionnaires were developed on the basis of reference models, to enable the execution of a specific analysis and to discover errors in the reference models. In each school the principal was asked which of his/her staff members could give a careful picture of the following school activities:

- recruitment, admittance and registration of new students;
- grouping students into classes;
- blocking (which lessons can be given at the same moment on the timetable, by which teachers, for which students, and in such a way that every student can follow the lessons he/she wants to follow);
- pastoral/counselling and careers/academic counselling activities;
- absentee registration;
- test scores registration;
- registration of internal and external final examinations;
- deleting students' names from the school register;
- devising timetables;
- resources supply (including the book fund*);
- personnel administration;
- financial administration;
- planning the next academic year.

---

* Quite a few Dutch schools offer students/parents the possibility of subscribing to a school book fund. This means students/parents can rent the books they need from the school. Since costs of purchasing books can be divided over several students/ parents and school years (books are used for many years), costs for a student can be lower than when each student has to buy his/her own books.

After the principal had provided the relevant information, recommended staff members were contacted for one or more interviews. The following staff members were interviewed:

| | school A | school B | school C | Total |
|---|---|---|---|---|
| principal | 1 | 1 | 1 | 3 |
| deputee principals | 5 | 4 | 4 | 13 |
| student counsellors | 2 | 2 | 1 | 5 |
| clerical staff | 2 | 3 | 2 | 7 |
| book fund functionary | 1 | - | 1 | 2 |
| timetabler | 1 | 1 | 1 | 3 |
| heads of departme:.. | - | 1 | 1 | 2 |
| caretaker | 1 | 1 | 1 | 3 |
| | --- | --- | --- | --- |
| | 13 | 13 | 12 | 38 |

*Table 3: Number of staff members interviewed*

Several of the staff interviewed were involved in more than one school activity and therefore interviewed about all their activities (they were interviewed twice or three times). Moreover, some schools had more staff members of a specific type (e.g. deputee principals) than others. As a result of both facts, in some schools less staff members of a certain type have been interviewed than in others.

In the three schools analyzed 85 two-hour interviews (42, 16 and 27 in school A, B and C respectively) were carried out. All interviews were recorded and later transcribed.

As a result of the interviews, all school documents used when an activity was carried out were collected because they showed in a detailed way which data were registered and processed and how this was done. The enormous number of documents was filed and analyzed.

4.2.3 Formulating draft elementary activities, their verification and adaptation

On the basis of the data collected in each school a chronological description was made of the elementary activities comprising each organizational activity subsystem. Descriptions of organizational activity subsystems of each school, in terms of elementary activities, were then presented to interviewed staff members for verification and as a result were adapted. When each organizational subsystem of the three schools had been described in a more final form in terms of elementary activities (Essink & Visscher, 1989a+b), the next important step could be taken: the designing of a general model of the information housekeeping of an AVO/VWO school.

4.2.4 Towards a school information system framework

It was attempted to construct a general model (the school information system framework) of a Dutch school for general secondary and/or pre-university education that did justice to each of the school organizations analyzed. Sometimes it was impossible to design a subsystem that integrated everything that had been observed in all the analyzed schools. In such cases a choice had to be made on what would be honoured and what would not. Moreover, when subsystems were designed, not only the situation was depicted, as it already existed at the time a computer was not in use, but it was determined how modern information technology could be used for administering schools. So new elementary activities, possible as a result of having a computer available, have also been included in the general model. One can for instance think of activities like registering data previously not registered, or of computer-assisted retrieval of information, formerly not available (e.g. relating various data elements, stored in the database, to each other), producing new reports, forms and the like. Sometimes new forms were designed because such forms in the opinion of the designers of the school information system framework could be of use. An important goal in defining new computer-assisted activities was the availability of reliable information for internal and external purposes. This goal especially lead to defining elementary activities intended to provide school management with all kinds of management reports. A computer enables school managers to relate various kinds of data to each other, and as such to investigate relations between variables: e.g. relations between teachers on the one hand and achievements and truancy figures of the classes they teach on the other. Furthermore, the computer can provide reports on other matters, like:

- the number/proportion of final examination failures, per lesson group/per subject;
- the number/proportion of unsatisfactory marks per subject, compared to other subjects;
- per school type achievement scores for each final examination subject of the National Written Examination when compared to previous years, as well as comparative studies of internal final examination scores and national average scores;

- budget management;
- school staff absence: individual absence over a certain period, absence within certain sectors of the school, surveys per absence type or staff member type over various school years;
- percentages concerning chosen school type grades, subjects and school type levels, in comparison with previous years;
- student absence reports per school type, period, student, and lesson group; or cross sections such as absence of students who have failed in more than five subjects;
- reports on the number of students that have applied and the number of students admitted;
- relationship between primary school attended and student achievement (scores, school types).

As well as defining new useful activities that become possible when a computer is available, other reasons lead to new defined activities too.
One of the goals that guided the design activities concerned the realizing of a sound administrative organization. This means that a situation was strived for in which an accurate view of the existing organizational situation can be given speedily, at any desired moment, and that the availability of essential information makes it possible to carry out activities in a coordinated way. Therefore the aim was to see that all data relevant for an activity are available within the school, and that internal and external persons and bodies are timely informed about topics they inquire about. Moreover, for reasons of efficiency an attempt was made to prevent double registration of data. It was also considered important to determine which staff members were competent to take decisions, and which procedures should be followed in case of important decisions. Finally it was attempted to avoid informal procedures, if they were considered to be ineffective.

Designing subsystems is a creative activity. The aforementioned design principles are latent and every now and then designers have an idea about how to improve school procedures by making use of the design principles.
As an example of the way in which subsystems were designed, the structure of the 'Enrollment' subsystem will be presented, including how it was designed and why it was designed in that way. For information on other subystems of the school information system framework the reader is referred to Essink & Visscher (1989a+b).
The analysis of project schools showed that each school had its own way of handling enrollment activities. One can observe differences with regard to procedures followed,

forms used, admission criteria etc. Moreover, even within the same school, enrollment procedures for admission to one grade proved to differ from admission procedures for another grade. The task was to find general required activities and to design a set of activities that could be used in any school.

In order to obtain insight into enrollment activities, first the concepts that proved to be important within this subsystem were defined. Concepts like application form, information form, confidential information form, influx of students, score improvement, profile improvement and admission examination were defined.

The next stage concerned the distinguishing of four enrollment component activities (= groups of interrelated activities), on the basis of the school analyses: recruitment, handling applications, admission and composing student files. These four groups of component activities were considered to be the core activities of an enrollment subsystem. Component activities were then detailed into roughly fourty elementary enrollment activities. The 'Enrollment' subsystem structure will be summarized now and after that some characteristics of the design will be explained. Appendix 2 shows the Enrollment subsystem to be the first subsystem of the Pupil administration subsystem. A-scheme 3.1 (Appendix 2.1) shows the four component activities comprising the Enrollment subsystem, as well as the input and output sets of the Enrollment subsystem. A description will now be given of the elementary activities of the Enrollment subsystem. In fact the SISF includes only part of all possible computer-assisted elementary activities, since a gigantic number of information retrieval activities are possible when so many data are stored in a relational database (since it is possible to bring all data elements in relation to each other). However, it is impossible and pointless to try to include all possible information retrieval activities. The reader should however be aware that not all elementary activities are presented here and neither all possible computer support as such. A (**) sign behind an elementary activity indicates that the execution of an activity can be supported by the computer.

Description of the designed elementary Enrollment activities

*After the school has executed activities to recruit students (e.g. contacting delivering schools, placing advertisements for new students), application and information forms (to obtain information on students applying to the school) are sent to schools and parents. After some time these forms are returned completed. In the design it was proposed to give each returned information form a number and to place it in the application files, after it had been checked for completeness. In case of missing data, parents or schools were given a reminder (**).*

*Parents receive confirmation of application (**) and data relevant to the entrance decision (e.g. student name, advice of the principal of the previous school, the school type grade a student applies for, his/her desired subjects, his/her test scores) are registered (**).*

*Then the so-called cross list is produced (**) comprising all students applying for a certain school type grade (sorted out per delivering school), as well as data important to the entrance decision (a student's previous training, advice of the delivering school, etc.). This cross list goes to members of the admissions committee taking the entrance decisions. In the designing of the subsystem it is proposed that this committee takes one of the following decisions: admits provisionally (AP), admits definitively (AD), rejects (R). A student will be admitted provisionally if one or more conditions for his/her definitive admission still have to be fulfilled, like:*

- *firstly the student has to pass an entrance exam for a certain subject or take a psychology test;*
- *a further talk with the parents/students is necessary;*
- *the student has to pass the final exam of the delivering school.*

*Decisions taken are subsequently registered via the cross list and processed later by the school office (**). On the basis of these data a list of all students with a specific 'wait-condition' can be produced (**) at any desired moment, as well as a list of all students admitted definitively.*

*When the information required for the 'wait-conditions' is known (e.g. results of entrance examinations or of psychology tests) and all entrance decisions have been taken, parents/students are informed of these decisions (**). Those students who have not been admitted can demand a review of the entrance decision. This request would then be handled, after which the final entrance decisions for this group of students can also be taken. Subsequently student data on students admitted are completed (**), since until then only data relevant to the entrance decision has been registered. After that student stickers (containing principal student data and used for making student cards and files), student card and student files of each admitted student are produced(**).*

*After the first school weeks application and admission reports are produced for each delivering school and for each internal school type grade (**); at the end of the school year, when interim applications/admissions are also known, this is repeated.*

The role of the design principles

The way the design principles played a role in designing the Enrollment subsystem will now be explained. As already mentioned, as a result of analyzing the schools a sound administrative organization was aimed for. Therefore a distinction was made between direct, indirect, incidental and interim student applications, and elementary activities necessary to each of them were designed. A direct application is an application that comes directly from parents (by telephone or letter). On receipt of an application the school sends an application form to parents to complete. An indirect application comes from delivering schools that are regularly approached by a staff member of a receiving school. Incidental applications are direct applications at the start of a school year for grades that normally do not have many applicants (like the second, third and sixth grade), nor a formal admission committee. The applying student in these cases is often only approved by one person (e.g. the deputy head). An interim application is an application submitted during the school year and as such is always a direct application. In cases of interim applications for a school type grade, the application is always treated very informally (no admission committee).

A distinction has also been made between applications for the transition grade and applications for higher grades. It was proposed to use different application forms for both grades because different data are important for the application decision in both situations (e.g. subjects a student would like to choose are only important for the entrance decision concerning applications for higher grades).

Other examples of attempts to realize a sound administrative organization are as follows:

- It was proposed to send a confirmation letter to parents/students when an application is received and when the final entrance decision has been taken in order to inform them about the progress of their application;
- Steps were taken to ensure missing data on forms and missing forms are timely noticed and to take action in cases of missing data/forms;
- It was proposed to give each application form received a number according to the order in which it is received as well as the total number of applications at a given moment;
- When application forms have been received data relevant for the entrance decision have to be registered first. Other data on the application forms are only registered after a student has been admitted. This is done for reasons of efficiency, since all other received data of students who will not be admitted does not then have to be registered;

- An important characteristic of the designed subsystem concerns the already mentioned cross list which contains data relevant to the entrance decision. The list is meant to be used by the admissions commitee and always provides an up-to-date overview of the number of applied students and the state of each application. As such the cross list has an important coordinating function. The 'wait-condition' terms were proposed to be able to distinguish between different states of application;
- If parents do not agree with the rejection of their application these are dealt with as follows: parents have to submit a request for a review, if approved the admissions committee (as the competent body) changes the state of an application from 'Rejects' into 'Admits Definitively.' By defining this procedure it is attempted to avoid informal procedures;
- Schools delivering students are informed about their students' enrollment. They receive a report including which of their students applied for the school and the final entrance decision concerning these students.

Next to striving for a sound administrative organization, defining new valuable (computer) activities was mentioned as a goal/design principle. The (**) sign behind some of the elementary activities indicates which new elementary computer activities were proposed when the Enrollment subsystem was designed. The role the computer play in executing each elementary activity has been evaluated as follows: (a) none, an activity which cannot be formalized, b) one that can be formalized, but which should be executed by a person, c) a supporting role (a man-machine activity carried out partly by a person and partly by the computer), or d) complete executing role (the computer carries out a machine activity). Figure 2 depicts the various possible organizational activities.

Some of these activities are meant to retrieve valuable information. School management can for instance investigate:
- the relation between the number of students applying and the number of students that have been admitted;
- trends in the number of students received from each of the delivering schools;
- the relation between the school of origin, or the school advice of the principal of the delivering school on the one hand, and student achievement on the other.

Other new elementary activities have been designed to draw the attention of users, if a certain action has to be carried out (e.g. to obtain missing data), again others are executed to register new relevant information in order to produce new forms/lists, or to process data.

Since data are supposed to be registered in a database that can be approached from various points (terminals within a computer network) within the school, double registration of data is avoided.

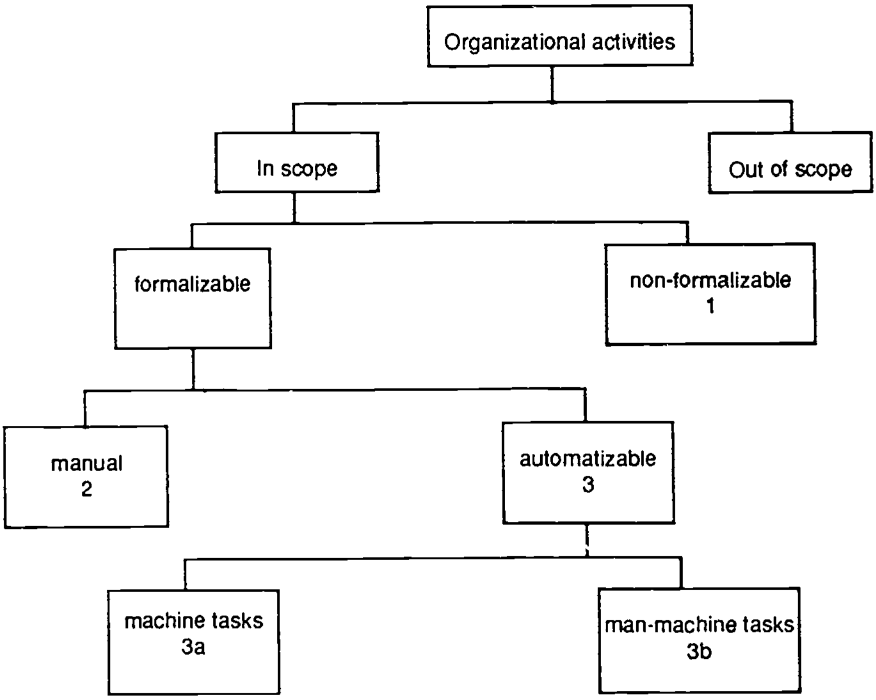



*Figure 2: A classification of organizational activities*

Legend:

- in scope: the activity is part of the framework of the information system framework;
- out of scope: the activity is not part of the framework, so no attention is paid to it;
- formalizable: the activity can be described within strict rules;
- non-formalizable (code 1): the activity cannot be described within strict rules;
- manual (code 2): the activity cannot be automatized (e.g. judging if a student can have a day's leave of absence or not);
- machine tasks (code 3a): for instance the computer produces lists;
- man-machine tasks (code 3b): e.g. entering data into the computer.

4.2.5 Collecting feedback and defining the final SISF

To prevent a School Information System Framework being designed that does not fit the practical situation of schools, it was decided to have the activity subsystems and their elementary activities judged by school staff. Feedback was obtained by arranging several meetings with schools during which members of the SCHOLIS-project team presented their proposals with regard to each activity subsystem: proposed elementary activities, their sequence and the degree to which the computer was plar .ed to be used for their execution. Each school was represented by a cross-section of staff members (among others clerical staff, principal, deputy heads). During these meetings the essence of each activity subsystem was explained and after that a subsystem was discussed in subgroups. Then feasibility, advantages and disadvantages of proposed subsystems were discussed plenarily.
As a result of the feedback, the SISF was modified until a framework became available that did justice to the potential of modem information technology as well as to school characteristics and needs.

Having described the various design activities, the sequence of design stages can be summarized as follows (see Figure 3). After the reference models of various school organizational activities had been constructed 'from behind a desk' (step 1), they were confronted with the reality of school life and adapted accordingly (step 2). Interviews and document analysis showed reference model limitations. On the basis of the information collectod by testing reference models, each school analyzed was portrayed in terms of its elementary activities (step 3). These descriptions were then returned to project schools to verify if analists' perceptions of school life were correct. Where necessary the set of elementary activities was modified (step 4). The fifth step consisted of constructing a general School Information System Framework (SISF) draft on the basis of elementary activities of all schools. This included constructing a general set of elementary activities, meant as proposals for operating any Dutch secondary school for AVO/VWO. The draft SISF was then presented to school staff delegations to check if it would fit with the actual reality of school life (the sixth step). When this step had produced the desired information the final SISF could be constructed which formed the basis for the functional design of SCHOLIS (Essink & Romkema, 1989), software development, and the introduction of SCHOLIS-software into project schools.

1. constructing hypothetical reference models
2. testing reference models in project schools
3. draft description of each project school in terms of the elementary activities comprising each activity subsystem
4. verification and adaptation of elementary activities of all schools analyzed
5. designing the general School Information System Framework draft
6. collecting feedback on the School Information System Framework draft
7. defining the final School Information System Framework

*Figure 3: Design strategy stages*

## CHAPTER 5 RESULTS OF ANALYSIS AND DESIGN ACTIVITIES

### 5.1 Introduction

The complete results of the analysis and design activities have been published in Essink & Visscher (1989a+b). Their full presentation here would take more than two hundred pages, so a selection had to be made. Those readers interested in the full results are referred to Essink & Visscher (1989a+b).
In this chapter the main results are treated first (section 5.2) by describing the computer support possible in each subsystem of the school information system framework. In section 5.3 the results are then reflected upon in three ways. Firstly, the types of elementary activities comprising each designed activity subsystem is discussed. Then the way in which computers can give support to management staff is treated. Finally, computer functions will be related to school organizational processes. In the last section (5.4) a follow-up to the design results is described.

### 5.2 Description of the design results

#### 5.2.1 Portrayal of the school

The first type of output of the analysis and design activities outlines the interaction of a school for general secondary and/or pre-university education with its environment. It lists the external persons/bodies with which the school exchanges information, goods and the like as well as *what* goes from the school to these persons/bodies (output) and comes from them (input). The diagram is not meant to be exhaustive, listing only the most important entities. For details the reader is referred to the diagram 'The interaction of the school with its environment' in Appendix 3 of this thesis, which shows the school interacting intensively with its environment. Seventeen (groups of) persons/bodies the school exchanges output and/or input with are mentioned.
The school interacts most intensively with (parents of) admitted students and school staff (teachers, management and non-teaching personnel). The school also has to deliver much data to the Ministry of Education and Science and the Schools Inspectorate. Next to these major entities an AVO/VWO school receives information/goods from, and delivers information/goods to, thirteen others. In Appendix 3 input and output that come from and go to all entities are mentioned.

A more sizeable kind of design result is the school organizational activity subsystems comprising a school, their desired input and output and the activities by which input is transformed into output. This portrayal of schools in terms of organizational activity subsystems is hierarchical. It starts with the school as a whole and on a global level typifies a number of organizational subsystems, their mutual relations and their input and output. Six organizational activity subsystems have been distinguished at this level: planning, resources, student administration, teaching-learning process, financial registration and personnel administration (see Appendix 1). Since the goal was to design an information system that supports registrational and management activities the teaching-learning process has not been analyzed.

After presenting an overall picture of the school, the elements of the school diagram (see Appendix 1) have been elaborated upon in other diagrams whereby each organizational activity subsystem is portrayed more in detail. When the step from the school as a whole to the level of organizational activity subsystems has been taken, activity subsystems are divided into component activities (all component activities together make up an activity subsystem). In Appendix 2 the third organizational activity subsystem ('Pupil administration') is elaborated upon by showing its subsystems, their mutual relations and the input/output of the subsystems. In Appendix 2.1 the subsystems of Appendix 2 are elaborated upon by showing their mutual relations, their component activities and mutual relations as well as their input and output. Moreover, the elementary activities of a component activity are defined and the design shows which elementary activity can be supported by means of the computer and how (see Appendix 2.2 for the elementary activities of the Absentee registration subsystem).

The structure of the SCHOLIS documentation is presented in Appendix 4 'An overview of the hierarchy of 'A-diagrams' in the SCHOLIS documentation'. This overview gives the structure of the organizational School Information System Framework, showing six organizational activity subsystems and their subsystems and component activities:

1. Planning, 2. Resources, 3. Student registration, 4. Teaching-learning process, 5. Financial registration, 6. Personnel registration.

When this <u>organizational</u> activity subsystem structure was available, the structure of the <u>computer-assisted</u> information system SCHOLIS was determined by deciding on the subsystems SCHOLIS was planned to consist of.

In some cases this meant that parts of the organizational activity subsystems were planned to be separate computer-assisted SCHOLIS subsystems. The structure of SCHOLIS is portrayed in Figure 4, which shows seven registrational and four management subsystems.

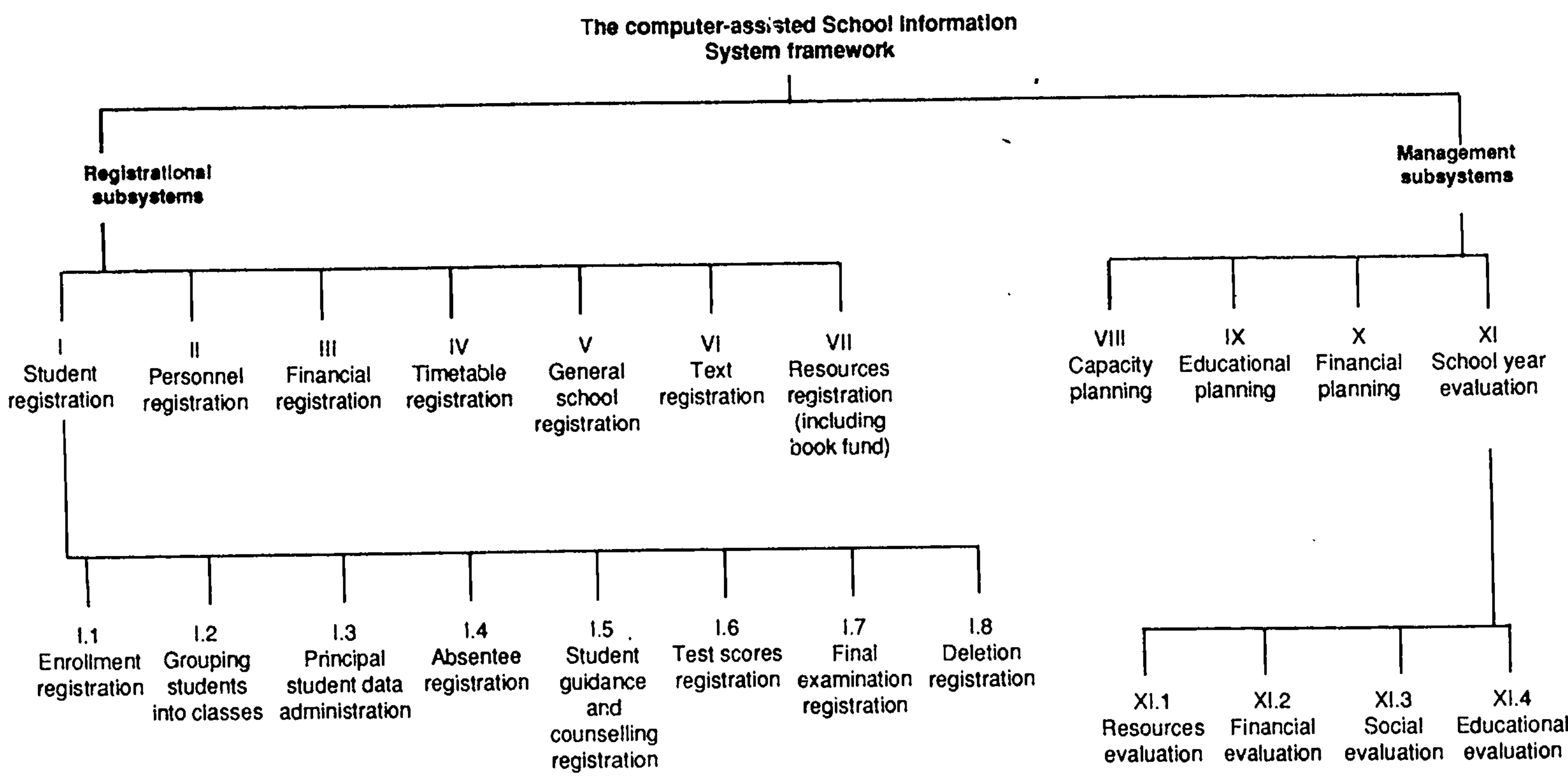



*Figure 4: A computer-assisted School Information System Framework for schools for general secondary/pre-university education*

Timetable registration (subsystem IV), General School registration (V) and Text registration (VI) were considered as separate SCHOLIS subsystems, although they are not separate subsystems of the organizational SISF because of being subsystems of little organizational complexity. Within General School registration certain aspects of the school are registered like its building situation, tasks to be carried out, organizational goals and lesson table. In subsystem IV timetables and timetable modifications are registered. The computer-assisted subsystem 'General School Registration' has been defined in terms of the organizational activity subsystem 'Planning' (General School Planning and Evaluation), whereas 'Timetable registration' has been defined in terms of the organizational activity subsystem 'Educational Planning' ('Timetabling/Timetable administration'). No separate organizational activity subsystem exists for 'Text registration', the sixth computer-assisted subsystem, which is meant to keep texts that are used within schools up to date. In fact within all six organizational activity subsystems, texts are used that are produced and modified within this subsystem.

Within the organizational framework, desired school organizational activities, their mutual relations and the role the computer can play in their execution (is it a 1, 2, 3a or 3b activity; see Figure 2 in chapter four) are presented. Potential registrational and computer output functions have also been determined. In the functional descriptions (Essink & Romkema, 1989), design activities on the basis of these potential information system functions concentrate on realizing the support the Information System (IS) can offer. For that reason a number of IS-subsystems is distinguished that are subdivided into component computer functions and elementary computer functions. The functional description concentrates on computer functions and their accompanying entity structure (a data structure model to represent input messages and to generate the desired output). However, in this thesis attention is focused on the construction of the organizational information system framework. The computer-assisted framework (figure 8) has been the point of departure for computer scientists designing the computer functions and the so-called entity structure). For details on the functional descriptions the reader is referred to Essink & Romkema (1989).

Subsequently some remarks concerning the structure of the computer-assisted SISF presented in Figure 4. This figure shows the 'Student Registration' subsystem to be an important one, since eight student registration subsystems are reserved for registering student data. A student's school progress is depicted by eight Student registration elements ranging from 'Enrollment' to 'Deletion'). Similar to other organizations a personnel (subsystem II), financial (III), text (VI) and resources supply registration (VII) subsystem have been identified in AVO/VWO schools.

As mentioned before two more subsystems have been classified as registrational subsystems: 'General school registration' (V), which includes registration and mutation of general school characteristics like the school structure, student promotion standards and subjects to be taught and 'Timetable registration' (IV) in which timetables and daily timetable modifications are recorded.

As far as management subsystems are concerned three planning activities, capacity, educational and financial, have been identified as well as school year evaluation. 'Capacity planning' concerns planning the required manpower (teaching and non-teaching), technical infrastructure, school buildings and grounds. Under manpower planning one can think of planning the number of lesson- and task periods to spend and planning the number of lesson groups (the latter has consequences for the manpower required). Capacity planning in particular involves a lot of work and is an area in which computers can be considerably important.

Another planning activity concerns 'Educational planning' which includes teacher recruitment and determining who (which teacher) will teach what (which subject) to whom (which lesson group) and when.

'Financial planning' covers all kinds of budgetary activities including drawing up the draft school estimate and determining the final estimate, department estimates, and investment plans. The 'School year evaluation' subsystem (XI) covers wide-ranging management processes, like evaluating resources (buildings) and organizational structures the school has used, the way in which financial resources have been used, social aspects and achieved teaching results.

The contents of all subsystems of the computer-assisted School Information System Framework is now presented briefly by describing some telling results with regard to each element of the School Information System Framework: a summary of the computer support possible within each subsystem.

### 5.2.2 Registrational subsystems

Within each subsystem many possibilities exist to register data by using a computer. Most of these registrational computer functions are not mentioned here for reasons of legibility. Student data are registered in the first subsystem and includes application, lesson group, principal student, student absenteeism, guidance and counselling, test score and final examination data.

The general structure of the 'Enrollment' subsystem (element I.1 in Figure 4) has been presented in chapter 4 which also explains how this subsystem has been designed. It proves possible to use the computer for a number of enrollment activities like:

* making cross lists (see chapter 4 for an explanation) that contain an actual report of the admission situation at a certain moment as well as lists with provisional conditions (the student has to fulfill a condition e.g. to pass the final exam from his/her previous school);
* producing stickers that can be used for correspondence with parents (e.g. for confirming an application, admission decision) as well as enrollment stickers with general student data for student cards and student files;
* generating application/admission reports;
* tracing missing student enrollment data.

Within the second subsystem of Student Registration, I.2 'Grouping students into classes', students are allocated to lesson groups; to root classes (where students follow core subjects together; see Appendix 5) and to cluster lesson groups (a group of students from the upper grades are taught an optional subject together). Allocation desires of students and teachers are registered within this subsystem. Lists with all relevant data for student allocation (e.g. a student's level, subjects and allocation desires) can be produced in a computer-assisted way, as well as stickers (containing information on allocation criteria like influx-student or through-flow student, sex) for allocation activities.
Allocation of students to cluster lesson groups is a complex activity since students have to be allocated in such a way that each student can follow the lesson periods he/she desires while as few as possible lesson periods are used. This activity can be done using a computer which can throw-up all possible lesson group composition variations, so that the school management can choose the best alternative. Registering allocation results by this means enables lists of root classes and cluster lesson groups to be compiled.

'Principal student data administration' (I.3) is a small subsystem comprising basic student information (e.g. name, address, family situation). Modifications to these data are processed here too, and stickers with student data are also produced within this subsystem.

The fourth element (I.4) of Student Registration comprises 'Absentee registration'. The computer can assist many activities here, like registering truancy and absentee messages. In case of a student arriving late the computer can indicate which students have been late more than X times and therefore produce a list of all students that have to come back on a specific day.

Computer produced 'absence control lists' contain all the day's and previous day's truants (or the truants from any other desired period), and the reasons (if known) for absence. This list is handed to appropriate staff members (to determine if a student has been given permission or otherwise for absence). When the results of their investigations have been registered, the computer can provide school management with various kinds of absenteeism reports, like:

* an overview of the degree of absenteeism in a certain school type grade over a certain period;
* the number of lessons missed per student per lesson group for each subject;
* the extent of absenteeism per school type grade, per subject/teacher combination;
* comparisons of the magnitude of absenteeism between various grades;
* various cross-sections, for instance the extent of truancy of students who have to repeat their grade;
* surveys of protractedly absent students.

Student guidance and counselling registration (I.5) covers the fifth element of Student Registration. Some forms of computer support prove to be possible here. The computer can be used to retrieve student's school type grades and report marks, which data can be combined with other registered data like previous school, school type advice from the principal of the previous school, and psychological test results. Thus an overview of a student's school career can be called-up at any desired moment, what may be helpful in case of guidance and counselling activities, or when decisions have to be taken about promoting a student. As with other subsystems of the framework, various possibilities of office automation are also possible here: producing invitations for a talk with parents/students, presenting feedback on subjects chosen by students (standard letters) and the like. Moreover, the computer can be used to register results of guidance talks with students, subjects temporarily chosen by them and next school type grade forecast. Thus a prognosis can be produced of the number of students in each school type grade in the next school year and the number of students that has chosen a specific subject. This can be done per school type, grade and lesson group. When student subject choices are known the computer can also observe unallowed choices. Besides, choice-profiles are available then: percentages of chosen school type grades, school type specializations (e.g. a combination of subjects), subjects and education levels (within a school type grade), also when compared with other school years.

'Test scores registration' (I.6) is the sixth 'Student Registration' subsystem whereby a computer can be important in various ways. It can produce lists of the students of each lesson group for collecting student test scores. The computer can be used to register collected test scores, surveys of test scores, student reports, reports used to have student scores checked by teachers, and report lists (for students of a root class a teacher/score combination of all students' subjects which can be used in report meetings, when decisions are taken on promoting students to the next grade). The computer can also draw to the attention of school staff students with more than X unsatisfactory grades or indicate that the number of students with an unsatisfactory grade for a specific subject is more than Y percent and the like.
Specific management reports can be created like the relation between student achievement on the one hand and students' sex, subjects, school advice, absenteeism data and teachers on the other. Moreover, data concerning one school year can be compared with other school years or other periods. Next to these specific test score reports, surveys of results of each delivering school and student through-flow reports (the through-flow from one school type grade to other grades) can be created. A final type of report that can be called-up via the computer concerns statistical overviews: the average percentage of satisfactory/unsatisfactory grades for each subject for a school type grade/root class/cluster lesson group, overviews of grade repeaters, promoted students and students' next school type grade. These figures can also be compared with comparable data concerning other school years.

Similar to 'Test scores registration' is the 'Final examination registration' (I.7) subsystem. How can the computer be utilized here? Firstly various lists required by the Ministry of Education can be produced, like lists of final examination participants with their name, address, final examination subjects, level and number. As with other subsystems office automation is valuable here too: for instance correspondence with parents/students, so-called second correctors (for an explanation see Appendix 5) and the Schools Inspectorate (in relation to the final examination). Lists to collect final examination scores per teacher/lesson group combination and examination-session cards (with student data and used during examinations) can also be created by the computer. When scores for internal and external final examinations have been registered by the computer it can produce lists per teacher/lesson group combination in order to have student scores checked by teachers, as well as various examination meeting lists per school type grade (with data relevant for the meeting, like subject scores per student, student's previous school type grade and scores in the previous school type grade). Examples of some specific reports the computer can provide include:

- performance reports made for final examination meetings: the number of unsatisfactory grades per subject and the number of students that would fail an examination on the basis of student results of a given point in time. These reports may also be compared with the results of previous school years;
- surveys of results of internal and external final examinations: the number/proportion of unsatisfactory grades per lesson group, average scores per subject/school type/ teacher/lesson group, the number of unsatisfactory grades per subject, students' scores of teachers who teach a certain subject, in comparison with previous school years;
- a general final examination report, for instance with data concerning teacher scores (scores of their students) for the final examination in comparison with other school years (and possibly in comparison with internal final examination scores and with average national scores).

The computer can supply school staff with internal final examination student reports as well as lists of final scores of students, lists of those students that passed the final examination and lists per examination grade for the Ministry of Education (with detailed final examination results). Computing the final examination scores per student on the basis of several subject scores per subject can also be achieved on-line.

The final element of 'Student administration' (subsystem I.8) concerns the deletion of student names from the school register. Using a computer student names can be struck-off the student roll. The reason of departure and students' destination (to be able to analyse student careers) can be registered. School-leavers' reports, required by external bodies, and also used within the school can then be created by computer too. This also applies to producing departure stickers (to put on student cards and files), annual school-leaving surveys and supplying information for the following schools receiving the students.

Subsystem II of the framework concerns 'Personnel Registration'. Several forms of computer- assistance have been defined within it. The first computer-assisted activity is the producing of standard confirmation letters sent to applicants applying for a position. Others are related to registering staff departure, creating staff departure reports to be

sent to external bodies, and supplying information to new employers about ex-employees.
For arriving and departing school staff the computer can for instance be used to produce various lists with personnel data demanded by external bodies (e.g. the Central Registration of Educational Salaries office, the Employees' Pension Scheme, the Central Statistical Office) and/or used within the school. Examples that can be used internally could be an overview of all teachers of a school, their competences, number of lesson and task periods and the like, data required for determining salaries of teachers, reports on school staff that have been ill during a certain period, and mutations in personnel data.
Many schools use a personnel card that has to be updated each school year, in connection with changed teachers tasks (especially the number of subject lesson periods and task periods, within one or more school type grades). Using the computer for this (for instance for producing stickers with up to date data that can be put on a personnel card) can save much time. Moreover, several types of personnel reports being used by school managers can be retrieved from the database, like those listing staff competences (in redundancy list or in alphabetical sequence), the subjects they teach, the year in which they can benefit from the Early Retirement Scheme and the number of permanent and temporary lesson periods of teachers. Finally school management can use the computer for producing personnel statistics for:

- the age structure of school personnel;
- the number of male/female employees;
- the number of teachers in the first and second educational sector of the school;
- the teacher/student ratio (for the school as a whole, per department, per subject and the like);
- illness per type of employee (teaching, support and management staff).

Within 'Financial registration' (subsystem III) rates for teaching materials students receive, parental school contribution and the like can be determined in a computer-assisted way on the basis of expected student numbers and the material costs. Cash-, bank- and giro-book of course can be kept up to date in a computer-assisted way and invoices for parents, in connection with outstanding debts and restitutions can also be created with the computer. This also applies to the producing of financial statements on book funds, receipts and payments (including grants), debit and credit, depreciation of budgets and profit and loss over a certain period.
A last possible form of computer support concerns producing annual accounts, transactions, profit and loss statements, balance sheet).

'Timetable registration' (subsystem IV) is related to the weekly timetable (it will be shown that other types of timetables can be constructed as well). When the weekly timetable has been constructed (this is done within the Educational Planning management subsystem) it is registered here. In case of illness of personnel, field trips and the like the normal timetable is adjusted in subsystem IV. The same goes for constructing a temporary timetable for special periods, like when internal final examinations are taking place as a result of which some teachers cannot teach and some classrooms cannot be used. These temporary timetables are registered here too.

'General school registration' (subsystem V) comprises a small subsystem in which a number of data are registered for various purposes:

* the administrative form of the school (e.g. public-authority/ministerial/private; school bodies, their members, their function and the like) and the school organizational structure (school types, school type grades, classes, optional specializations and possible student through-flows);
* financial school exploitations and account numbers for each type of payment;
* buildings and classrooms, delivering and receiving schools;
* school rules and criteria, for instance with regard to student absenteeism, determining report marks and promotion to the next grade;
* planning parameters (e.g. how many lesson periods can be incorporated into one school day, which rooms can be used as classrooms), the school books list, the yearly plan (which activities and when for the school year);
* subjects that can be taught in each school type grade and the number of lesson periods for each subject per week.

'Text registration' (subsystem VI) is geared to registering and generating documents used within the school and keeping these updated. Within all subsystems texts are produced and used. Examples of documents that can be generated in a computer-assisted way include:

* brochures for parents, students and staff containing information on how the school is organized, school rules, procedures etc.;
* standard letters for parents/students used every year in connection with student applications, student reports, subject choice, the final examination etc.;
* forms used for student applications, subjects chosen by students, and for recruiting new staff.

'Resources supply registration' is the last registrational subsystem (subsystem VII). This subsystem includes all activities with regard to the acquisition and administration of book-fund books and other materials. So article data (like steady data, tender data, order data), orders, receipts, the book fund list and the like are registered. The computer can also provide school management with general stock reports, surveys of the number of book-fund books present, lent out and being repaired, book-fund book delivery lists and intake lists. Reminders for suppliers, if ordered goods have not been delivered yet, can also be done by computer. Other possible forms of assistance concern a prognosis of the numbers of book-fund participants per school type grade and delivery forecasts for each book title (in connection with orders and book-fund prices), determining book-funds prices per school type year and producing the book-fund collection base (what each student has to pay towards the book-fund). Other management subsystems are presented now.

5.2.3 Management subsystems

Three management subsystems are related to planning issues: planning the required capacity, planning educational conditions (who teaches which subject, where and when) and financial planning. Each of these management subsystems is now treated in more detail.

The most important component activity of 'Capacity planning' is planning the number of lesson periods and task periods a school has. At first the number of expected students per school type grade has to be determined for each school type grade. At the start of the school year this number is estimated on the basis of information with regard to actual numbers of students in each school type grade, in combination with historic index numbers on student influx, through-flow and outflow. As the school year proceeds and more information becomes available on student achievement in the final grades of delivering schools, and of 'own students', student number estimates become more reliable. The number of school-type-grade-subject students has also to be planned. Historic index numbers and subjective forecasts of promotion, examination pass rate and subject choice of students are the basis for this. The next step comprises determining the required subject-lesson-group numbers and (in combination with the number of lesson periods for each subject, for each educational sector) the number of subject-lesson periods for each educational sector of the school. After that government formulas are used to determine numbers of lesson, task and management periods that will probably be available. Then a school determines the number of gross required task periods, the desired lesson period reserve as well as how many of those three types of periods will be spent. Often a discrepancy has to be resolved between the number of gross periods required and the number of periods to be spent. This among others can be done by adapting the teacher-student ratio, the lesson table (how many lesson periods per subject, per week), student choice (blocking certain choices), or by borrowing from the school lesson period reserve.

'Educational planning' subsystem (subsystem !X) is closely related to the 'Capacity planning' subsystem. It consists of two elements: a) allocation of iobs (lesson periods) to teachers, and b) constructing the timetable. At first job allocation will be discussed. Results of the 'Capacity planning' subsystem (the determined number of lesson periods and task periods to be spent) comprise the starting point for these job allocation activities.

First the number of lesson periods within the first and second educational sector of the school are determined, as well as available teachers within each of those educational sectors. The reduction of working hours per staff member is determined (in order to determine how many lesson periods a teacher is available) and registered, and finally lesson periods and task periods are allocated to teaching staff. Allocations are done on the basis of teachers' legal positions and c mpetences to teach subjects as well as govemment directives, indicating exactly how available lesson periods should be allocated to school staff. This activity is called constructing the Statement of Lesson Period Distribution (SLD, for an explanation see Appendix 5). Since the described allocation procedures are unambiguous they can be transformed into software and the computer can 'puzzle out' activities that usually demand a lot of time from school management. This also goes for producing government forms with the results of these allocation processes. When allocation activities are completed, it is easy for the computer to produce the required govemment forms.

Other school management allocation activities that can be carried out by computer concem the creating of a redundancy request list and determining the composition of the departments. The redundancy list is drawn up by: allocating staff members to a place on this list according to the number of years a teacher has been teaching in general and at the school in particular. Ways of doing this differ between boards of govemors. The composition of departments is much less complicated: a teacher of a department is determined by the subjects he teaches. Both allocation activities can be done by computer if the relevant allocation algorithms have been translated into software and the appropriate data on teachers, subjects, teaching experience etc. have been entered. Computers can help generate a set of alternative solutions to these problems which are evaluated by school management on the basis of qualitative criteria and from which the best alternative is chosen.

The compiling of school timetables (another form of educational planning) can also be done in a computer-assisted way. The most important timetable is of course the weekly one containing all lesson groups, classrooms and teachers. Other timetables that have to be made are for parent evenings, test week timetables (when will each lesson group be tested for each subject?) and exam invigilating timetables.
As far as the weekly timetable is concerned, at first the special timetable desires of teachers (e.g. regarding subjects, lesson groups) are collected, judged and, if accepted, registered on the timetable. Cluster strips (a combination of subjects that are assigned to the timetable at one and the same lesson period) are subsequently registered. When that has been done various conditions are of importance, e.g. a subject must not be taught to the same class twice on the same day, no more than X (this varies between schools) timetable periods per day must be used and one should try to produce as few as possible free lesson periods in the timetable. After cluster strips have been registered on the timetable, the class lesson periods (= non-cluster lesson-periods) have to be fitted into the timetable and classrooms allocated. After all required lesson periods have a slot and the final timetable is available (possibly after school management has optimized the computer result a little), the computer can retrieve various timetables: teacher, classroom, lesson group and individual student timetables. Formerly those timetables had to be transcribed from the timetable board which took a lot of time and often produced mistakes.
Constructing the other mentioned timetables is much less complicated than the weekly timetable. Teacher-subject-lesson group combinations (in case of test week timetables), or teacher-parent combinations have to be allocated to a timetable without other variables playing a constraining role. When algorithms for these allocation problems have been designed and transferred into software the computer can construct those timetables in no time at all and produce hard-copies of them as well.

Within the last planning subsystem, 'Financial planning' (subsystem X), a budget estimate is drawn up on the basis of data from previous years, expected trends, available finances, planning parameters etc. One of the activities to be carried out concerns computing the expected school income. The computer can take care of executing essential computations. It can also provide those who have to draw up the budget proposal with last year's exploitation reports. The budget proposal is among others made on the basis of actual payments, payments in the current school year and expected trends in exploitation costs. When this proposal has been discussed within the school, available financial resources are tentatively estimated, plans drawn up and budgets reserved for certain goals. When the estimate has finally been discussed and determined the computer can support the following activities:

- forecasting liquid assets within a certain period, for instance a month;
- registering budgets allocated to departments, specific cost types and the like;
- producing government forms concerning the request for the exploitation costs allowance.

The last management subsystem 'School year evaluation' (XI) is not related to planning issues but supports the evaluation of what has taken place over a school year. This evaluation concerns:

- school finance (e.g. where did the school make more costs than planned, and where less; what trends can be observed in developments in cost types?);
- social aspects of the school (jubilees, illness, newly appointed or departing personnel);
- academic aspects: the percentage of diplomas handed out in various final grades compared to other school years and/or national averages; the percentage of students promoted to next school type grades, the number of drop outs and class repeaters;
- school resources like the lesson timetable (how many lesson periods per subject, per week for each school type?), buildings, classrooms and available technology.

As well as the possibilities discussed so far, the computer is usable in many other valuable ways. Registering data for the subsystems described, in combination with using a relational database, offers the advantage that all database data can be brought in relation to each other and thus an important management tool becomes available. One can for instance investigate relations between:

- the school advice given to students and their school career;
- student profiles (in terms of their test scores for several subjects) of those students who received a school advice that proved to be not the right one;
- each of the school admission criteria and not passing the final examination of a specific school type;
- : tudent absenteeism rates and student achievement;
- timetable characteristics and absenteeism figures;
- drop-outs and their characteristics in terms of their school career, or absenteeism profiles;

- average results of lesson groups and the number of lesson periods cancelled they faced;
- a fictitious tightening up of school criteria for promoting students to next school type grades and the consequences this would have for promoting students;
- predicted liquid assets and actual liquid assets.

### 5.3 Reflection on the design results

#### 5.3.1 Introduction

In this section the results of the design activities are considered from three different viewpoints. First the number of elementary activities of a certain type comprising each designed activity subsystem is determined (5.3.2) to gain an impression of the number of activities that can be executed in a computer-assisted way. Then some reflections are presented on the way in which the computer can help execute three types of school management activities (5.3.3). Section 5.3.4 then explains which computer functions can be used for which types of school organizational processes (as distinguished by Mintzberg, 1979).

#### 5.3.2 Types of elementary activities comprising the activity subsystems

In chapter four (see Figure 2) a distinction has been made between four types of elementary activities: non-formalizable (type 1 activities), manual (type 2), machine (type 3a) and man-machine activities (type 3b). Machine and man-machine activities are most important since the computer can play a role in their execution. The degree to which each organizational activity subsystem comprises each of these four types of activities, is depicted in Table 4. As indicated in section 5.2 some of the organizational activity subsystems contain more than one computer-assisted subsystem.
Table 4 shows some 1.000 elementary activities have been distinguished and almost half of these can be executed in a computer-supported way (3a + 3b activities). Of these more than 230 activities are machine activities and 200 are man-machine activities. The other elementary activities are non-formalizable or are manual. In most of the organizational activity subsystems about 20 elementary activities can receive computer support, but in 4 of these much more computer-assistance proves to be possible. In 'Resources Supply' (49 elementary activities), 'Internal Examination/National Written Examination' (65), 'Financial Registration' (34) and 'Personnel Registration' (68).

| Activity subsystem | Type of activity* 1 | 2 | 3a | 3b | 3a+3b | Total |
|---|---|---|---|---|---|---|
| 1 PLANNING & EVALUATION | | | | | | |
| 11 GSE | 11 | 11 | 2 | 21 | 23 | 45 |
| 12 CAPACITY PLANNING | 16 | 4 | 9 | 12 | 21 | 41 |
| 13 EDUCATIONAL PLANNING | | | | | | |
| 131 JOB ALLOCATION | 7 | 2 | 7 | 4 | 11 | 20 |
| 132 TIMETABLE | 17 | 15 | 8 | 14 | 22 | 54 |
| 14 FINANCIAL PLANNING | 15 | 23 | 10 | 7 | 17 | 55 |
| 2 RESOURCES SUPPLY | 20 | 91 | 26 | 23 | 49 | 160 |
| 3 STUDENT REGISTRATION | | | | | | |
| 31 ENROLLMENT | 3 | 34 | 10 | 14 | 24 | 61 |
| 32 GROUPING STUDENTS | 3 | 9 | 16 | 7 | 23 | 35 |
| 33 ADMIN. PRINCIPAL STUDENT DATA | - | 5 | 3 | 2 | 5 | 10 |
| 34 ABSENTEE REGISTRATION | - | 18 | 8 | 8 | 16 | 34 |
| 35 STUDENT GUIDANCE AND COUNSELLING | 15 | 30 | 11 | 9 | 20 | 65 |
| 36 TEST SCORES REGISTRATION | 1 | 7 | 17 | 6 | 23 | 31 |
| 37 IE/NWE | 4 | 49 | 37 | 28 | 65 | 118 |
| 38 DELETE STUDENT NAME FROM SCHOOL REGISTER | 2 | 6 | 8 | 3 | 11 | 19 |
| 4 TEACHING PROCESS | - | - | - | - | - | - |
| 5 FINANCIAL REGISTRATION | 5 | 40 | 20 | 14 | 34 | 79 |
| 6 PERSONNEL REGISTRATION | 14 | 54 | 40 | 28 | 68 | 136 |
| | ----- | ----- | ----- | ----- | ----- | ----- |
| | 133 | 398 | 232 | 200 | 434 | 963 |

Legend:

11 GSE = General School Planning and Evaluation

132 Compiling the timetable and Timetable Administration

37 Internal final Examination/National Written Examination (IE/NWE)

* type 1 activity: non-formalizable; type 2 activity: manual; type 3a activity: machine; type 3b activity: man-machine

*Table 4: The number of elementary activities of a certain type within each organizational activity subsystem*

If one looks at the activity subsystems (so comprising several 'subsubsystems') as totals 'Student Registration' proves to receive most (187 3a and 3b activities) computer support, followed by 'Planning and Evaluation' (94 activities), 'Personnel Registration (68 activities), 'Resources Supply' (49 activities) and 'Financial Registration' (34 activities).

5.3.3 How school management can benefit from computer use

In section 5.2 it was shown that executing various clerical and management activities within schools can be supported by the computer. In this section attention will be paid to the way in which school management can benefit from computer usage in a more abstract way than in section 5.2. Some attention has already been paid to this topic briefly in section 3.1, when the expected improvement of school efficiency and school effectiveness was discussed. The subject will be addressed more extensively now on the basis of the results of the analysis and design activities by discussing ways in which school managers can improve effectiveness by using the computer.
School management can probably benefit from registrational computer applications because they often spend a lot of time on manually executing these clerical activities. However, they can also use the computer in other effective ways by:

a) Using computer-generated data for policy development and evaluation.

When various types of data about students, personnel, finance and the like have been stored in a computer database in such a way that those data can be brought in relation to each other, the computer can be used to search for and generate information relevant to solving policy problems. If school management is faced with problems in the area of education, finance, personnel and the like, computer usage in many cases can produce data that can be used in preparing and developing policy. Such information will often consist of relations between variables.
Questions school managers like to have answered vary according to the policy area to be developed and the problems to be solved. As a result an information system should be flexible and able to produce tailored information. Manually, it is physically impossible to produce such information, thereby considerable uncertainty exists in the policy-making process because decisions cannot be taken on the basis of a solid information base. When a flexible computer-assisted information system is used it becomes possible to take more well-founded policy decisions.

Next to policy development, computers can also be used when evaluating executed policies. If essential data are registered the effects of an executed policy can be studied. One can for instance think of evaluation questions like:

- In how far did truancy increase after date X, when the timetable was changed?
- Have student results improved in school type grade Y, after it was decided to provide extra mathematics lessons?
- Did student achievement over the last four years reflect that school entrance criteria was lowered two years ago?

b) Using computers for complex allocation activities.

As described in section 5.2 a number of complex allocation activities has to be carried out each school year. Students have to be allocated to lesson groups, teachers to positions on the redundancy list and to the statement of lesson period distribution (for an explanation see Appendix 5), whereas teacher-lesson group-classroom-combinations have to be allocated to the timetable. Most allocation activities are complex and time-consuming. However, the problems to be solved can be formalized by means of mathematical models which can be translated into software. Computer use in this field can not only save a lot of time, but can also lead to better allocations because the computer can explore alternative problem-solving strategies, and in many cases can present several alternative solutions that can be evaluated by school managers.

If one succeeds in thrashing out complex allocation activities, school management need no longer be satisfied with one *possible* solution, but can choose the best possible alternative. A daily school timetable influences the behaviour of school staff and students, therefore timetable 'quality' is important for a school functioning properly and as a result the impact of good timetables can be great.

c) Having computers play a process control role.

Assisting school managers with controlling school organizational processes, possibly in combination with corrective actions is the last type of school management computer support discussed here. The computer can have an observation function. For instance, a school can define standards with respect to how frequently a student is allowed to play truant, the ceiling for department expenditure, the number of unsatisfactory grades for a subject and so on. When these standards have been transcribed into software the computer can act as a warning light and warn when developments within the school require school management attention. This can result in taking more timely action which, if successful, produce schools that operate more effectively.

### 5.3.4 Computer functions in relation to school organizational processes

Assistance the computer can give in schools within the area of administration can also be approached from another viewpoint, namely by first distinguishing various possible data processing computer functions and subsequently relating them to five types of school organizational processes, as distinguished by Mintzberg (1979). The result shows which computer functions can be utilized in which school organizational processes.

At first five possible computer functions will be mentioned, after that all five will be illustrated by presenting one example:

a. *Updating the data base* (abbreviated as UPDATE): recording relevant changes in the organizational environment and within the organization itself.

b. *Information retrieval and production of documents* (IRPD): retrieval of data stored in the computer database and producing standard reports for use within the school. These reports and documents concern the organizational situation and its environment as registered by means of the computer function UPDATE. Information is retrieved on behalf of all kinds of daily, operational activities. Decisions to be taken for these activities are of an operational kind, they can be taken quickly, that is, little time is needed for problem diagnosis. Available data directly lead to the decision taken.

c. *Decision making support* (DMS): this relates to administrative decisions directed at coordinating operational activities. These decision-making activities are less obvious, less routine than the type of decisions mentioned under b. Problem diagnosis, searching for and choosing solutions are important and time-consuming activities. Problems to be solved can vary according to the degree of complexity. Some are so structured, that they have a limited number of alternative solutions and the way in which they have to be solved is known. In such cases the computer can generate alternative solutions that can be evaluated (and slightly modified) and a solution chosen. In the case of less structured problems the computer can analyze relevant data (e.g. relations between various data) and provide decision makers with information important to problem-solving. This information will consist of answers to very specific management questions for which no standard report exists. In the case of the latter a query language may be used to obtain the desired data.

d. *Decision making* (DM): the computer 'itself' takes a decision on the basis of available information. This computer function is probably not very important within schools.
e. *Communication* (COM): several computers within the school and/or computers of other organizations are mutually connected which makes it possible to exchange messages with other staff members and other organizations.

To illustrate these five computer functions, applications and admittance of new students is now dealt with. After a student completes an application form, this is checked manually for correctness. After that certain application data are entered into the computer database (function UPDATE). The secretary of the admittance committee can have the computer produce an overview of those students (function IRPD) who have applied, or of students who have applied but still have to hand in certain data relevant to the admittance decision. To admit a student or not will most likely always be a decision in which the human angle plays an important role, but it is imaginable that if admittance criteria have been defined unambiguously the computer can take the admittance decision (function DM) on the basis of entered student data and, moreover, produce standard admittance- c.q. refusal-letters for students/parents. After admittance decisions have been taken and lists amended and returned, new data are entered into the database (function UPDATE). Thus these adjusted lists can be transmitted by computer to relevant staff members with a computer terminal (function COM). When the admittance procedure is completed, an analysis can be made of admittance trends over several school years. One can for instance investigate the number of admitted students and their characteristics (e.g. from which delivering school, type of diploma, type of school advice). These characteristics can be related to students' school careers. The computer as such can provide information on which developments, problems and possible solutions concerning student admittance can be analyzed (function DMS). On the basis of this information schools can develop or adjust their future admittance policy.

Five types of organizational processes that can be distinguished within schools are now discussed. Building on the well-known work of Mintzberg (1979) a distinction is made between the following organizational processes:
- the operational process in which the main organizational activity, *the primary process* (in the case of schools the teaching-learning process) takes place;
- management activities directed at *primary process control.* The school management (head and school board) cannot supervise all operational activities carried out within

the primary process. For that reason at lower organizational levels (deputy heads and heads of department) are needed to collect information about what takes place in classrooms (e.g. student results, absenteeism figures) and to pass it on to the top level of the organization;

- activities directed at *optimizing the primary process*. This can for instance be done by linking up with environmental developments (for instance the demand for specific training), designing more efficient procedures, staff development and the like. In schools individual teachers themselves decide what happens in the classroom to a high degree (so their work is not prepared and optimized by other staff). While those who compile timetables do plan the work of teachers, this does not concern the content of their work, but rather allocating teachers, lesson groups, and classrooms to the timetable. Nevertheless, an educational committee for curriculum development for one or more subjects could be considered to prepare and optimize the contents of the teaching process;
- the strategical top (in schools the principal and school board) has to pay attention to realising organizational goals. Therefore it supervises the way in which the organization operates and maintains contact with (external) persons and bodies and develops an *organizational strategy*;
- processes directed at indirect *primary process support*. Support of this type is not aimed at direct optimization of the primary process, but at realizing conditions important for the primary process: e.g. the caretaker, canteen, library, cleaning service and school office.

It will now be shown (see Figure 5) which computer functions can be used especially for carrying out the various school organizational processes described. Only accents are presented by means of + and +/- symbols. If both an organizational process and a computer function is not marked by a + or +/- this does not mean the computer function is not used in that organizational process at all, but that this computer function is not used intensely within the organizational process. Only the use of computers for clerical and management activities in schools is discussed here, so instructional applications are not treated, which means that none of the computer functions distinguished is used for the primary teaching-learning process.

Although each organizational process can lead to database maintenance (entry, updating of data), this computer function can be used especially for processes supporting the primary process. The database with student, personnel, financial and other data has to remain updated by support staff (especially clerical staff) in order to execute other organizational activities.

| computer functions / organizational processes | updating the data base | information retrieval and document production | decision-making support | decision-making | communication |
|---|---|---|---|---|---|
| primary process (PP) | | | | | |
| control of PP | | + | | +/- | |
| optimization of PP | | | + | +/- | |
| strategical policy making | | | + | +/- | |
| support of PP | + | + | | +/- | + |

*Figure 5: The use of computer functions for five types of school organizational processes*

'Straightforward' information is received from the computer (computer function 'information retrieval and production') on behalf of various operational processes, especially those directed at support and control of the primary process. One can for instance think of retrieving student data (in which lesson group is a certain student, what is his/her record of absenteeism, which optional subjects have been chosen?), teacher data (e.g. competences, addresses, timetables) and the like.

Providing information (e.g. analysis of data, relations between factors, alternative solutions for complex problems) on behalf of non-routine decisions (computer function: 'decision-making support') is important for administrative organizational processes within the technostructure and strategical apex of the organization (optimization of the primary process, strategy development). One may for example think of analyzing trends regarding the extent of absenteeism, student achievement and through-flow within the school, in order to develop a school policy on this. Compiling a timetable may serve as an example of a complex problem that can be solved by making use of the computer function 'decision-making support' (the computer cannot execute this activity completely autonomously).

Autonomous computer-executed decision-making, as aforementioned, will probably hardly occur within schools. However, for certain optimization of the primary process and directed organizational processes this computer function may play a role. Think for instance of the construction of lesson groups: the computer can solve such problems on its own. However, although the computer can provide one or more solutions for these problems the final decision will probably always be taken by staff members who choose and/or adjust a solution.

The 'decision-making' computer function can also be important for primary process control activities. When certain standards have been defined (e.g. a student is not allowed to play truant more than X times, or to have an unsatisfactory grade for more than Y subjects) the computer can warn when those standards are violated. The computer in that case indicates something has to be done, however what should be done has to be determined by humans. Something similar is conceivable in the case of strategical organizational processes (e.g. the computer observes examination results, or student applications strongly declining) and in processes supporting the primary process (for instance the computer indicates which parents have still not paid after X days and therefore automatically produces a standard reminder letter). However, within none of these processes is the role of the computer as an autonomous decision-making tool very big.

Although the computer function 'communication' can be used of course everywhere, one may expect that this function will be used especially for organizational support processes, since these processes are meant to provide information needed both internally and externally (for instance reports for the government and inspectorate).

### 5.4 How the design results have been used

The goals of the SCHOLIS-project, as defined in section 3.2, can be summarized as follows:

a. to carry out a fundamental analysis of schools to detect all possible forms of computer support at administrative and clerical level;
b. to develop prototypes of school information subsystems;
c. to optimize prototypes and implement information end systems;
d. to study end system usage.

It has been stated already that in this thesis attention is focused on constructing an organizational school information system framework on the basis of the results of the analysis of schools. So SCHOLIS-project goal (a) is crucial here. Goal (b) and (c) are of a different nature. The organizational information system framework has been the starting point for realizing goal (b). Computer programmers used the analysis and design results by concentrating on the component of the school organizational information system framework to be automated. In Essink and Romkema (1989) the designed computer-assisted subsystems and their contents (computer functions and the entity structure) are presented. In this thesis neither the way in which these so-called functional descriptions have been designed, nor the following activities will be discussed:

* development of prototypes (goal b) on the basis of functional descriptions of Essink & Romkema (1989), and
* testing and optimizing information system prototypes within schools, as well as developing and implementing information end systems with a high probability of acceptance (goal c).

The above activities are of a computer-science nature, whereas this thesis focuses on defining those school organizational activities that can be supported by the computer, as well as on studying conditions (other than hardware and software conditions) for, and effects of, using computer-assisted school information systems. So SCHOLIS goal (a) and (d) are addressed in this thesis, whereas goal (b) and (c) had to be realized to produce an information end system schools can benefit from. Moreover, producing such a school information system would make it possible to study conditions for, and effects of, school information system usage. Although the realization of SCHOLIS goals (b) and (c) are not discussed here, some information about development and implementation of SCHOLIS will be presented here to give the reader some insight into how the SCHOLIS-project has been carried out after the organizational school information system framework had been designed. For this reason the organizational structure of the SCHOLIS-project is now presented (see Figure 6) briefly.

The SCHOLIS-project was controlled by a *steering group*, consisting of a representative from each of the three organizations participating in the project (two university departments and one body from the educational support branch). The steering group was meant to coordinate project activities and develop an overall project policy.

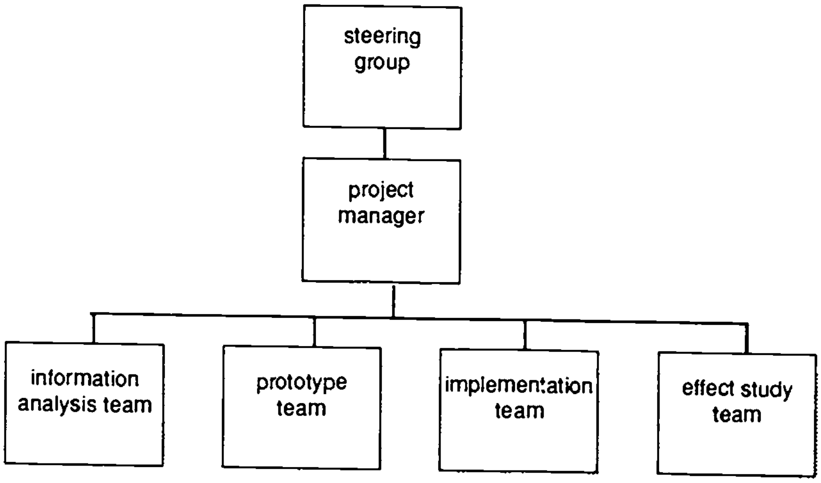



*Figure 6: Organizational structure of the SCHOLIS project*

A part time *project manager* was put in charge of managing all activities of the four project teams and acted as a link between the steering group and the project teams. The project was carried out by four different teams: an information analysis team, a prototype team, an implementation team and an effect study team. *Information analysts* were responsible for the analysis of school organizational processes and for determining the possible role of the computer. The organizational school information system framework is a result of the analysis and design activities of the information analysis team that designed the so-called functional descriptions (Essink & Romkema, 1989).

The *prototype team* produced prototypes on the basis of functional descriptions and implemented and tested those prototypes in project schools. An important goal of the prototype strategy was to present an information system draft to schools quickly, so that they could react at an early stage and to have a system that could be adapted easily to schools' desires and characteristics. It was expected such a strategy would increase the probability of the innovation being accepted by allowing users to contribute to the information system design process. The prototype team developed prototypes by using up-to-date software development tools that made it possible to produce information system prototypes relatively easily. Moreover, when the experiences of the prototype schools showed that the software had to be adjusted, this also could be done quickly. To decide on the programming language to be used, a study was made of two popular programming languages of the so-called fourth generation, namely FOCUS and ORACLE. This comparison resulted in a report (Romkema, 1986) in which advantages and disadvantages of each programming language were discussed. On the basis of this ORACLE was chosen as a software development tool. A relational database was also used which among others offered the advantage that data elements can be brought in relation to each other to allow a flexible supply of management information. The database was planned to support all SCHOLIS subsystems to be developed and would make the integration goal possible i.e. to enter data once and subsequently use them for many different types of activities.

When the computer-assisted school information system framework was ready a decision had to be made about the order in which information system prototypes and end systems would be developed. Because student administration is at the centre of many registrational and management activities, software development began here. The student administration subsystem consisted of several subsystems that were developed in the following sequence: Absentee registration, Enrollment, Principal student data administration, Deleting students' names from the school register, Test scores registration, Internal final Examination/National Written Examination, Student guidance and counselling and Grouping students into lesson groups.

Some management subsystems of the school information system framework were planned to be developed later. For other management subsystems (e.g. for financial planning, financial registration, resources supply) no software development was planned because software was already available elsewhere or because these subsystems were too complex (e.g. timetabling administration) to develop software within the time available for the SCHOLIS-project. Therefore it was planned to offer developers of already existing, high quality software the possibility to connect their software with the SCHOLIS database.

Because the Dutch government first subsidized development of the Absentee registration subsystem, implementation of part of SCHOLIS started in schools that participated in this Absentee registration project. One school was involved intensely because it was very close to the University of Twente and also because the part time project manager of the SCHOLIS-project was deputy headmaster of the school. Prototypes were first tested in this school and after the biggest problems had been solved and software could be used in more schools, prototypes were then implemented elsewhere. The other prototype schools were situated in the western part of Holland (Haarlem and Amsterdam). Introducing these systems in more schools made it possible to test prototypes at a wider level and to adapt them on the basis of how they were used in schools with different characteristics. Prototype activities were very labour intensive because most schools did not have much experience with computer-assisted information systems and moreover had to work with a prototype that was not completely stable yet. An extra problem concerned the geographical distance between developers and implementers on the one hand (the eastern part of the Netherlands) and system users (the western part) on the other hand. Testing, optimization, maintenance and implementation support demanded much travelling time.

The *implementation team* consisted of people with experience in introducing computer-assisted information systems into schools as well as with training and supporting end-users. Implementers explained software characteristics and provided assistance in the ways it could be used. After implementers had given this basic information and training to users they were also involved in solving the problems of end-users.
The originators of the SCHOLIS-project did not aim at production and maintenance of end systems (stable software and usable within every arbitrary school without intensive user support). Their goal was to show where the computer can assist clerical and management activities in schools as well as to develop stable *prototypes* of school information subsystems. The final stage of producing solid end systems on the basis of final prototype versions, and marketing, selling and maintaining these was considered something that was more for a commercial software house rather than university departments. The latter neither have been founded for such activities, nor are equipped for them. Therefore a software house that would take care of these activities had to be found. Various houses active in the area of computer-assisted school information systems were contacted and received information about the SCHOLIS-project, as well as their possible role and conditions for participating in the SCHOLIS-project. These companies were invited to take part in the project, describe how they would like to cooperate with project workers and how much (in terms of finance, manpower) they would like to invest in the SCHOLIS-project.
On the basis of their reactions some companies were selected. The steering group invested a lot of time and energy negotiating with these companies and finally selected one company. The next step was to draw up a contract that arranged the cooperation between both participants in a solid legal way.
The company selected had to take care of end system development and its implementation and maintenance in about 35 project schools. These schools had been selected by the Dutch Ministry of Education to explore possibilities of reducing truancy by using a computer-assisted absentee registration system (this was the first

subsystem to be implemented). Next to software to register absenteeism, project schools later also received software that supported other activities like student enrollment, test scores registration, principal student data administration and the deletion of student names from the school register.

The *effect study team* investigated to what degree project schools used the developed system, what conditions promoted the implementation of a computer-assisted school information system (in this case an absentee registration system) and what effects system usage produces (goal (d)). In chapters seven, eight and nine these research activities and their results are reported in detail.

## CHAPTER 6 A CLOSER LOOK AT THE SCHOLIS STRATEGY

### 6.1 Introduction

In chapter four the procedure for designing the school information system framework was described. Having presented the design results and how these were used in the previous chapter, this chapter reflects on the nature of the design strategy and on project activities carried out after the SISF became available. In section 6.2 the strategy used is compared to other strategies. The merits and demerits of the design strategy chosen is reflected upon in section 6.3.

### 6.2 Features of the design strategy

*The SCHOLIS strategy compared to the design approach and developmental approach*
Characteristics of the strategy used for designing the SISF will first be discussed by comparing it to two organization consultancy strategies as distinguished by Ganzevoort (1985): the design approach and the developmental approach. Ganzevoort argues for a synthesis of both approaches in what he calls the organizing process consultancy approach. However, discussion is limited here to the design approach and the developmental approach.

First it has to be stressed that the design situation in the case of SCHOLIS differs from the organizational consultancy situation Ganzevoort (1985) refers to. In the case of SCHOLIS there is no organization consulting an external expert to have a problem solved. In fact school staff did not perceive a problem they wanted to have solved, but participated in the SCHOLIS-project because they expected that using a computer would improve the organizational functioning of their schools. Besides, project initiators were convinced that introducing a computer would be of great value, since it could improve the quality of school information.

Nevertheless, SCHOLIS design activities are considered here as attempts to solve general school organizational problems. If a problem is defined as a difference between an existing and a desired situation, the problem to be solved was that schools did not have optimum information housekeeping characteristics, they may have had if they had benefited from the possibilities of modern information technology (among others availability of valuable information and efficiency of data processing). The designed SISF was planned to be implemented in schools by introducing the computer-assisted school information system in combination with the accompanying non-computer-assisted activities. The SISF first functioned as a point of departure for SCHOLIS-software development. When the SCHOLIS-software had been developed, computer-assisted as well as essential non-computer-assisted activities from the SISF were introduced into schools. Non-computer-supported activities (e.g. collecting data) are closely related to computer-assisted ones and have to be carried out too if schools are to benefit fully from computer-assisted activities.

Both of the aforementioned organization consultancy approaches will now be characterized on the basis of Ganzevoort (1985). Then the design strategy chosen for the SCHOLIS-project will be compared to these approaches.

The *design approach* stresses the formal organization, the visible, describable and especially the prescribable (for instance procedures or competences of staff and bodies). The formal organizational structure (Mintzberg (1979) is an exponent of this approach), sometimes in combination with the organizational infrastructure (work and control processes of organizations) are mostly the subject of design activities within this approach. Emphasis on the formal and visible organization runs the risk that the organization is treated as a thing (reification) and approached as if it were static (a solution solves a problem, it does not create new ones). Moreover, people in organizations with their values, desires and informal behaviour might receive too little attention as a result of this approach.

Within the design approach an appropriate professional carries out the analysis and diagnosis of the organization and defines the solution (advice with respect to the desired situation). A distinction is made between inventing a new organizational form or procedure on the one hand and its implementation and hereby between external architects and executors (those who work in organizations) on the other. Followers of the design approach use design rules from organization science (see e.g. Khandwalla, 1977 or Mintzberg, 1979). They require answers to 'what-if 'questions ('what has to be done if the problem situation has certain characteristics?').

The change strategy as part of the design approach is linear: from diagnosis to advice; the expert invents a solution but does not treat implementation as a problem. It is also top down: the consultant (and top management) versus the other members of the organization. The change strategy has characteristics of the empirical rational Research Development and Diffusion innovation strategy (see Havelock, 1969). It is assumed that change will be accepted and implemented if one can prove its relevance to the user.

*Developmental approach* emphasizes human relations and the needs of members of the organization. 'Human relations' and 'Organizational Development' are central to this approach. Not the formal organization but the actual behaviour of organizational members, their relations, desires and needs are the determinants of organizational structure and are subject of design activities. An important critique of the developmental approach concerning the design approach is that the basis for design approach consultants consists of the values strived for by a powerful organizational management. It's values are considered to be rational and objective: goals have to be clear, there must be efficiency as well as organizational growth, and so on. Within the developmental approach a consultant takes into account the desires, feelings and needs of *all* members of the organization and lets these be the basis for the design, which is a product of the cooperation between consultant and an organization's staff members. So, the input of all organizational members in the change process is important to this model, it is a bottom-up model.
Another characteristic of the developmental approach is that organizations are supposed to be dynamic and that organizational development is regarded as a never ending process. Organizations, their goals, activities and people are dynamic, they change continuously. Organizing processes can be planned to a limited degree only, and in many cases a problem is not a matter of one problem with one solution. If a problem is solved the new situation in many cases will cause new problems. Social psychology and other social sciences (especially knowledge on planned change) provide a basis for working on organizational change within the developmental approach. The know-how of the consultant on how to realize change as desired by the client is very important. As such the consultant also participates in the implementation processes; his role is to support clients to realize the desired change. This innovation strategy resembles the normative-re-educative innovation strategy (Havelock, 1969). Within the developmental approach it is assumed that the implementation of an innovation is only probable when people's values and standards change.
The features of both strategies are summarized in Table 5.

Where should the SCHOLIS strategy, in relation to the described strategies. be placed? Although the SISF design is the focus of attention here, its translation into software and the implementation of SCHOLIS software into schools will be also referred to.
The final planned output of the SCHOLIS-project concerns a computer-assisted school information system (software and hardware) in combination with a definition of the way in which this system can be used (the elementary activities as described in the SISF)

| Feature | Design approach | Developmental approach |
|---|---|---|
| 1. orientation of design activities | - the formal organization | - actual human relations and desires of staff members |
| 2. vision on organizations | - static | - dynamic |
| 3. design tools | - organizational science (design rules) | - social psychology and planned change know-how |
| 4. consultancy role | - linear and top down: problem diagnosis & presentation of 'smart' solution by expert (versus an organization's staff)<br>- not involved in implementation | - bottom-up: design based on an inventory of human relations and needs of all organization's staff<br>- support clients to realize change |

*Table 5: Features of the design approach and developmental approach*

and knowledge on implementation conditions and effects of system use. The designed SISF comprises clerical and management processes prescribed for schools. The accent is on defining clerical activities like collecting, registering, processing and retrieving information. Moreover, a number of structured management activities has been elaborated upon in the SISF as well as a number of information retrieval activities of managers that will probably be valuable in many schools, like the retrieval of statistical reports of the percentage of unsatisfactory and satisfactory grades per subject, per school type grade. However, it is impossible to determine all possible decision making and evaluation activities of school management within the SISF. The less routine a management activity, the less probable it has been defined in the SISF, though it should not be concluded that non-defined management activities cannot be supported by means of the designed school information system. The database contains so much data that it can support the execution of many non-structured, decision-making processes in the SISF.

The SISF was designed according to what Ganzevoort (1985) calls the formal and prescribable. Organizational activities (clerical as well as management activities) have been prescribed and were intended to produce valuable information within schools. SCHOLIS design activities were not geared towards changing human relations, the object of the developmental approach. The rational, formal side of schools was focused on in developing organizational procedures and activities related to collecting and using information relevant to schools (the empirical rational view). SCHOLIS proposals were expected to result in efficient and sound administrative procedures and to provide schools with valuable information. The point of departure for design activities was the requirements of school management: "What information do they need and how can they best control schools?" The way in which the SISF has been defined has other linear design features. In its mode of operation the static view on organizations prevailed. It was attempted to solve problems with regard to the school information housekeeping by means of a well-considered designed school information system. Possible organizational problems that might arise as a consequence of introducing SCHOLIS (e.g. the impact of improved possibilities to evaluate teacher results) did not receive much attention. Nevertheless, certain possible elementary activities were rejected because they were not expected to fit in with the features of schools and could raise new problems. Moreover, some problems of project schools directly connected with the implementation of SCHOLIS were solved as part of the implementation process. However, no attention could be given to problems possibly arising in non-project schools.

To design the SISF and computer-assisted subsystems of SCHOLIS, computer science and educational administrative knowledge was first used to determine a strategy for information analysis and for developing the reference models to start the analysis. When analysis results had become available computer science know-how was used to determine the possibilities for computer use. Educational administrative knowledge was then needed for determining the school organizational activities required and for the information schools desire, as well as for judging the most feasible proposals for computer use. Knowledge of computer science was of course very important in developing functional descriptions (Essink & Romkema, 1989) and the SCHOLIS software. To define a strategy fc· implementing the SCHOLIS subsystems knowledge about planned change was necessary. This included know-how on the logistics of an innovation process (e.g. arranging that all project schools would possess a ready to use SCHOLIS on time) including how to motivate, train and support users, the pace of innovation etc. In contrast with the developmental approach of Ganzevoort (1985), the SCHOLIS-project was not a matter of changing human relations in a planned way. Creating the best conditions for information system implementation was what was aimed for.

The information system framework was defined by professionals in the field of computer science and educational administration by assessing the situation in schools and formulating advice as to what, in their opinion would improve school functioning.

The design strategy followed cannot be seen as a pure design approach in terms of Ganzevoort since, where possible, the input of future users has been stimulated. Although designers fulfilled a dominant role, the information system framework has been designed in cooperation with users. Designers analyzed and formulated proposals (oral and written descriptions of the system to be developed as well as information system prototypes) and future users provided them with feedback on these. However, when SISF proposals were presented to school staff directly involved in using SCHOLIS (managers and clerical staff) teachers were involved in this feedback process to a very limited degree only. Therefore one might question how representative for the whole school the staff members consulted were. Besides, what will be the impact if teachers do not have much opportunity to give their opinion on the feasibility of proposals? One problem is that users can never gain a comprehensive view of what is proposed by designers, just because of the complexity of these proposals. Besides, they can not judge how much time and energy it will take to use the computer, and the information it generates in the proposed way.

When designers had formulated the SISF it was handed over to programmers who developed SCHOLIS-software on the basis of it. Implementation in project schools was considered difficult but important and certainly part of SCHOLIS-project activities. Although SCHOLIS was meant to be used in as many schools as possible, future non-project users of course could not receive support from SCHOLIS-project staff. The degree to which implementation in these schools would receive attention and be supported by external staff was uncertain. Project initiators were aware not to expect the quality of the information system itself to produce directly a successful implementation of the system. Users needed support, both technical support as well as informative on its relevance, possibilities and advantages as well as support with regard to the organizational conditions necessary for information system usage. As explained in chapter five, the software was implemented in project schools by a special implementation team. As a consequence the SISF was designed by certain team members, whereas others (prototypers and implementers) received feedback on the developed product. Although the feedback did lead to software adaptations, it did not produce changes in the contents of the SISF as a result of this form of task specialization. The whole process of designing, developing and implementing computer-supported information systems is too sizeable and complicated to have it done by one and the same group of people. Many different disciplines are required. Designers need to have know-how about computers and what is needed in schools. Developers should possess knowledge and skills with regard to software development, whereas implementers should know how the information system should be introduced and used in schools. The features of the SCHOLIS strategy are summarized in Table 6.

| Feature | SCHOLIS approach |
|---|---|
| 1. orientation of design activities | - the formal organization (prescription of clerical and management activities) |
| 2. vision on organizations | - static |
| 3. design tools | - computer science<br>- educational administration<br>- educational innovation |
| 4. consultancy role | - modified design approach role<br>- implementation in project schools |

*Table 6: Features of the SCHOLIS strategy compared to the design and developmental approach*

The SCHOLIS-project was not exactly the same as an organizational consultancy situation in which an organization likes to have a problem solved by an external consultant. After the pilot study initiators of the SCHOLIS-project (see chapter 2) were convinced that a carefully designed school information system could improve the level of functioning of schools using such a system. Some project schools were analyzed and received (prototypes of) SCHOLIS subsystems but future users who did not participate in the project of course could not be involved in the 'problem-solving process'.

SCHOLIS design activities were directed at defining organizational activities related to information collection and processing that would improve school functioning, if schools operated in the proposed way. In other words, the formal and prescribable was the focal point instead of the human relations aspect of school organizations.

A static approach towards organizations predominated. The goal was to improve the quality of how schools function by constructing a computer-assisted school information system. Although it was attempted to solve undesired effects of IS-implementation in project schools, SCHOLIS was developed to be introduced in as many non-project schools as possible without the need to have to pay attention to possible problems arising in these schools as a result of using IS. Knowledge used for designing, developing and implementing SCHOLIS came from the disciplines of educational administration, computer science and educational innovation. SCHOLIS designers

operated in a manner that in many ways resembled the design approach Ganzevoort (1985) describes, which probably results from the nature and complexity of the task to be fulfilled, i.e. designing a professional and sophisticated school information system (SIS). Nevertheless, the users in project schools were offered the opportunity to comment on design proposals which led to modifications of the initial proposals.
The role of project staff did not only include the constructing of a design but also the implementing of SCHOLIS in project schools. Introducing a SIS successfully into project schools was considered a difficult task that required considerable attention. Therefore a lot of time and energy were dedicated to user support and training by a special implementation team. As such the SCHOLIS strategy also possessed some characteristics of the developmental approach of Ganzevoort.

*SCHOLIS strategy in relation to the regulative cycle*

The SCHOLIS-project strategy will be compared to the so-called regulative cycle of Van Strien (1975) to clarify the characteristics of the project method used.
Van Strien distinguishes a predictive cycle from a regulative cycle. The first concerns the general scientific approach which is directed to predictive testing (falsification). Reality is studied as it is and if interventions are carried out this is done to observe their consequences for reality. The regulative cycle according to Van Strien applies in the case of problem-oriented thinking like clinical diagnostics and counselling/guidance activities. The cycle especially is a matter of designing (instead of predicting and testing); the subject of investigation is something that changes and is changed, instead of something to be explained only. Within the regulative cycle the future is anticipated for in a realizable way; an attempt is made to accomplish a desired situation. Problem-oriented thinking is guided by a rule or goal and observation is directed by criteria, standards and goals (e.g. a social ideal, a health criterion or an organizational model). Client behaviour, organizational behaviour and the like are compared to those standards and it is determined where the behaviour observed deviates from the standard. If interventions are carried out, this is done to have the client, the organization etc. deviate less from the standard.
In the case of guidance/counselling activities the standard is designed as a design in cooperation with the organization or patient, and the client is supported in the realization of the goal(s) set. Following Schein (1969) Van Strien (1975) distinguishes between two subcycles of the regulative cycle:

1. thinking: diagnosing the entrance situation, developing proposals for a solution, forecasting effects of interventions, evaluating them, and

2. action planning: looking for excuses/barriers for change, executing the action planned, evaluating the actions.

Summarizing both subcycles, the regulative cycle goes from problem definition, via diagnosis, drawing up a plan and intervention to evaluation.

The strategy used within the SCHOLIS-project has many features of the regulative cycle. The SCHOLIS-project started with a *definition and diagnosis of the problem*, when the pilot study (see chapter 2) was executed, to determine the state of the art concerning computer-assisted school administration in the Netherlands as well as to take stock of existing problems in that area and to investigate factors causing those problems. Diagnosing the existing situation implied that information collected on the state of the art of school administrative computing was compared to what was possible in that field, taking into account essential school activities as well as possibilities of modern information technology. Moreover, if the situation observed deviated from the standards set the factors causing the difference between the existing and desired situation were investigated. The desired situation comprised a situation in which schools benefit from the advantages modern information technology offers and as a consequence operate efficiently and effectively.

The third step in the regulative cycle (*drawing up a plan*) in the case of the SCHOLIS-project consisted of defining SCHOLIS-project goals, including a project strategy (see section 3.2) that was meant to accomplish the desired situation.

SCHOLIS-project activities like designing the School Information System Framework, developing SCHOLIS software and introducing software into project schools, in terms of the regulative cycle of Van Strien must be regarded as elements of the *intervention* stage.

In trying to construct the computer-assisted school information system, first the organizational SISF was designed. This was done by taking stock of school organizational activities (including their interrelations and the information required for their execution), carried out in project schools. Similar to the problem definition and diagnosis stages, when the general SISF was designed the information collected in project schools was compared to a standard, the standard of a school benefiting from the advantages of computer use and possessing a sound administrative organization. If working methods observed in schools could in the opinion of designers be improved by means of computer usage, or where a schools' administrative organization could be improved, this was translated into the SISF design.

When the SISF was available and software had been developed, intervention really started. Schools were taught how to work with SCHOLIS software (first prototypes,

later end systems) and several school procedures were changed because of the expected positive effects of introducing and using SCHOLIS subsystems.
Finally effects of interventions were *evaluated* (the final stage of Van Strien's cycle), when the impact of implementing of one SCHOLIS subsystem, the Absentee Registration subsystem, was determined (see chapter 7 upto and including 9).

The analysis given proves that the SCHOLIS-project method can be described quite well by means of the regulative cycle. The central goal of this project was not to explain a phenomenon scientifically by means of the predictive cycle, but to improve the quality of schools by constructing and implementing SCHOLIS. This was done by analysing the existing situation by determining how far schools had developed with school administrative computing and where they deviate from the desired situation, and how the existing situation could be changed into the desired situation. The state of the art of administrative computing in schools was compared with an ideal situation and was analysed by using information on historical developments of CASA and on computer developments within other types of organizations. As a consequence the target situation was formulated and a proposal developed to reach the ideal situation.
After that activities were carried out related to intervening in the way schools operate: analysis and design activities, developing and implementing SCHOLIS software, realizing changes required in schools for SCHOLIS usage. Finally the impact of one computer-assisted SCHOLIS subsystem was studied.

### 6.3 Merits and demerits of the design strategy

In this section positive and negative characteristics of the SCHOLIS design strategy are discussed.

*time required and the input from users*
A general remark on the strategy is that it proved to be very labour intensive. Emphasis on the importance of creating a SISF-design after a thorough analysis of schools implied that much energy had to be invested in analysis and design activities. These included the construction of reference models via intensive discussions within the project team, their tests in schools by means of approximately 85 interviews, processing the interview results and document files with masses of school forms, definition and verification of descriptive elementary activities for each project school, and finally designing the general School Information System Framework. One important reason why these activities took so much time was that it was impossible to

build on existing analyses of school administrative life due to the lack of detail required. A positive effect of the large amount of time invested is that detailed images of school administrative processes are now available (see Essink & Visscher, 1989a and b), although features of the strategy mean it can only be used in research and development projects. It is unrealistic to expect that commercial software developers base a design on such intensive time consuming organizational analyses. In the case of commercial organizations all time invested has to be recovered, therefore labour intensive strategies will lead to high product prices. It would be interesting to compare information analysis results based on the design strategy used in the SCHOLIS-project, with the results of an information analysis by commercial institutions which has to be carried out more quickly and as a result is more general.

In fact it is surprising that the described strategy could be carried out, since it demanded so much time and energy from school staff and regular input from almost all non-teaching staff. Schools were probably willing to invest so much in this project because they expected to receive support from computer usage and were thus eager to think along with designers about this. During the feedback sessions with schools, in which IS-proposals were presented to school staff, their enthusiasm for this innovation was evident.

*from complex to simple*

Starting with the analysis of the most complex (as far as school structure is considered) school proved to be a correct strategy. The analysis of the first school proved to be difficult, but offered the advantage that a framework for the analysis of the other two schools was developed which did not have to be changed that much anymore. Most important differences observed in the second and third project schools were related to differences concerning the type of school administration of these schools: the first school was a local publicly maintained school, while the second and third were a government publicly maintained and private school, respectively. However, the differences between the first school and the second and third schools were less than expected.

*the number of schools analyzed*

Due to the labour intensive character of the analysis only three schools could be analyzed in depth. Ideally an in-depth strategy like this should be followed by a broader study in a large number of other schools. Unfortunately there were not the resources. Therefore an attempt was made to find a compromise between available manpower and the ideal number of schools to be analyzed. To maximize the information value of the analysis results the schools were varied as much as possible with regard to those characteristics that were expected to have implications for their school information housekeeping characteristics: the type of governing body, the types of education the project schools provide and their selection procedure (a one or two year transition form, separated or unseparated VWO).

It was reassuring the analysis showed that differences between the schools analyzed were not dramatic. An attempt was made to design and construct a school information system that could be used in as many schools as possible by constructing a model that would do justice to all three schools, and by prototyping (testing provisional information system versions) with school information system prototypes in many more schools than the schools analyzed. The testing of software prototypes in a number of schools gave designers information on their usability in other schools than the project schools.

Designing information systems for a large number of organizations means that the complexity of reality (in this case the various ways in which schools operate) has to be reduced. Therefore all existing differences between schools could not be honoured. Moreover, some standardization can be good for schools that operate in sub-optimal ways, which implies that not every difference between schools should be honoured. However, an important prerequisite for successfully developing one information system for a large group of schools is a well-thought-out design. In other words, schools that have to change their procedures as a result of system usage will eventually judge the change as an improvement.

*using reference models*

Developing and testing reference models in the form of A(ctivity)-diagrams (for examples of A-diagrams see Appendix 1 and 2) proved to be of great value. Their construction forced designers to form images of what happens in a school and how a school is run, before information about that could be collected in the project schools to be analyzed. The idea was to portray the essential clerical and administrative activities, their input and output, and how they are interrelated in terms of information and/or material flows between them.

Next to the construction of 'hypotheses' the models helped to generate very specific questions about topics on which too little information was available. Using reference models for this made it possible to operate efficiently and effectively in project schools without using general and vague questions like "How does a school register a student?", or "What is done in schools regarding financial administration?". More specific questions could be asked to test assumptions and to collect the required missing information. This procedure had the advantage that one was not completely

dependent on respondents' 'brainwaves'. Using reference models also means that one has a framework that enables distinctions to be made between essentials and matters of minor importance in respondents' answers to interview questions. This is important because the type of information analysis carried out results in a flood of data about organizational activities, their sequence, the data processed, the way in which data are processed etc. If reference models are not used, one easily drowns in this flood of information.
Interviews based on reference models should ideally be carried out by two or more interviewers in order to react adequately to the information given. Since much of the information presented is new and often concerns complex activities it is difficult for one interviewer to think of all the relevant questions.

*formulating and verifying descriptive elementary activities*
As described, reference models were tested in project schools and resulted in detailed information about what takes place. On the basis of the information of the analyzed schools a description was made of the elementary activities within each organizational activity subsystem. To accomplish this the information collected had to be translated into carefully defined organizational activities. These descriptions of elementary activities were much more detailed than the initial reference models. Defining those activities and presenting them for verification to those interviewed led to modifications of the descriptions. Incorrectnesses in draft descriptions were probably caused by a number of factors:

- descriptions of the elementary activities may have been incomplete due to the interviewer not asking all the relevant questions, or the interviewee not giving all the essential details of an activity;
- communication between interviewer and interviewee is often imperfect since both form an image of what the other says and means; these images may not fit completely with what the other person meant to say.

Sometimes it proved difficult explaining the information needs of designers to school staff and to let them describe an activity in full detail. Many operations carried out by school staff are so self-evident to them that they only described them after persistent questioning. So, verifying descriptions by presenting them to interviewed staff served two purposes: 1. checking if the image of the information received was correct and complete and 2. investigating if designers' ideas were correct on those activities where information proved to be incomplete.

*designing the proposed elementary activities*

On the basis of the descriptive elementary activities of the three project schools analyzed, the proposed elementary activities were designed for a situation in which the computer could be used. The creative character of these design activities has already been indicated in chapter four. New computer-assisted activities were also defined (e.g. retrieving certain information or having the computer indicate developments that require attention), or alternatives for existing activities were proposed if this was considered to improve the quality of school organizations. The design resulted from the efforts of a number of people who sometimes began having diverging ideas but afterwards reached a compromise. It is not out of question that another project group may have produced other design results. Design processes like these require that designers generate ideas concerning valuable procedures, as well as estimating the feasibility of their proposals. The latter requires that they take account of characteristics of school organizations: what is possible in logistic terms and what fits in with the way the school is run? The goal was to design activities that were desirable from the viewpoint of the school. Nevertheless, those designs are proposals from experts outside schools who, although well-intended, may not fit completely with daily life in schools. On paper proposals might lead to an effectively operating school, but prove impractical. Perhaps the proposals require too much time and energy (e.g. because much data has to be registered), therefore staff might prefer to live with less demanding sub-optimal solutions. An attempt was made to prevent this by involving project school staff in the design process and later by testing prototypes in schools. However, it would be better still if one already knew at an earlier stage what works and what doesn't, thereby saving much time when prototypes are developed and tested. However, this is difficult to realize since users sometimes think they will appreciate some form of computer assistance when it is described, but later it is used only to a limited degree, because it requires too much time and energy. The actual usefulness of a computer for certain activities only becomes clear after it has been implemented in schools for some time. One should take care to avoid being too restrictive and thereby not designing applications that would have been valuable. On the other hand capital should not be invested in very sophisticated applications that will never be used because they are incompatible with daily life in schools.

*design as a combined activity*

Cooperation between people from different scientific disciplines is another aspect of the design activities executed within the SCHOLIS-project that should receive attention here. Division of labour had the following characteristics. The method for analyzing schools was designed by L.J.B. Essink of the Department of Computer Science, University of Twente and the author of this thesis. A.J. Visscher was subsequently responsible for analyzing the project schools and their description and verification in terms of elementary activities. On the basis of the information analysis data Essink and Visscher designed the School Information System Framework (SISF). Essink's main input here was his knowledge about the possibilities of computers, while Visscher's input was his knowledge of educational organizations (including know-how on the features of administrative activities in schools as a result of analyzing the project schools) and school management theory. The combining of both disciplines sometimes led to conflicting views. Constructing the SISF meant that an attempt was first made to integrate the descriptions of the three analyzed schools into one model, and in such a way that the relevant characteristics of each school were taken into account and each school would be able to work with the proposed model. Discussions between designers were initially directed at developing a design that was correct (e.g. choosing the best alternative procedures observed in the three project schools, a correct sequence of activities and the like). Defining new activities often led to discussions about what was feasible in schools and what was not. These discussions were often confrontations between 'what is technically possible' and what 'will not work' in schools. Knowledge about school characteristics and information collected during the information analysis stage often resulted in pessimistic assessments of the feasibility of a technical possibility. Sometimes these discussions produced a rejection of a technical form of computer assistance. In other cases, where it was uncertain whether something would work in schools a form of computer assistance was incorporated in the design so that each school itself could decide whether to use it or not.

*feedback on the proposed elementary activities*

Presenting the structure and contents of each designed subsystem to future users proved to be very valuable. It resulted in important additional information as well as many suggestions to improve the design proposals. School staff involved saw that their participation was considered important and would have consequences for the form of the automation, so that their input was great. However, only project schools were involved intensely in the design process. All other schools not involved in the design activities but that will be working with the developed system in the future will have to accept the end system as it is. It is impossible to organize a project in such a way that all, or many future users, have the opportunity to influence end system characteristics. Therefore the goal was to develop a system that fitted with as many project school characteristics as possible and that was directed at realizing a sound administrative

organization. If one can succeed in doing this, the probability that the system will be a valuable tool in other schools is high.
Although user participation had many positive characteristics, one might question the degree to which practitioners can have an overall view on the information presented, and therefore one may question the extent to which they can comment on it from a broad perspective. Most users did not have much experience with using computers for school administrative purposes. Therefore it was probably impossible for them to judge the proposed activities for their true value and for that reason one should not only collect feedback on oral presentations of design proposals. Using the developed information system will eventually produce the best feedback on its value. For this reason a prototyping phase was carried out during which users could experience working with a school information system prototype and on this basis could judge its merits and demerits in a thorough way.

To summarize, the design strategy proved to be very labour-intensive but effective for both SCHOLIS-project staff and school staff, among others because information analysis of schools could not be based on earlier scientific work concerning the information housekeeping of schools.
The use of reference models proved to work positively since it enabled an efficient and effective analysis of schools and enabled the flood of information the analysis produced to be processed.
Formulating and verifying elementary activities also offered the advantage that the characteristics of information collection and processing in schools had to be stated on a more detailed level, than the level of the reference models.
When elementary activities were designed for a situation in which the computer could be used the assessment of the feasibility of proposals proved to be crucial but difficult. To prevent proposals being designed that would not fit in with the features of schools, project staff were asked to give feedback. As a result of this input from future system users valuable additional information was obtained and the draft design proposals could be improved. However, it was felt that users could probably not judge proposals completely because of their complexity and because of the difficulty of assessing how proposals would work in practice. For that reason feedback on more tangible design results was important and therefore at an early stage of information system development users were presented with information system prototypes and were asked to react on their features. This proved to be important, since it was difficult for users to react to design proposals on paper. In fact prototyping may prevent wasting time, energy and resources in designing proposals that will not be used.

Since the design was carried out by project staff from different scientific backgrounds, this sometimes led to a confrontation between 'what's technically possible' and 'what will work' in regard to schools.

Although project staff would have liked to test the organizational information system framework (developed on the basis of an analysis of three schools) in other schools, this proved to be impossible because of limitations in time and resources. Project staff therefore used varied schools for the analysis concerning characteristics that were expected to have important implications for information collection and for information processing features of schools.

When schools were analyzed differences between them did not prove to be great. After the school analyses an attempt was made to construct an organizational information system framework design, usable in all Dutch schools for AVO/VWO. Moreover, software prototypes (developed on the basis of the designed framework) were introduced in non-project schools, an activity which actually concerns testing the framework too. Prototyping produced satisfying results and did not lead to radical changes in the designed computer-assisted information system framework.

## CHAPTER 7 RESEARCH FRAMEWORK FOR EVALUATING THE IMPLEMENTATION OF THE ABSENTEE REGISTRATION SYSTEM

### 7.1 Introduction

ARS is an acronym for Absence Registration System, which is one of the computer-assisted SCHOLIS subsystems and which supports the registration of absent pupils, as well as the analysis of absence data. The Dutch government looking for a means to reduce absenteeism started a project in 1988 in which secondary schools in four large cities in the western part of the Netherlands participated.

The Department of Computer Science and the Department of Education, in cooperation with the Educational Computing Consortium (ECC), were asked to set up a project directed at developing and implementing a computer-assisted absence registration system (ARS). An ARS prototype was first developed and tested in project schools. When this prototype had become stable, a commercial software house was asked to transform it into an 'end system' which could be used by any school, without intensive user support.

Four cities were asked to select schools within their borough that were willing to participate in the ARS-project. This resulted in the following number of schools: Amsterdam (11), Rotterdam (8), Utrecht (11), Haarlem (6). These project schools received hardware and ARS software, as well as support when implementing the system into their school organization and resources to have one school staff member coordinate ARS implementation within the school. In exchange for these facilities schools had to collaborate in a study set up to evaluate the introduction, use and effects of ARS and executed between 1988 and 1991.

The precise research questions for this study are formulated in the next section (7.2). The research framework for evaluating ARS-implementation is presented in section 7.3. The method used to answer the research questions and the research results are presented in chapters 8 and 9.

### 7.2 Research questions

The study tried to answer the following questions:

1. How and to what degree is ARS used by the project schools?
2. What factors stimulate a successful implementation of ARS?

3. To what extent did absenteeism rates change in the experimental schools and control schools between 1988 and 1991?
4. To what extent can possible changes in absence rates be attributed to ARS use?
5. Did the use of ARS bring about some other effects than potential changes in absenteeism rates?

The first two questions are meant to determine the degree to which ARS is used and the variables that promote the desired ARS usage. Examples of such variables are school organisational characteristics, aspects of the implementation process and characteristics of the ARS innovation. The third and fourth questions focus on the effects of ARS usage on the degree of absenteeism. The reason for the fifth question is that using ARS may also result in other positive effects (e.g. a more efficient registration of absentees) and/or negative effects (e.g. less job satisfaction for clerical staff because of increased data entry work) than reducing absenteeism.

### 7.3 Research framework

In this section the framework used to answer the aforementioned research questions is presented. Before doing this, however, the characteristics of ARS are revealed by describing the support ARS can give (7.3.1). Then the way the research framework was constructed is explained (7.3.2) just as which variables and relations between variables were studied in the evaluation. Finally the hypotheses are summarized in section 7.3.3.

#### 7.3.1 Main characteristics of ARS

It is very common to speak about 'the influence of automation'. However, this assumes that 'automation' always has the same characteristics and impact. Such an approach is rejected here. A wide variety of forms of automation is possible that differ greatly from one another and as a result affect school organizations in different ways. For instance, it makes a difference whether a computer only supports registrational activities, or whether it is used for this and also for data-analysis, problem observation, internal and external data communication, allocation activities (e.g. constructing timetables) and simulation. Therefore information on the nature of an information system (IS) is important to be able to judge the degree in which it encroaches school organization. For this reason features of ARS are defined here.

First, some information will be given on the procedure for absence registration and handling that ARS usage implies. Parental reports on the illness of students are received by telephone or letter and entered into the computer by the caretaker or clerical staff. If a student is given special leave this is also registered in the computer. Moreover, teachers register absentees during their lessons which are also entered later into the database.

When all these activities have been executed so-called *absence control reports* can be produced. The reports contain the names of those students that have been absent and for whom no reason for their absence is available. Thus absence control reports indicate for how many lessons students have been absent without special leave or having been reported sick. These reports are distributed among those staff members who handle absenteeism and who have to determine the reasons for absence, i.e. allowed absence (e.g. illness) or disallowed (= truancy). When the absence reasons have been determined these staff members counsel or/and punish students who have been absent without due causes. They then write down the reasons for absence on the absence control reports and whether the absence was allowed or disallowed. The reports are returned to the ARS-operator who enters the information into the ARS database. The ARS-menu offers the possibility to generate various alternative absence control reports: reports per absence-handler, class, school type (e.g. for all grades of general secondary education), grade (e.g. for the third grade), school type grade (e.g. the third grade of general secondary education), for a number of students, or for one student only. A school's choice for one or more of these report variants will probably depend on its policy concerning absenteeism (especially what type of staff member is in charge of handling absences).

So far the description of how ARS can be used for daily absence registration. However, ARS can also produce *absence statistics* that can be used by schools to combat absenteeism. This type of ARS-output does not only contain absences that have not yet been handled (the person dealing with absences has to find a reason for absence) and does not only cover a short period (absent control reports are mostly produced once in one or two days or once a week). Absence statistics contain all absences, those that have been handled as well as those not yet handled. Absence statistics cover long periods and can be used to study trends, patterns and relations in absenteeism. The ARS-menu contains the most obvious statistics: the number of absences for the whole school, per school type, grade, school type grade, subject, root class (see Appendix 5 for an explanation), teacher and per absence reason. Moreover,

the computer can produce *combination-statistics*, for instance the number of absences per school type, itemized per subject and subsequently itemized per teacher.
So far the *standard statistics* that are part of the ARS-menu have been discussed. The ARS-menu does not contain all possible statistics because the number of alternative statistics is huge and it is not sure whether for all statistics they would be used in many schools. ARS, however, can also produce statistics that are not part of the ARS-menu. As an example the number of absences per timetable hour can be mentioned. Statistics here can be generated by means of the Standard Query Language (SQL) by which all data elements in the database can be connected to each other. The user can produce this type of statistics by asking self-generated questions to the database, though to be able to do this he/she needs to know how to work with SQL.
Schools can use ARS statistics for anti-truancy policy-making. For instance, a student counsellor can discover that a student has played truant very often on the basis of an absence statistic per student. Trends in a student's truancy behaviour can be studied by means of various statistics concerning the lessons of which teachers, subjects and at what points in the timetable the student plays truant.
Combating absenteeism can also be directed to groups of students, subjects or teachers. ARS reports can indicate a problematic degree of absenteeism and the relation between for instance teachers, subjects and timetable moments can be investigated. On the basis of these data, possibly in combination with additional information, appropriate policy measures can be taken.

Considering the foregoing it can be concluded that a very important function of ARS is its registrational use. To be able to register all aspects of absenteeism is the basis for combating it. Moreover, ARS can act as a decision support system (provide users with information relevant for a specific decision). Decision makers in schools can retrieve much information from ARS to determine the size of absenteeism and relations between absenteeism and other variables. On the basis of this information they can decide to develop anti-truancy policy measures and ARS can also be used to evaluate the effects of these. For instance when absences are registered precisely a careful comparison can be made between the number of truants before and after anti-truancy measures were introduced.
A different type of IS frequently mentioned in literature (Ahituv and Neumann, 1982) is a programmed decision system. This system processes data on the basis of completely structured and formalized procedures (e.g. computing a student's final examination score by certain clear rules). In the case of ARS this type of IS is less important, although ARS has some of its characteristics. Registered absences for instance are

compared automatically with the timetable and as a result it is decided whether a registered absence should be counted as a case of absenteeism or not. Nevertheless, ARS especially has the characteristics of a registrational information system and decision support system.

7.3.2 Construction of the research framework

When trying to compose a research framework already embedded in literature and which can be helpful when answering the above mentioned research questions, one is confronted with the problem that no research tradition exists in this area. In this respect Kwon & Zmud (1987) point to the fact that despite growing attention for IS-implementation a coherent body of knowledge is missing. Keen (1981) states that understanding processes that play a role in IS-implementation is incomplete and blames this on three factors:

* a consistent definition of IS-implementation is missing;
* the implementation vision as the basis for research in this area is limited;
* a dominant paradigm/reference framework is lacking.

Limited systematic knowledge on the role various variables play when implementing computer-assisted information systems goes as well for the introduction of information systems into schools as for similar innovation processes in other types of organizations. As a result of there being no accepted theoretical framework available, an attempt was made through literature research to identify variables that play an important role when IS's are implemented. Although the precise working of these detected variables is unknown, studies have shown them to be important. To identify variables, literature from three fields was analyzed:

* educational innovation;
* business administration and computer science (the development and use of information systems);
* school information systems (SIS's).

Various authors distinguish clusters of variables they consider important when innovations are implemented within (educational) organizations (see Fullan, 1982; Stasz, Bikson & Shapiro, 1986; Rogers, 1983; Björn-Andersen et al., 1986; Mayntz, 1984). Some of these authors deal with various kinds of innovations others specifically with introducing computer-assisted (school) information systems. Although some variation exists regarding the variable groups these authors mention, a number of groups are often mentioned:

1. characteristics of the innovati .n contents;
2. characteristics of the innovating unit;
3. innovation strategy used.

Fullan (1982) mentions a fourth cluster of variables, namely the societal and social environment, but those he considers to be part of this group (the counselling received from external bodies, the relation between innovation planners and users) are included by other authors in the variable group 'innovation strategy used'.

The three aforementioned clusters of variables were supposed to be important for studying the introduction, use and effects of ARS too. As far as the first group of variables is concerned, the perceived quality of the innovation seemed to be especially valuable. Besides, the effects of the innovation process would probably be influenced by the characteristics of the schools as well as by the characteristics of the innovation strategy.

By especially following the empirical studies on the introduction of computer-assisted information systems of Björn-Andersen et al. (1986), Rogers (1983) and Mayntz (1984) it was assumed that the impact of introducing computer-assisted school information systems is also determined by the way in which the IS has been designed and how and to which extent it is used.

Since the (change in the) primary effect variable, the degree of absenteeism, is possibly related to the school-context, some relevant school-context variables were included in this study too. This made it possible to investigate the degree to which school-context variables are related to changes in the degree of absenteeism. An example of such a context variable is the degree to which the school environment encourages absenteeism. If the school environment stimulates absenteeism this may mean that despite using ARS absenteeism cannot be reduced, or only to a small degree.

Schools can develop other measures to reduce absenteeism than policy measures based on ARS data. To be able to determine the relation between these 'other measures' and possible trends in absenteeism, the degree to which schools develop such 'other measures' was also studied.

To summarize, it was assumed that the following groups of variables were valuable for answering the research questions formulated in 7.2:

- A. the characteristics of the ARS design strategy;
- B. the quality of the developed information system;
- C1. the way in which ARS is implemented;
- C2. characteristics of the school organization into which ARS is introduced;
- D. how and to which degree ARS is used;
- E. changes in the degree of absenteeism and other positive and/or negative effects of ARS use;
- F. characteristics of the school-context as far as is relevant to this innovation;
- G. the degree to which a school develops anti-absenteeism policy measures that are not based on ARS output.

Figure 7 contains the groups of variables A to G and shows the relations that are assumed to exist between them. The way in which the IS (in this case ARS) was designed (block A) is supposed to determine the ARS-quality (block B). The design method used for instance was to a certain extent thorough, which probably influenced the quality of ARS positively. The quality of ARS is expected to influence the extent of ARS use (block D) as well as the characteristics of the implementation process (C1; e.g. the degree of support schools received) and the features of schools (block C2; e.g. the extent to which schools were motivated to use ARS and the degree to which they are able to develop a school policy) are supposed to affect the extent and manner of ARS use. The intensity of ARS use and how it is used (block D) are expected to produce certain effects (block E) in terms of changes in the degree of absenteeism and other positive (e.g. student absence reports can be made more quickly) and negative effects (like more boring data entry work). Block F (the features of the school-context like characteristics of the school location and student population) and block G (policy measures to reduce absenteeism that are not based on ARS data) were part of this research project to enable a study of the degree to which these factors influence trends in absenteeism.

These groups of variables (block A-G) include many that have been elaborated upon in the research framework for the specific situation of ARS; variables were selected that were supposed to be relevant for answering the research questions.

The research framework that was constructed is now presented and explained by discussing the variables in each of the variable groups (the variables that have been examined in this study), as well as the relations that were assumed to exist between variable groups and why these assumptions were made.

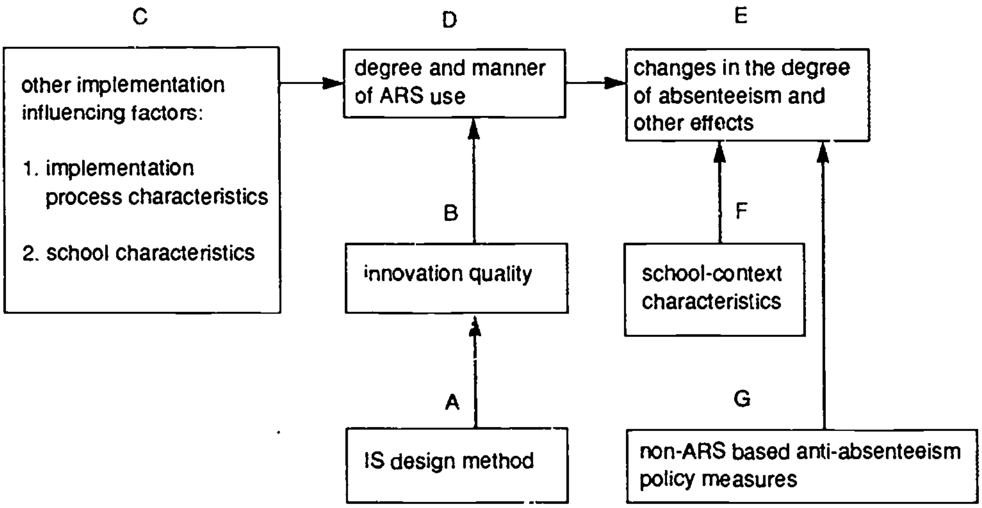



*Figure 7: Variable groups and their relations*

<u>Re A: IS design method:</u>

This block of variables concerns the method used for designing the computer-assisted information system. Such a method can differ with regard to a number of aspects:

- the degree to which it offers possibilities for user participation (see Hedberg, 1980; Mumford, 1980; Camillus & Lederer, 1985; Cornelis & Oorschot, 1986);
- the level at which automation plans and activities come into being (e.g. one school or the government);
- the goals of automation activities (for instance to try to realize the organizational goals better or to carry out clerical work more efficiently);
- the degree to which a fundamental approach is used for developing the IS (thorough organizational analysis and integrated design), (Fung, 1988);
- the degree to which one strives for a standard or a flexible (adaptable to the unique characteristics of a school) information system.

However, the aforementioned design variables were <u>not</u> considered to be variables in this study since one design and development strategy was used within the ARS-project, which resulted in one ARS system for all schools. In other words, it could only be decided what the result of this one used design strategy was in terms of IS quality.

The questions then are what quality ARS, that has been designed by means of a strategy with certain characteristics possesses, to what degree that system is used and what effects system usage produces.
For information on the features of the ARS design strategy, the reader is referred to chapter 4.

Re B: innovation quality

The design and development strategy used resulted in an IS of a certain quality. As far as aspects of quality of a computer-assisted information system are concerned one can think of the support software offers, as well as its reliability and user friendliness. Information system quality and the degree of IS-use (block D) are expected to be interrelated. The other element of variable block D (see Figure 7), the way in which ARS is used is especially related to school characteristics (variable group C2 in Figure 7). This relation is discussed later in this chapter.
Little literature exists on the quality of IS. Van Hulzen & De Moel (1987) state that a reference framework to express the information quality of organizations is missing. The authors recommend reliability as an indicator for the quality of behavioural and performance characteristics of the informat n supply. This is close to what Van Hulzen & De Moel mean by quality: "the degree o which the whole of characteristics of a product, process or service meet the requirements that result from the goal of the user". The degree to which users are satisfied on various aspects of an IS is often used as a measure for IS quality. Frequently such a perception measure is chosen because another, more objective, measurement of IS quality is impossible. Ivies, Olson and Baroudi (1983), however, point to the fact that IS quality, measured as user satisfaction, should not just be viewed as a surrogate-indicator for 'IS-quality' or 'system success'. After all perception of IS quality by experienced IS users is vital for how an IS is treated within an organization. Several studies have shown how important user perceptions are for the degree of system use (Lucas, 1975; Robey & Zeller, 1978; Robey & Bakr, 1978; Robey, 1979; Rodriguez, 1977). Ivies et al (1983) put it like this " A 'good' information system perceived by its users as a 'poor' system is a poor system". Bailey and Pearson (1983) refer to Cyert and March who already in 'The Behavioral Theory of the Firm' (1963) pointed to the fact that the degree to which an IS meets user needs decreases or increases user satisfaction. If user satisfaction falls below a certain level users will avoid the IS and look for alternative information sources.
Ivies et al. (1983) compared various research instruments for measuring user satisfaction using four criteria:

- the basis for the derivation of the measured factors (literature research, interviews, empirical research);
- psychometric characteristics of the instruments like reliability, content validity, predictive and construct validity;
- the degree to which an instrument pays attention to the IS product (the content and output of the IS) as well as supporting the development and maintenance of the system and its product;
- the number of indicators (aspects of user satisfaction) the instrument contains.

Of the instruments judged, Pearson's (1977) proved to be the best one. However, it could not be used completely to measure ARS quality, since the instrument contains many scales that are not applicable to the ARS situation. Nevertheless, the Pearson instrument as well as the earlier mentioned work of Van Hulzen and De Moel (1978) functioned as a starting point for measuring ARS quality. When constructing the instrument, it was decided which quality aspects mentioned by Van Hulzen & De Moel and Pearson were relevant to the ARS context. Some examples of measured IS quality aspects are: the degree to which the application software contains bugs and is reliable, the ease with which data can be entered, retrieved and altered, the ease with which reports/statistics can be generated, and the value of ARS output for absence registration and handling. As such the ARS quality as judged by system users could be determined, as well as the degree to which information system use is related to perceived IS quality.

Re C: Other implementation influencing factors

Literature (see e.g. Kwon & Zmud, 1987) shows that IS quality is only one, although a very important one, of many factors that influence IS implementation. Innovation quality is a separate variable in Figure 7 because of its essential role and close relationship with the design method. Variable block C contains the other variables that are assumed to influence the degree of ARS usage. Block C is divided into two groups of variables: 1. characteristics of the implementation process, and 2. school characteristics. First the C1 group variables are discussed then the important characteristics of schools (the C2 variables).

Re C1: Variables concerning the implementation process

Considering the large number of implementation process variables mentioned in literature, only those were selected that were expected to be important within the context of ARS. A variable often mentioned as being valuable for implementing innovation successfully (Berman & Mclaughin et al., 1977; Bird, 1984; Fullan, 1982) is the degree to which the implementation process is *encouraged by school management* (C1.1). This would manifest itself among others in school management participation in the innovation process and the degree to which school management stimulates other staff to work on the innovation.

Not only school managers are important when an innovation is introduced but the internal coordinator who solves problems, coordinates innovation activities etc. plays a similar role (Bird, 1984; Bergsma, 1986; Nath, 1989). The more *the internal coordinator encourages* (C1.2) school members to innovate, the more successful the innovation process was expected to take place.

Available literature showed that the considerations that played a role in the decision to participate in an innovation process are important for the degree in which the innovation is realized as intended. Fullan (1982) distinguishes between opportunistic and bureaucratic adoption motives on the one hand and more *intrinsic motives* (C1.3) on the other. In the case of ARS an example of the former motives may be that a school participates in the project because it will receive a computer that can be used for student administration. More intrinsically motivated schools may participate in the project because they hope such behaviour will enable them to organize their absence registration and handling more effectively and as a result reduce absenteeism.

It goes without saying tnat the *extra resources* (C1.4) schools can use for the innovation process are also important. The better users are equipped for introducing and using IS's, in terms of manpower (among others to enter data and to handle absences), hardware, software and so on, the more successful the implementation is likely to be. Innovation literature supports this assumption (Uhlig et al., 1979; Fullan, 1982; Wentink & Zanders, 1985).

The degree to which schools were confronted with hardware and software problems could differ between schools. Therefore it seemed valuable to study the relation between the degree of ARS use and *the extent to which schools had met problems when implementing ARS* (C1 5).

Another valuable factor concerns the *support* users receive. User support and training is often mentioned as an important variable for the degree to which an IS is implemented successfully. Nath (1989) states that "...adequate user training is a critical but missing link in many organizations' overall strategy to successfully implement information systems". The work of Benson (1983) points to the great importance of training users too. To be able to 'do the job' users have to be equipped regarding the knowledge of the IS and the logistics required for IS use.

The passionate pleas for support and training are in strong contrast with the amount of empirical research on how to train computer users effectively. However, some evidence exists on the characteristics of support that encourages implementation. Research data from Uhlig (1979), Berman & Mclaughin et al. (1977) and Nath (1989) show that the intensity of user training and counselling is important as is the degree to which support is directed to real and familiar problems, the degree to which it is adapted to user needs and to which it offers users possibilities to exchange experiences and ideas. To understand the importance of these variables for introducing ARS, the following 'support variables' were studied:

- the *degree* to which schools were supported (C1.6);
- the way in which support was given (whether *together with other schools* (C1.7), or separate and whether in an *oral or written manner* (C1.8));
- *the orientation of the support* (C1.9), that is the degree to which support was directed to various school staff members (the computer operator, the internal ARS coordinator, the system administrator, the absence-handlers, teachers and school managers);
- the *content of the support* (C1.10): the degree to which support was directed towards the possibilities the information system offers, the way in which it should be implemented, its operation, the goal and background of the project, solving hardware and software problems, the interpretation of ARS output and the use of the so-called SQL-language;
- the degree to which users were *satisfied with the support* (C1.11) received.

Next to variables that have been selected as a result of literature research, a number of other variables were selected that were expected to be important and are now discussed.

Not all schools possessed ARS at the same moment, since it could not be installed immediately in all schools. In combination with the short period between introducing the systems into schools and the first moment ARS use was monitored (after about 7 to 8 months), it seemed sensible to investigate *how long each school had possessed an ARS* (C1.12) which could be used (ready for data entry).

Two different *types of computers* (C1.13) were introduced into schools due to differences between them regarding the required memory capacity. One of these

proved to cause technical problems and for that reason the relation between the type of computer used and the degree of ARS implementation was studied too.
Before the second ARS end system (the ECC/UTOPICS version) was available schools had worked with an imperfect version. Some schools had progressed considerably with the introduction of the first end system, others did not use the first ARS end system anymore due to problems when wo.king with it. Obviously schools that had progressed with the introduction of the first ARS end system could assimilate the second version more quickly than schools that had to start again with the second end system. Thus the relation was studied between *the degree to which schools had progressed with implementing the first version of ARS* (C1.14) and the extent to which the second ARS end system was used.

The implementation process variables already discussed are now summarized. In most cases it concems variables which the more they were encountered, the more it was expected ARS implementation would be successful and the more the IS would be used. For example, it was supposed that the more a school manager encourages his staff members to use ARS and the more resources a school has at its disposal for implementing ARS, the more intensely ARS would be used. However, in a number of cases there was uncertainty regarding the influence of a variable and for that reason its effect was studied. For instance the impact of various types of support contents and the degree to which the support was geared towards specific staff members.

To summarise, the following implementation characteristics were studied:

- C1.1, the degree to which the principal encouraged ARS innovation;
- C1.2, the degree to which a school internal ARS coordinator encouraged ARS innovation;
- C1.3, the degree to which adopting the innovation was a matter of intrinsic considerations;
- C1.4, the extra resources a school could use for implementing ARS;
- C1.5, the degree to which problems arose as a result of introducing ARS;
- C1.6, the degree of support a school received because of introducing ARS;
- C1.7, the degree to which a school received support: a. together with all other project schools from one borough, b. with some of those schools, c. separately;
- C1.8, the degree to which a school received oral or written support;
- C1.9, the degree to which the support was geared towards various staff members;
- C1.10, the support contents: the degree to which the support was directed towards various topics;

- C1.11, the degree to which schools were satisfied about the received support;
- C1.12, the period during which a school had a ready-to-use ARS available;
- C1.13, the type of computer a school received;
- C1.14, the degree to which a school had progressed with implementing the first ARS end system at the time the second ARS end system became available.

Re C2: School characteristics

It was assumed that school characteristics influence how schools handle ARS. When ARS was characterized (see 7.3.1), it was stated that ARS can be used in a registrational way as well as in a decision-supporting way. Especially the latter form of system usage was expected to be correlated with organizational characteristics of schools. This will be explained now by first discussing possible organizational differences between schools and by then giving attention to the assumed relation between school organizational characteristics and ARS use.

Marx (1975) and Van der Krogt (1983) have shown that schools can differ concerning their educational and organizational characteristics. The authors distinguish between various types of school organizations. The three most important ones are respectively called the segmental, the line-staff and the fraternal school organization. Although no large scale research is available on whether each ideal type exists, studies have indicated that schools possess the characteristics of each of these three organizational types to a higher or lesser degree (Witziers, 1992). The three ideal types are inspiring when thinking about school organizational differences that may be relevant for studying the use of ARS as a decision support instrument. The three types of schools are now outlined on the basis of Van der Krogt & Oosting (1988). First, however, some background information is presented that is important for a proper understanding of the 'Marx models'.

The concept 'policy', following Van der Krogt & Oosting (1988), is understood here as structural, far-reaching actions that are developed within an organization. Four areas of policy-making can be distinguished (Van der Krogt, 1983):
- *resources*: the means and arrangements necessary to let the educational system of a school function like finance, hardware, personnel, external contacts, the student consultation system etc.;
- *general pedagogic-didactic matters*: general arrangements concerning the way students are approached and treated, general teaching process characteristics (how teachers and students are grouped, forms of specialization, student evaluation

methods, didactics, arrangements concerning homework, tests, timetables and internal examinations); student counselling is also an important aspect of this area of policy-making;

- *educational profile*: the educational structure as it becomes manifest in the school structure in terms of grades and educational directions, possible educational routes, possibilities to switch between grades of different school types and possible student careers;
- *subject content and subject didactics*: subject matter and how it is taught.

So far some background information regarding the Marx models. The three school models mentioned are now briefly outlined.

The segmental school organization consists of loose segments; each teacher takes care of his teaching task, almost without cooperating with colleagues. In this type of school relatively little consultation and policy-making takes place and if it is done it mainly happens at school management and at school board level. Policy is made in the resources area, in other words, there is little policy-making in the other three areas of policy-making.

The line-staff school organization has the following features:

- compared with the segmental school, the line-staff school consults more at school management and at school board level;
- staff bodies (e.g. General Teacher Meeting, Representative Advisory Body and special advisory bodies) also consult more in this school type and especially advise school management;
- school management and school board develop policy measures in the area of resources and the educational profile of the school.

Within the fraternal school the situation is again different. It is represented by strong departments; no individually operating teachers but solid cooperative teacher groups per subject. Departments set up subject instruction, execute and evaluate it. They put forward general problems and ideas concerning the didactics and contents of subject instruction in a coordinating body in which the activities of all departments are coordinated. Consultation between school management and departments is intensive from both sides within these schools. School management concentrates more on encouraging and initiating than controlling the content of instruction, arranges that departments can fulfil their policy development task and aims to gain the resources necessary to execute a subject content policy.

So, in fraternal schools:

- consultation is intense at various school levels: at school board and school management level, as well as at the level of the advisory bodies and divisions;
- subject departments and school management actively operate as policy developers and school management stimulates departments that fulfil a pivotal function in fraternal schools;
- policy measures are developed in the field of resources, educational profile, general pedagogic-didactic affairs and subject content.

The three ideal types of school organizations show that schools can differ with respect to their consultation size and degree of policy-making. These variations in intensity apply for the school as a whole as well as for its various organizational levels. One school as a whole may consult more and also develop policy measures more actively while in another school the departments only may be active policy developers, while in yet another school management may operate particularly intensively.

The Marx models also show that it is important to determine *in which areas* of policy-making an organ (e.g. school board) or a section (e.g. school management, teachers) within a school develops policy measures. Some schools are only active in one policy area, whereas others develop policy in various fields.

A general assumption within the Marx models is that schools do not only differ concerning the degree of their consultation activities and policy-making, but that a relation exists between both. The stronger the intensity of consultation at a certain school level, the more intense policy-making will be at that level.

In this evaluation project it was assumed that if more consultation occurs within a school, policy development will also be more intense in that school. So, in the case of ARS it was expected that more policy measures to reduce absenteeism would be developed in a school, if more consultation took place within it. Anti-truancy policy development using ARS is discussed extensively where variable block D of Figure 7 is discussed.

In connection with the aforementioned, this study investigated:

- to what degree consultation occurred at various school levels (school board, management, divisions, departments etc.) and within the school as a whole;
- to what degree and in which areas of policy-making anti-truancy measures were taken;
- what relation exists between the consultation frequency of schools (as a whole and at various school levels) and the degree of policy-making directed at reducing absenteeism.

Moreover, various Marx school models were distinguished on the basis of several variables because a combination of variables reflects the organizational nature of a school better than individual variables do, and the relation between a school model on the one hand and characteristics of an anti-truancy policy on the other is probably stronger than the relation between one school organizational variable and the degree and contents of anti-truancy policy-making. Groups of project schools were planned to be compounded on the basis of the following variables:

- the degree of *consultation at various school levels* (C2.6);
- *the degree of influence of various school organs (e.g. school board)/sections (e.g. school management, teachers)*, as perceived by school staff in the four Marx areas of policy-making (C2.7).

The latter variable was studied because it was also presumed to be valuable for the characterization of schools.

In connection with the foregoing the following relations were expected:

- the more consultation occurs within a school, the more anti-truancy policy measures are developed within that school;
- the more consultation takes place at a specific school organizational level, the more actively that level will operate with regard to developing an anti-truancy policy;
- if a school has more segmental characteristics, relatively few policy measures will be developed within that school concerning truancy reduction, and policy measures will be mainly developed in the area of resources;
- if a school has more line-staff characteristics it will, in comparison with the segmental school, work more intensively on an anti-truancy policy and anti-truancy measures will be developed regarding both resources and general pedagogic-didactic matters;
- if a school possesses more fraternal model features, policy development to prevent and reduce absenteeism will be directed towards resources, general pedagogic-didactic matters and subject content.

In this study the development of an anti-truancy policy was especially expected at school management level and at the level of special truancy-related organs like truancy consultation at school level. At the level of divisions, departments, clerical staff/caretaker etc. little effort to reduce truancy was expected because combating truancy was assumed to be often part of the daily school routine and therefore not their responsibility. Students play truant and therefore should be tracked down and where

appropriate be punished or counselled. Truancy was not considered to become such a problem in many schools that it should be tackled with structural policy measures. If a policy was developed in this area it was supposed that in most cases this would concern the procedure for absence registration and handling.
Resources and, to a lesser degree, general pedagogic-didactic measures were considered appropriate since policy measures related to subject content and a school's educational profile are much more radical and therefore much less likely to succeed. Radical because subject content measures touch the territory of the autonomous teacher or require far-reaching changes in the educational structure. Moreover, the link between truancy and subject content and the educational profile of a school would probably not be seen so quickly in schools.

*Other school characteristics*

Next to the organizational variables that have been discussed other school characteristics were considered important for evaluating of the implementation of ARS. *User-attitudes concerning ARS* (C2.1) is one. The decision to adopt the innovation in many cases was probably taken by school management. School management might decide to participate in the project because it offers a number of advantages without involving other school staff (who would have to work with ARS) in the decision-making process. However, the attitude of all school staff is important for the way in which a school deals with the innovation. Bennet & Lancaster (1986) state "If the innovator does not have their commitment and trust 'dysfunctional behavior' is obvious". The existing attitude within a school regarding the innovation is shown among others from:

- the degree to which the innovation has the approval and appreciation of school staff (Piercy, 1987; Bird, 1984; O'Brien et al., 1989). According to O'Brien et al. the innovation has to fit with existing values and attitudes; the other authors stress that a certain need for the innovation should exist;
- the degree to which one expects advantages of system use (Piercy, 1987; Fullan, 1982; Rogers and Shoemaker, 1971; O'Brien et al., 1989);
- the degree to which one is afraid that the innovation will result in more power at a central level (Piercy, 1987).

The more positive the innovation attitude of users, the more successful the implementation phase and the more intense ARS is probably used. In the case of ARS, clerical staff/caretaker (operating the system), teachers (delivering absence data, and absence handling), school management (adoption and encouragement of the

innovation, handling absences, analysis of absence data) are all involved in the innovation process.
Gross, Giacquinta & Bernstein (1971) and O'Brien, following Rogers (1983) stress the importance of past experiences on innovations. Such experiences can be a source of resistance, or conversely create a positive climate for innovations. For that reason it was studied how *motivated* school staff were to implement the second ARS-version, after they had experienced problems with the first ARS version (C2.2). It was expected that the second version would be used more intensively if experiences with the first version were more positive.

In innovation literature it is stressed that the complexity of the innovation is relevant to it being implemented successfully (see a.o. Fullan, 1982). The more simple the innovation, the more easily it can be introduced. To switch to computer-assisted absence registration like ARS means that a school has to go over to a new absence registration procedure. The more the *ARS-procedure corresponds with the procedure that used to be used* (C2.3) in a school, the less complicated and radical the innovation and the more simple the switch for the school. Therefore it was investigated to what extent absence registration, before ARS was introduced, corresponded with the ARS-procedure.
If a school already actively tried *to reduce truancy before ARS was installed* (C2.4), then truancy was probably a problem that existed and the school was likely to want to fight it. This would be reflected in the effort put into introducing ARS and the degree to which the innovation succeeded. Therefore the truancy reduction effort before introducing ARS was determined and linked to the extent with which ARS was used. It was supposed that ARS would be used more if the truancy reduction effort before ARS implementation was more intense.
Bos, Van Kesteren, Stoel & Vermeulen (1990) on the basis of literature research state that various categories of truancy causes can be distinguished: the individual student, the family, the school, the educational system and society. Aspects of the educational system that might produce truancy include its form and contents like continuous selection and assessment in secondary education. The categories 'school' and 'educational system' have been merged into one category in this study. If school staff attributed the cause of truancy more to causes outside the school, the assessed role of the school itself concerning truancy reduction was considered to be small. As a result, motivation to work hard on truancy reduction and on implementing ARS would probably not be big. Conversely a school would probably be motivated to work on truancy reduction by means of ARS if it thought that truancy causes should be looked for in the

student and in the school. Therefore it was investigated *how school staff thought about truancy causes* (C2.5), and if the assumed relation between truancy cause perceptions and ARS use really exists.

Schools can differ with respect to the extent to which *teachers are counselled* (C2.8) concerning their jobs. In many schools teachers carry out their work autonomously and receive little or no counselling. In other schools teaching work is much more a point of discussion and there is teacher counselling and extra training activities. The degree to which schools pay attention to counselling teachers was studied because if ARS use proves that certain subjects/teachers have more than average truancy figures it was assumed that schools that coach their teachers more can use this ARS information better than schools where teachers are never or hardly counselled.

Schools can also differ concerning the *degree of attention for student counselling* (C2.9). The problem of school absence is closely connected with student counselling. If one attempts to prevent and combat truancy and therefore tries to discover and remove causes of disallowed absence, one has to deal with students that need counselling because of academic problems, problems at home etc. In other words, absence prevention and reduction and student counselling often go hand-in-hand. Therefore, the degree to which a school paid attention to student counselling was considered important. The more this was done, the more active a school was expected to be regarding student care and the more a school was expected to pay attention to absenteeism and thus be more inclined to use ARS.

To summarise the following school characteristics were part of this investigation:

- C2.1, the attitude of school staff towards ARS;
- C2.2, the degree to which school staff was motivated to implement the second version of ARS, after the negative experiences gained with the first ARS version;
- C2.3, the degree of similarity between the ARS procedure for absence registration and handling and the procedure used before ARS was installed;
- C2.4, truancy reduction efforts before ARS was used;
- C2.5, the degree to which school staff attributed truancy to the individual student, the school, the family, and society;
- C2.6, the consultation frequency at various school levels;
- C2.7, the degree of influence of various sections/organs within the school concerning resources, subject content, general pedagogic-didactic and educational profile matters;
- C2.8, the degree of teacher counselling of a school;
- C2.9, the degree of student counselling of a school.

Re D: Degree and manner of IS-use

The degree to which an IS is used is often defined in terms of 'IS-success'. Nath (1989) on the basis of studying literature on management information systems implementation states that four types of variables are used as measures for IS-success: the degree of system use, organizational functioning, user decision-making characteristics and user satisfaction. User satisfaction according to Nath (1989) is the most frequently used indicator for IS success since it can be measured most easily and empirical research has shown it's value as a success-indicator. When the success indicators mentioned by Nath are compared with the research framework for the ARS evaluation study both the use of ARS (Nath's indicator system use) and how a school operates regarding absence prevention and handling (indicator organizational functioning) are included in the framework. The third indicator of Nath, user satisfaction, was not used in this study as a measure was preferred that reflects the degree of ARS use and the extent of policy-making on the basis of ARS-data. Nevertheless, some indications for user satisfaction were collected by having users give their opinion on ARS quality and by measuring the way users perceived its positive and/or negative effects. The fourth indicator mentioned by Nath (1989), the decision making characteristics of users was not applicable to this ARS study for content reasons.
The various aspects of ARS usage can be summed up as follows:

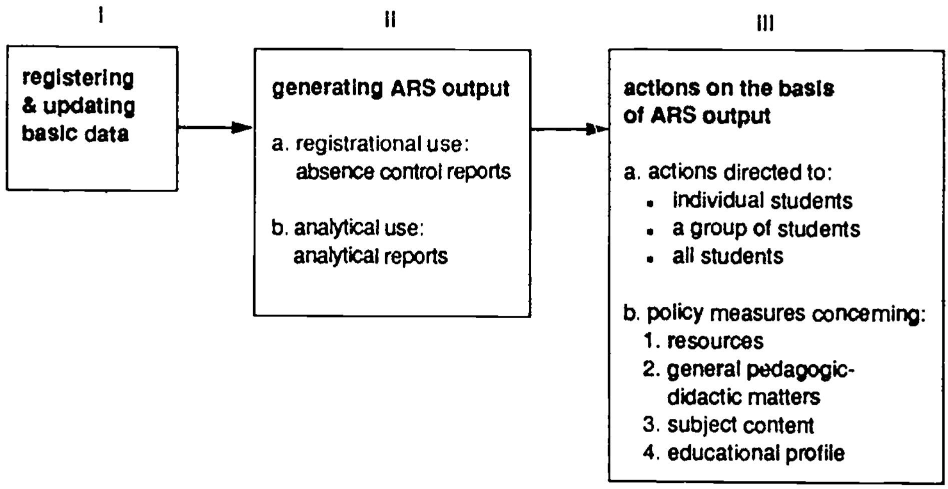



*Figure 8: Some aspects of ARS use*

Figure 8 shows that some basic data have to be registered to be able to work with ARS (block I) like student data, teacher, subject, timetable, and absence data (who, when, why, where?). To be able to use ARS properly data must be updated frequently as changes occur. The output that can be retrieved from ARS (block II) can vary regarding its nature. Absence control reports are meant for daily *registration* and handling of absentees. *Analytical* reports are used for absenteeism trends and to detect factors related to absenteeism in order for it to be reduced. In Figure 8 block III truancy reducing actions are presented. These can be directed towards an *individual* student, a *group* of students or to *the school as a whole* (e.g. a new procedure for absence registration, improving the timetable, stepping-up student counselling). The development of an *anti-truancy policy* is important in block III. Policy measures taken can vary; they can be directed towards one or more of the Marx areas of policy-making (resources, subject content etc.). Policy measures related to *resources* are the least sensitive for school staff since they do not interfere with the work of relatively autonomous teachers. *General pedagogic-didactic policy measures* (e.g. new arrangements concerning how students are treated) and *educational profile* policy measures (e.g. new possibilities to switch between school types) affect the work of teaching staff more closely. Educational profile policy measures were not expected to be taken very frequently since there is no obvious relation with truancy and such measures are radical. *Subject content* policy measures (e.g. modifying how a subject is taught) were expected to be most difficult to carry through because they encroach on a teacher's territory. Therefore such policy measures were not expected to be taken, or only to a limited degree.

The ARS use has been split into a fourth group of variables (block D) in the research framework (see Figure 7) because it was assumed that the intensity with which and how the IS was used results from the variables in block B and C. Moreover, the degree and manner of working with ARS were assumed to determine the effects of ARS use (block E). It was expected that the more the innovation quality (block B) was appreciated and the higher a school scored on the other implementation influencing variables (block C), the more intense the use of ARS would be. The degree to which analytical ARS usage and an anti-truancy policy based on ARS data were realized were assumed to depend on school organizational characteristics (C2.6 and C2.7) which have been discussed in the previous block.

It was assumed that the degree by which truancy was reduced with ARS use was related to the intensity of ARS use. Schools must first use ARS in a registrational way before they could work in a more analytical manner, and develop anti-truancy policy measures. Therefore a truancy reducing influence was expected to result first from *registrational ARS use* (D1). It was expected that *analytical ARS use* (D2) and the development of structural *anti-truancy policy measures based on ARS data* (D3) would further reduce absenteeism. It was planned to explore to what degree *policy-making in each of the policy areas* (resources, subject content etc.) would have a truancy reducing influence (D4-D7). This also goes for the *scope of the developed policy measures*: which policy measures reduce absenteeism the most - individual oriented (D8), group oriented (D9) or general (D10) ones?

The foregoing led to studying the following ARS usage variables:

- D1, the degree to which ARS was used in a registrational way;
- D2, the extent to which ARS was used in an analytical way;
- D3, the degree to which schools developed anti-truancy policy measures on the basis of ARS data;
- D4, the degree to which anti-truancy policy measures in the area of resources were developed on the basis of ARS data;
- D5, as well as in the general pedagogic-didactic area;
- D6, as well as in the subject content area;
- D7, as well as in the educational profile area;
- D8, the degree to which anti-truancy policy measures were directed towards: a) individual students,
- D9, b) a group of students, or
- D10, c) the schooi as a whole.

<u>Re E: Changes in the degree of absenteeism and other effects</u>

An important development in the way studying the impact of automation is approached concems criticism of so-called 'technologic determinism' (Bemelmans, 1984; Bjöm-Andersen, 1986; Blacker & Brown, 1986; Zanders, 1986). This criticism implies a rejection of the idea that certain effects of computerization always logically and inevitably result from the implementation of information technology. The criticism of technologic determinism precisely states that the effects of automation are dependent on the characteristics of the organization into which the IS is introduced, as well as on how the automation process is shaped (among others the degree of user training) and on the characteristics of the IS.

Therefore choices made conceming these three factors are considered to determine the impact of automation. Automation can be done in various ways and different approaches produce different effects which to a certain degree will realize the goals set.

Actual criticism of technologic determinism establishes the research framework (see Figure 7) that was used within this project. In that framework the characteristics of the IS (block B), th automation process features (block C1) and the characteristics of the school organization (block C2) are also considered to be important determinants of automation effects. It was also assumed in this study that these three factors result in a certain degree of usage and way of using ARS and that ARS use finally brings about certain effects or otherwise.

In IS literature the expected positive effects of automation are emphasised. When thinking of automation effects one often thinks of a possible improvement to organizational efficiency. Such an improvement is considered feasible because data can be registered with the computer once and subsequently used for many purposes. Besides, processing registered data (data analysis, production of reports, lists) in a computer-assisted way costs remarkably less time and manpower. Malaney & Grives (1986) and Strassman (1985) take the view that efficiency improvements of this type can be realized and determined in the short term. Another repeatedly mentioned effect of automation is the improvement of organizational effectiveness. In the opinion of Malaney & Grives and Strassman these effects can be realized and determined in the long term only. Realising a more effective school by means of automation becomes possible because the computer can take over many registrational and data processing activities giving more time for other important tasks like educational evaluation and improvement, policy-making and the like. Besides, the data processing activities of computers enables more well-founded evaluation, analysis and policy preparation, as a result of which schools may become more effective. One may, for instance think of school improvements like better student achievement which can be realized through policy measures developed on the basis of computer-generated information.

A problem of investigating automation effects is that little research has been done in this field. To measure effectiveness improvements objectively is difficult (Strassman, 1985; Hirschheim & Smithson, 1986) and one often has to work with user perceptions. What is available are studies on what users expect as effects, or what they perceive as effects.

This problem does not only apply to automation within schools but is of a more general nature. Robey points out in Bjõrn-Andersen et al. (1986)"......most research conducted in this area makes little attempt to assess the effectiveness of the system under investigation , let alone relate their findings of computer impact to overall effectiveness".

Although in literature the accent is often on efficiency and effectiveness when evaluating the consequences of automation, empirical research is giving increasing attention to negative automation effects too (Mertens, 1986). Visscher (1988) showed that automation in schools affected the quality of labour conditions, contents and relations. Lancaster (1985) speaks about 'fragmentation' and 'deskilling' as potential negative effects of administrative computer use and Olson & Lucas (1982) also have the view that computers can interfere with the nature of work (more stress, contacts with colleagues).

Considering the nature of ARS it is probably no surprise that the degree of absenteeism was used as the primary effect variable in this research project. In this context it was investigated whether after introducing ARS changes occurred with regard to:

- the *extent of allowed absenteeism* per school: absence with a reason regarded as valid by the school (e.g. absence in connection with a marriage, illness etc.), (E1);
- the *size of disallowed absenteeism* (= truancy per school: absence without a reason considered valid by the school (E2);
- the *percentage of truants per school that has played truant 1-2, 3-5, or 6-8 lesson periods*, on the day absenteeism was monitored (E3);
- the *truancy ratio* of a school: the percentage of students that play truant during one or more lesson periods on the monitored day (E4).

As mentioned above it was expected that a more intensive use of ARS goes hand-in-hand with a stronger reduction in absenteeism. However, to what precise degree the variables E1, E2, E3 and E4 would change as a result of ARS use could not be predicted in advance. Besides, it was also investigated what other effects introducing ARS would produce. As far as other possible positive effects of ARS are concerned it was among others studied to what degree:

- *truants were better traced* (E5);
- *a quicker reaction to truancy* was possible (E6);
- schools had a *better insight into the level of truancy* (E7);
- *computing absences cost less work* (E8);
- *absence registration and handling were improved* (E9);
- *truancy trends, and relations between truancy and other variables could be better detected* (E10);
- *less time was required for absence registration* (E11);
- *parents complained less about truancy* (E12);
- *the police/neighbourhood complained less about truancy* (E13).

A number of these variables are connected with the aforementioned possible improvement to efficiency in absence registration and handling as a result of ARS use (variable E8 and E11). Others touch combating absenteeism effectively, in this case better conditions for effectively reducing absenteeism (E5, E6, E7, E9, E10), or imply fighting absenteeism more effectively (E12, E13).

Concerning possible negative effects of ARS the following possible effects as a result of ARS implementation were studied:

- *more boring work due to an increased entry of absence data* (E14);
- *non-usage of ARS-output* (E15);
- *a stronger emphasis on analysing the degree to which students play truant during the lessons of certain subjects/teachers* (E16);
- *uncertainty regarding the quality of ARS* (E17);
- *more work in connection with absence registration and handling* (E18);
- *absence handlers feel they are checked more* (E19).

Potential effects E16 and E19 may be positive from the viewpoint of school management but will probably be judged negative by teachers (E16) and absence handlers (E19).

Re F and G: School-context characteristics and non-ARS based anti-absenteeism policy-measures

Two more variable groups exist in the research framework (see Figure 7) that can also influence the (reduction of the) degree of absenteeism: characteristics of the school-context (block F) and other non-ARS based policy measures intended to reduce absenteeism (block G). Variable group F contains variables that possibly relate to the degree to which students are absent in school. A number of school-context characteristics were assumed to correlate with the level of truancy of a school (e.g. the ethnic composition of the student population). It was not unthinkable that schools with certain characteristics like having many pupils from minorities or having a truancy stimulating environment are less, or precisely more, able to reduce truancy than schools with other context characteristics. Moreover, these variables were included in the study to determine to what degree changes in absenteeism proved to be related to changes in the school-context. This was done to prevent changes in the size of absenteeism being attributed erroneously to ARS use.

The following school-context variables were included:

- *school size* (F1);
- the *ethnic background of students* (F2);
- *the percentage of students from lower, middle or higher socioeconomic classes* (F3);
- *characteristics of the school's location*: in the city, in an old or new residential area, the presence of truancy stimulating factors in the neighbourhood (F4);
- the *school type(s)* comprising the school (F5).

As far as the G variable is concerned it will be clear that if other policy measures (than those based on ARS use) are executed, these can also be responsible for a change in the size of absenteeism. For that reason it was investigated whether the school had taken *policy measures to prevent and/or combat absenteeism that are **not** based on the use of ARS*, but that may have led to a change in the degree of absenteeism (G).

The research framework in detail

The figure now presented contains all variables that have been discussed in this section. Figure 9 is a more detailed version of Figure 7.

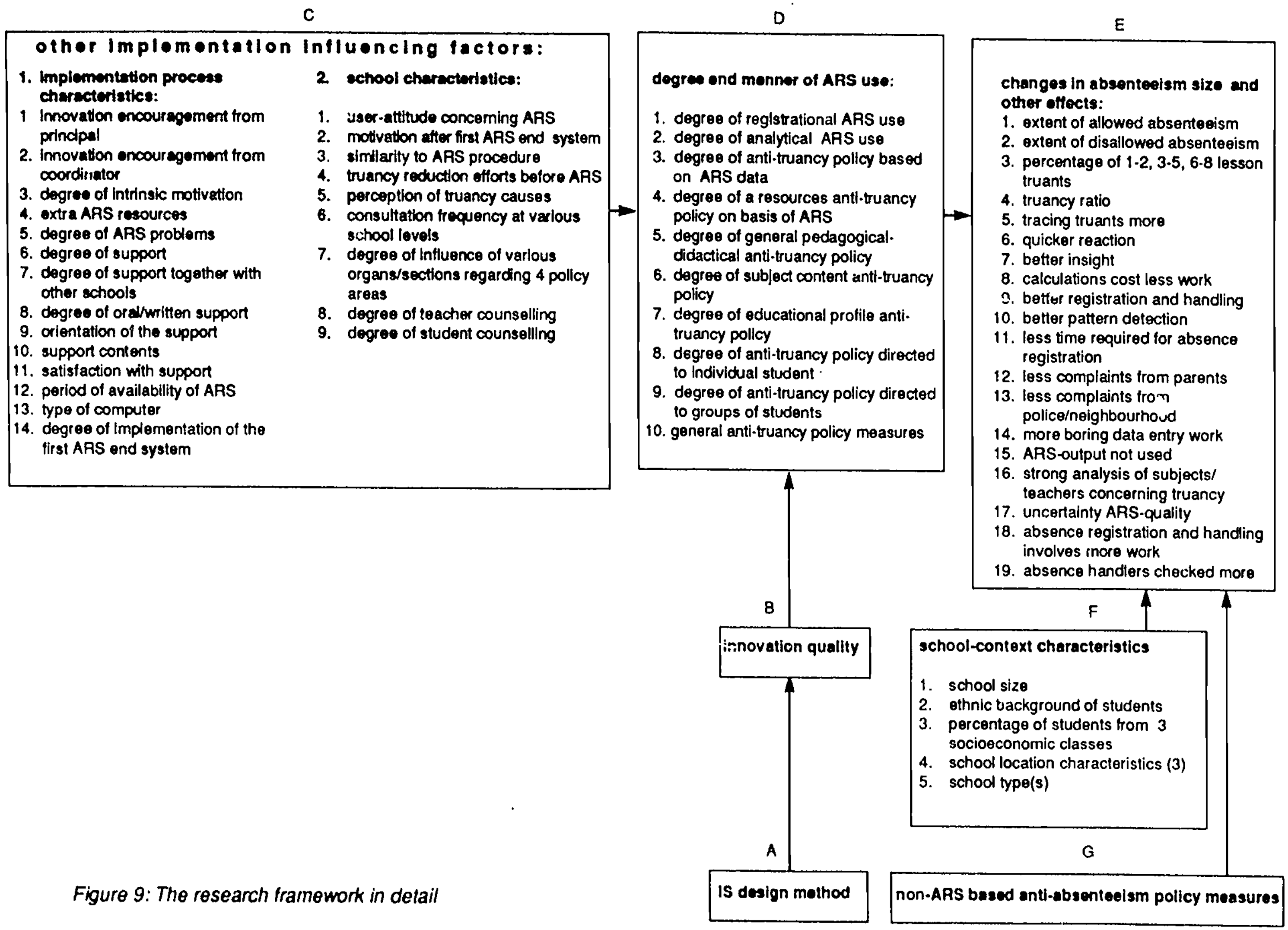



*Figure 9: The research framework in detail*

7.3.3 Summary of the hypotheses

The relation between Block B and block D:

1. The more schools appreciate the qualities of ARS, the more intensively they will use it.

Relations between block C1 and block D:

2. The higher schools score on the implementation process variables (innovation encouragement from the principal (C1.1), coordinator (C1.2), the degree of intrinsic motivation for ARS (C1.3), extra ARS resources (C1.4), support contents (C1.10), support satisfaction (C1.11), availability of ARS (C1.12) and the extent of use of the first ARS version (C1.14)), the more intensively they will use ARS;
3. In a number of cases no clear expectations existed regarding relations between C1 variables and D variables. This goes for the variables C1.6 (degree of support), C1.7 (the amount of support together with that of other schools), the extent of oral/written support (C1.8), the orientation of the support (C1.9) and the computer type used (C1.13) on the one hand and ARS use on the other. Those relations have been explored on the basis of the collected data;
4. The lower schools score on variable C1.5 (the degree of ARS problems), ARS use will be more intense.

Relations between block C2 and block D:

5. The more a school consults, its policy-making capacity will be greater and it will develop more anti-truancy policy measures;
6. The more consultation is made at a certain school level, the more actively it will develop anti-truancy policy measures;
7. If a school possesses segmental characteristics (little consultation, especially consultation at school management and at school board level, individual teachers have the most say regarding subject content while school management and the school board are most influential in the resources area), relatively few anti-truancy policy measures will be developed within that school and policy measures will mainly be based on school resources;
8. If a school possesses line-staff characteristics (more consultation compared with segmental schools; consultation especially at school board, school management and division-transcending level; staff organs like Representative Advisory Body, General Teacher Meeting and the Truancy consultation at school level especially advise; school management and school board are most influential in the resources

and general pedagogic-didactic area), then such a school will operate more actively than a segmental school in developing an anti-truancy policy, and in developing policy measures related to resources and general pedagogic-didactic matters;

9. If a school possesses more fraternal school features (next to consultation at school board, division and division-transcending levels, departments also consult very actively; departments are influential in the resources, subject content and general pedagogic-didactic areas), then the school will be more active in developing an anti-truancy policy than both a segmental and line-staff school and its policy measures will be especially directed towards resources, general pedagogic-didactic and subject content factors;
10. The higher schools score at variable C2.1 to C2.4 (attitude concerning ARS, motivation after experiencing the first ARS version (C2.2), similarity between the ARS procedure and the method used before ARS was introduced (C2.3), truancy reduction effort before ARS was implemented (C2.4) and C2.9 (degree of student counselling), the more intensively they will use ARS;
11. The more factors outside the school (C2.5) are considered to be truancy causes within schools, the less intensively ARS will be used in those schools;
12. The more the student and the school (C2.5) are considered to be truancy causes within schools, the more intensively ARS will be used in those schools;
13. The more individual teachers are counselled in schools (C2.8), the more anti-truancy policy measures in those schools will be directed towards teachers.

Relations between block D and block E:

14. A more intensive registrational ARS use (D1) will go hand-in-hand with a greater reduction in absenteeism (E1-E4);
15. The stronger analytical ARS use (D2) and anti-truancy policy development (D3) on the basis of ARS-output have developed, the greater the reduction of absenteeism (E1-E4).

Moreover, it was investigated what relations exist between the degree to which an anti-truancy policy was developed in each of the four Marx policy areas on the one hand (D4-D7) and the degree of absenteeism reduction (E1-E4) on the other (for the results see section 9.5). Relations were also studied between the degree to which policy measures with a certain scope (individual, group oriented, general; D8-D10) were developed and the extent of absenteeism reduction (E1-E4), (see section 9.5). The relation was also explored between the degree of ARS usage (D1-D3) and the extent to which other (than changes in the size of absenteeism) positive and/or negative effects of ARS use (E5-E19) occurred (see section 9.6).

Relations between block F, G and E:

It was planned to study the role of changes in school-context variables (block F) as far as the degree of absenteeism reduction is concemed. The same goes for the influence of 'Non-ARS based policy measures' (block G), (for the results of both see section 9.5).

Until now only bivariate relations were discussed, expected relations between two variables were stated. However, since several variables can be related, the relative influence of variables was also studied. Chapter 8 explains how this was done.

## CHAPTER 8 RESEARCH METHOD

### 8.1 Research design

#### 8.1.1 Quasi experimental design

Since the effects of using computer-assisted school information systems can only be observed after these have been used over a considerable period of time, a longitudinal design was required. The research design used to evaluate the implementation of ARS can, following Cook and Campbell (1979), be characterized as quasi-experimental, with one pre-test and two post-tests. The study lasted from 1988 to 1991. Originally a pre-test was planned in 1988 and post-tests in 1989 and in 1990. When the first end version of ARS had been developed and installed in project schools (April 1988), the system did not prove to meet requirements and raised many problems. A new software company built a second ARS version that was implemented in ARS schools in September 1989. The fact that project schools between April 1988 and September 1989 had worked with the first imperfect end system and had had many negative experiences with it is important, for it is likely that the large number of problems these schools had encountered influenced their motivation for ARS considerably. For this reason a problem-test was executed in project schools in September/October 1989, to determine the degree to which each school had used the first, imperfect ARS end system, as well as the level of motivation for the ARS innovation after the experiences with the first end sys'em. In this way the relation between these variables and the extent to which the second version of ARS was used could be determined. As a result of the problems with the first version of ARS the two post-tests were executed in 1990 and 1991.

The variables presented in Figure 9 have been measured at the following moments.

| pre-test (T0-test) | problem-test (Tp-test) | first post-test (T1-test) | second post-test (T2-test) |
|---|---|---|---|
| April/May '88 | Sept/Oct '89 | April/May/June '90 | April/May/June '91 |
| C2.3 - C2.9 | C1.14, C2.2 | B, C1.1 - C1.13 | B, C1.1, C1.2, C1.4, C1.5 - C1.11, C1.13, C2.1, C2.3, |
| E1 - E4, block F | | C2.1, block D and E | C2.5, C2.9, block D, E, F and G |

*Table 7: Overview of when variables were measured in experimental schools*

As well as the experimental schools that implemented ARS, a group of control schools also participated in this evaluation study. Section 8.2 describes how the control schools were selected and which characteristics experimental and control schools had. The control schools were included in order to determine if an effect (a change in the size of absenteeism) could be attributed to ARS use or not.

8.1.2 <u>Research instruments and respondents</u>

Three types of instruments have been used in this study: absence lists, interviews and questionnaires.

*Absence lists*

Absence lists and allowed absence lists were used to determine the degree of absenteeism in experimental and control schools. The former lists were completed by teachers who taught on a day when absenteeism was being monitored. For each lesson they wrote the names of absent students on the absence list. The <u>allowed</u> absence lists were filled in by the appropriate staff responsible for finding out whether an absence had been legal or illegal and for punishing and/or counselling students who play truant. When absence lists and allowed absence lists were compared the number of allowed and disallowed absent students could then be calculated.

*Interviews*

Interviews were used to collect data concerning many variables (see Appendix 6 for the interview variables and the respondents for each interview variable) in 1988, 1990 and in 1991. In ARS schools the following school staff were interviewed: the principal, the internal ARS-coordinator, ARS staff, lower school head, upper school head and the head of the Dutch/language department. The principal of each control school was also interviewed in 1988, 1990 and 1991 to collect data on F-block variables (see Figure 9).

*Questionnaires*

These were used to collect data on a number of variables from school management, the ARS coordinator, ARS school staff and teachers. Appendix 6 shows which variables were measured by means of questionnaires as well as the respondents for questionnaire variables.

### 8.1.3 Data collection

*Monitoring absence in project schools*

In order to compare the absence data collected at three different times (1988, 1990 and 1991) each of the three measurements had to be carried out in three similar weeks. So, factors that could influence absenteeism during these weeks had to play a role approximately to the same degree. Therefore the choice of the week for monitoring absenteeism was based on a number of criteria. Firstly it had to be a standard week, not before or after a week with one or more school holidays, and no week during which internal examinations were taking place. The monitoring week for each year had to be in the same month because absence varies according to the time of the school year (Karweit, 1973; Baum, 1978). The degree of absenteeism was monitored in the experimental schools on a Monday, Wednesday and Friday in one week in April 1988, 1990 and 1991. Determining the level of absenteeism in one similar week in April was only possible over a maximum three-day period as collecting data on more days would have burdened project schools too much. The degree to which the collected data do provide information on absenteeism on other days than those on which data were collected is unsure.

After the monitoring week school staff were asked if certain intervening factors had influenced the degree of absenteeism. This proved to be the case in the final grades because of internal examinations. For that reason these absence data were not used.

*Monitoring absence in control schools*

Since control schools could not be overburdened much (they had to invest time and energy but received nothing in return) the level of absenteeism was monitored only in one part of a control school and for one day during the same week as for the ARS schools. Absenteeism was measured in a school type grade in which the degree of absenteeism in general was considered not to be very high or low (on the basis of research of Babeliowsky, 1986, and De Vries & Peetsma, 1987).

*Collecting interview and questionnaire data*

Interview and questionnaire data were collected in May and June of each year.

## 8.2 Research group

### 8.2.1 Experimental schools

When the ARS-project started the Dutch Ministry of Education asked four large cities in the western part of the Netherlands to contact secondary schools in their boroughs to participate in this project. Eventually 36 schools in Amsterdam, Rotterdam, Utrecht and Haarlem agreed to participate and received ARS hardware and software. During the project nine of these schools dropped out of the project for various reasons. In 1988, 1990 and 1991 2, 4 and 3 schools respectively left the project leaving 34, 30 and 27 project schools respectively to participate in the study.

### 8.2.2 Control schools

Secondary schools that neither participated in the project, nor used another computer-assisted system for attendance registration were asked to become control schools. They were selected on the basis of location, size and type.

*Location*
ARS schools were situated in Haarlem, Rotterdam, Amsterdam and Utrecht. Since it was assumed that the size of absenteeism is larger in big cities than in small towns, control schools had also to be located in big cities. Control schools were contacted in every ARS city, except Amsterdam because schools here were already involved in so many research projects that the probability of these schools being willing to participate in the ARS-project when the return was zero was very small. Therefore schools in The Hague, another big city in the western part of the Netherlands, were contacted instead.

*School size*
Four school sizes were used: 0-300, 300-500, 500-750 and 750 and more students.

*School type*
Six school types were defined: MAVO, LBO- or IBO, LBO comprehensives, LBO and MAVO comprehensives, LBO and AVO comprehensives and AVO comprehensives. After project schools had been classified at least one control school per city was contacted for every combination of school size and school type per ARS-school.

| | project schools | | | | | control schools | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Utrecht | Rotter-dam | A'dam | Haar-lem | total | Utrecht | Rotter-dam | Den Haag | Haar-lem | total |
| <u>school size 1</u><br><u>(0-300 stud.)</u> | | | | | | | | | | |
| MAVO | 4 | 2 | - | 1 | 7 | 1 | 2 | - | - | 3 |
| LBO | 2 | 1 | 1 | - | 4 | - | 1 | - | - | 1 |
| LBO comp. | - | - | - | - | - | - | - | - | 1 | 1 |
| LBO-MAVO comp. | - | - | - | 1 | 1 | - | - | - | - | - |
| LBO-AVO comp. | - | - | - | - | - | - | - | - | - | - |
| AVO comp. | - | - | - | - | - | - | - | - | - | - |
| <u>school size 2</u><br><u>(300-500 stud.)</u> | | | | | | | | | | |
| MAVO | - | - | - | - | - | - | - | - | - | - |
| LBO | 1 | 1 | - | - | 2 | - | - | 1 | 1 | 2 |
| LBO comp. | 1 | 1 | 1 | 2 | 5 | - | 1 | - | - | 1 |
| LBO-MAVO comp. | - | - | 1 | - | 1 | - | - | - | 1 | 1 |
| LBO-AVO comp. | - | - | - | - | - | - | - | - | - | - |
| AVO comp. | - | - | - | - | - | - | - | - | - | - |
| <u>school size 3</u><br><u>(530-750 stud.)</u> | | | | | | | | | | |
| MAVO | - | - | - | - | - | - | - | - | - | - |
| LBO | - | - | - | - | - | - | - | - | - | - |
| LBO comp. | 1 | 1 | - | 1 | 3 | - | 1 | - | - | 1 |
| LBO-MAVO comp. | - | 1 | - | - | 1 | - | - | 1 | 1 | 2 |
| LBO-AVO comp. | - | - | - | - | - | - | - | - | - | - |
| AVO comp. | - | - | 1 | - | 1 | - | - | 1 | 1 | 2 |
| <u>school size 4</u><br><u>(750 and more stud.)</u> | | | | | | | | | | |
| MAVO | - | - | - | - | - | - | - | - | - | - |
| LBO | - | - | - | - | - | - | - | - | - | - |
| LBO comp. | - | - | - | - | - | - | 1 | - | - | 1 |
| LBO-MAVO comp. | - | - | 1 | - | 1 | - | - | 1 | - | 1 |
| LBO-AVO comp. | - | - | 2 | - | 2 | - | - | 1 | - | 1 |
| AVO comp. | - | 1 | 3 | 1 | 5 | - | 1 | 1 | - | 2 |
| middle schools | 2 | - | - | - | 2 | - | - | - | - | - |
| other | 1 | - | - | - | 1 | - | - | - | - | - |
| total: | 12 | 8 | 10 | 6 | 36 | 1 | 7 | 6 | 5 | 19 |

comp. = comprehensive, stud. = students

*Table 8: Characteristics of project and control schools*

**BEST COPY AVAILABLE**

Table 8 depicts the characteristics of project and control schools. This shows that the match between control and project schools is not perfect. Some combinations of school size and school type within the project group are not represented in the control group (4 combinations) and vice versa (2 combinations). Moreover, the number of control schools (19) is smaller than the number of project schools (as many as possible schools were contacted (42), and 19 were willing and suitable to be a control school). Thus the results of comparing project and control schools should be used cautiously.

### 8.3 Data processing and analysis

This section describes how data have been processed and analysed per research instrument.

#### 8.3.1 Data processing

*Processing absence data*

Absence lists and allowed absence lists were compared to determine the type of absence (legal or illegal). The size of (dis)allowed absence per school was expressed by means of an absence percentage which shows the percentage in which students were legally or illegally absent, in relation to the total number of lesson periods of a school.

*Processing interview and questionnaire data*

All other variables than the size of absenteeism were measured by means of interviews and questionnaires. Item-scores were aggregated per variable. After that scores of several respondents were processed into a school score (= the average respondents' score of a school). Per variable a school score was computed per monitored moment (1988, 1990 or 1991). For instance variable C1.5 (see Figure 9) concerns the degree to which schools experienced problems when implementing ARS. This variable was measured by means of seven predetermined items. The sum of these items for one respondent comprises the score for the degree of problems the school experienced according to that respondent. The scores of all respondents of one school were processed into a school score (= average respondent score) for each monitored moment. A few scores could not be processed in this way; for more details on the way in which they were processed the reader is referred to Appendix X4 in Visscher and Bos (1991). The analyses were executed with school scores.

For more detailed information on how the research data were processed the reader is referred to Appendix X4 (how answers of respondents were rated) in Visscher and Bos (1991).

8.3.2 Data analysis

Since the research design is a pre-test post-test control group design data were especially analysed to determine differences in results between three monitored moments. How the research data were analysed, for each of the five research questions (see 7.2) is explained.

*To what degree is ARS used by the project schools?*
The degree to which ARS was used in 1989/1990 (T1) and in 1990/1991 (T2) was analyzed by computing frequencies, percentages, means, standard deviations and minimum and maximum scores. Differences conceming the degree of ARS use between T1 and T2 were tested by means of the Wilcoxon test for matched pairs.

*What factors stimulate a successful implementation of ARS?*
For T1 and T2 statistical relations were determined between a number of potentially influential implementation variables (block C) and innovation quality (block B) on the one hand and ARS use (block D) on the other. This was done by means of multiple regression analyses. The set of predictors in the first regression analyses comprised variable B and compound variables consisting of C variables. The compound variable 'registrational and analytical ARS use' (D1+D2) was the dependent variable in the first regression analysis. In a second regression analysis 'the number of anti-truancy policy measures taken on the basis of ARS-output' (D3) was used as dependent variable. Four compound C-variables and variable C2.8 (consultation frequency school staff) were used as potential predictors in the second regression analysis. The set of predictors in both regression analyses is described in detail in chapter 9.
Moreover, Kendall's Tau correlations were calculated between various variables from block B and C on the one hand and block D on the other, in order to test the hypotheses of section 7.3.3 in which relations were stated between each of the B- and C-block variables (influential implementation variables) on the one hand and block D variables (ARS use variables) on the other.
Cluster analysis was used to test hypotheses 7, 8 and 9 of section 7.3.3 in which a relation is stated between a number of school organization characteristics (the Marx

models) on the one hand and the use of ARS-data for developing an anti-truancy policy on the other. How this was done exactly is explained in chapter 9.

*To what extent did absenteeism rates change in the experimental schools and control schools between 1988 and 1991?*

Difference scores were computed for all absenteeism variables (variable E1-E4 in Figure 9). An example of such a difference score is the size of disallowed absenteeism in 1990 (T1, the first post-test) minus the size of disallowed absenteeism at T0 (1988, the pre-test). Scores of two monitored moments were compared three times (T1-T0, T2-T1 and T2-T0) in this way. By means of the Mann-Whitney test differences between ARS schools and control schools concerning these difference scores were tested.

*To what extent can possible changes in absence rates be attributed to ARS use?*

In chapter 9 it is explained why this research question was not answered. However, since in hypothesis 14 and 15 a relation is stated between ARS usage (block D) and developments in the degree of absenteeism (variable E1 and E2) correlations were computed between those variables.

*Did ARS use bring about some other effects than potential changes in absenteeism rates?*

Positive and negative effects of ARS use were analysed per monitored moment (T1 and T2) by computing means, standard deviations and ranges. Differences between the scores for two different monitored moments were analysed by means of the Wilcoxon test for matched pairs. Pearson Product-Moment correlations were determined between the degree of ARS usage (block D in Figure 9) and positive and negative effects of ARS use (variable E5-E19) to explore possible relations between them.

# CHAPTER 9 RESULTS

## 9.1 Introduction

The research questions (see section 7.2) have been answered in full detail in Visscher and Bos (1991). Since it is impossible to present all detailed results at length, only the most important ones are presented here. Readers interested in further details are referred to Visscher and Bos (1991). Each research question is subsequently answered in section 9.2 to 9.6. In the final section of this chapter (9.7) some conclusions are drawn on the basis of the findings and the research results are discussed.

Because participation in the ARS evaluation study was a prerequisite for becoming an ARS-project school, response percentages were high. Appendix 8 shows the response percentages for the interview instrument (varying between 70% - 100%), the questionnaire (77% - 100%) and the (allowed) absence lists (77% - 100%).

## 9.2 ARS use

The research framework figure (Figure 9 in section 7.3.2) shows that a distinction is made between three forms of ARS use: registrational use, analytical use and the degree to which anti-truancy policy is developed on the basis of ARS data. Each type of ARS use is now explained and the degree to which they appear in experimental schools is described on the basis of the research data collected in 1990 (these data concern ARS use in the academic year 1989-1990) and 1991 (ARS use in 1990-1991). The results of both measurements are compared with each other.

### 9.2.1 Registrational ARS use

The degree to which ARS is used for daily absence registration and handling was determined by:

a. the extent of basic ARS use (the entry of basic data which enables it to be used for absence registration);
b. the degree to which four required absence registration and handling activities were carried out;
c. the degree to which so-called absence control reports were used.

Re Basic ARS use

In 1990 and 1991 many basic data proved to be entered into ARS by almost all ARS schools: teacher codes, root class (for an explanation see Appendix 5) and school type grade codes, root class students etc. However, basic timetable data (like lesson group codes, root class lessons and the lesson table) had been entered the least which undoubtedly was associated with the fact that only very few schools (only two) used the so-called 'timetable linkage'*. In 1990 and 1991 structural timetable changes were entered into ARS by only about one third of the schools. So, entering timetable data, updating these data and using the timetable for absence registration and handling passed off far from perfect. On the basis of available data it is impossible to say whether this is due to the fact that ARS software is not flexible enough to enter a timetable into the database, or that schools do not need this form of assistance.

Re Four required activities

To be able to use ARS, absentees (observed during lessons or reported by parents) have to be entered. Moreover, staff responsible for absence handling have to discover reasons for absence that later have to be entered into the computer.

| | 1990 | | | 1991 | | |
|---|---|---|---|---|---|---|
| | <50% | 50-90% | >90% | <50% | 50-90% | >90% |
| - entered lesson absences | 3(10%) | 2(7%) | 25(83%) | 1(4%) | 0(0%) | 26(96%) |
| - entered absence messages from parents | 2(7%) | - (0%) | 28(93%) | 1(4%) | 2(7%) | 24(89%) |
| - % absence handlers receiving absence reports | 5(17%) | 1(3%) | 24(80%) | 4(15%) | 0(0%) | 23(85%) |
| - number of unknown reasons handled | 10(33%) | 16(53%) | 4(14%) | 7(26%) | 11(41%) | 9(33%) |
| - entered discovered reasons | 7(23%) | 3(10%) | 20(67%) | 3(11%) | 1(4%) | 23(85%) |

*Table 9: Degree to which a number of absence registration and handling activities were carried out (in number of schools; n=30 in 1991 and n=27 in 1991)*

* The timetable linkage can be used to: 1) find the subject and teacher in a case of absenteeism; 2) to check at which timetable hours lessons really were taught and as such to correct for lessons at which a student was registered absent but that had not been given.

Table 9 shows that absentees observed during lessons as well as absentees reported by parents/students in 1990 (83%, 93% of the schools respectively) and in 1991 (96% and 89% of the schools respectively) were entered into ARS in almost all schools for about ninety per cent.
In most schools (80% of the schools) in 1990 and in 1991 (85%) more than 90% of staff responsible for absence handling received one or more absence control reports (acr's). A closer analysis of the 17% of schools that in 1990 distributed absence control reports under less than 50% of school staff showed that one school in 1990 distributed the acr's under 25% of the absence handlers and four schools did not distribute them at all. In fact these schools did not use ARS for absence handling. In 1991 15% of the ARS schools did not distribute any absence control reports.
When absence handlers had received absence control reports, 14% of the schools in 1990 and 33% of them in 1991 proved to use acr's to discover almost all (> 90%), initially unknown reasons for absence. In 53% (1990) of the schools and 41% of the schools (1991) this was done for 50-90% of the initially unknown reasons for absence. One third of the schools in 1990 and 26% of them in 1991 tried to find out less than 50% of the reasons for absence. Further analysis showed that 23% of these schools in 1990 did not try to discover reasons for absence at all, and in fact did not use ARS. This finding means that in both years about one third of the schools did not use the absence control reports to track down why a student was absent, nor did those schools do anything to combat student absenteeism. The fact that part of the schools used ARS only to a small degree for registering and handling absenteeism must have affected the extent to which other forms of ARS were used in those schools. Registrational use is a condition for analytical ARS usage and anti-truancy policy-making, so schools that did not register absenteeism in an ARS-supported way could not use ARS data for analytical and policy-making purposes either. When reasons for absence had been determined in 1990, they were entered in 67% of the schools for 90% or more (in 1991 in 85%), 10% of the schools for 50-90% and 23% of the schools did not do this at all, or only to a limited degree. The 1991 data were more positive: one school (4%) entered these data for 50-90%, 11% of schools for less than 50% of the discovered reasons and all other schools did this (nearly) optimally.

Re Use of absence control reports

The acr's indicate which students have been absent during which lesson periods and if the reason for their absence is known or not. On the basis of the absence control reports absent students should be tracked down and the reason for absence written down on the acr, as well as if an absence was allowed or disallowed. Table 10 shows that 7 schools (23%) in 1990 did not use any absence control report, in 1991 this went for 7% (2 schools). So, in 1990 77% of the schools, and in 1991 93% of the schools, used one or more absence control report.

| | | number of absence control reports | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| number of | 1990 | 7 | 8 | 4 | 5 | 4 | 0 | 1 | 1 |
| schools | 1991 | | 2 | 3 | 10 | 4 | 3 | 2 | 21 |

*Table 10: The number of used absence control reports per school in 1990 (N=30) and 1991 (N=27)*

Most schools (40% in 1990, 48% in 1991) used 1 or 2 acr's, 30% (1990) and 26% (1991) used 3 or 4 acr's, whereas 7% of project schools in 1990 and 19% of them in 1991 used 5, 6 or 7 acr's.

In Tables 11 and 12 it can be seen that three types of acr proved to be used most often: the acr per tutor (47% of schools in 1990 and 67% of schools in 1991), the acr per class (57% and 63%) and the acr for one student (37% and 63% respectively). In both years quite a number of schools (30% and 37%) also had an acr for a small group of students. Further analysis learned that in 1991 two schools (7%) did not use an acr per tutor, or per school type grade, or an acr per class. In 1990 this was seven schools (23%). A few schools produced one of the other possible acr's too, but this was not done frequently. For most schools it probably was sufficient to use one of the most frequently used acr's (especially the one per class and the one per tutor) because they had organized their absence handling on the basis of classes or tutors.

As far as the frequency of acr-production concerns, research data showed that in 1990 an acr was made every one or two days, 15 times. In 1991 eight acr's were generated once in two school days, so this number had gone down between both years. In other words, in about only half of the schools in 1990 and roughly one third of the schools in 1991 could school staff track down absentees quickly (between 1 or 2 days). Part of the schools probably tracked down absent students less quickly, since they produced an acr only once a week (20 times in 1990 and 17 times in 1991).

| type of absence control report | no use | every day | once in 2 days | once a week | once a month or longer | total use |
|---|---|---|---|---|---|---|
| | | | 1990 | | | |
| - acr per tutor | 16(53%) | 4(13%) | 1(3%) | 7(23%) | 2(7%) | 14(47%) |
| - acr per class | 13(43%) | 8(30%) | 1(3%) | 8(27%) | - | 17(57%) |
| - acr per school type | 28(93%) | - | - | 1(3%) | 1(3%) | 2(7%) |
| - acr per grade | 26(87%) | 1(3%) | - | 1(3%) | 2(7%) | 4(13%) |
| - acr per school type grade | 27(90%) | - | - | 1(3%) | 2(7%) | 3(10%) |
| - acr of a few students | 21(70%) | - | - | 1(3%) | 8(27%) | 9(30%) |
| - acr of one student | 19(63%) | - | - | 1(3%) | 10(33%) | 11(37%) |
| total per acr-frequency | - | 13 | 2 | 20 | 25 | 60 |

*Table 11: Frequency of absence control report retrieval in 1990 (N=30) in number of schools and percentages*

| type of absence control report | no use | every day | once in 2 days | once in 3-5 days | once in 8-19 days | once a month or longer | total use |
|---|---|---|---|---|---|---|---|
| | | | | 1991 | | | |
| - acr per tutor | 9(33%) | 3(11%) | 0 | 4(15%) | 10 (37%) | 1(4%) | 18(67%) |
| - acr per class | 10(37%) | 3(11%) | 0 | 10(37%) | 1(4%) | 3(11%) | 17(63%) |
| - acr per school type | 25(93%) | 0 | 0 | 0 | 0 | 2(7%) | 2(7%) |
| - acr per grade | 20(74%) | 1(4%) | 0 | 2(7%) | 0 | 4(15%) | 7(26%) |
| - acr per school type grade | 22(81%) | 0 | 0 | 0 | 0 | 5(19%) | 5(19%) |
| - acr of a few students | 17(63%) | 0 | 0 | 0 | 0 | 10(37%) | 10(37%) |
| - acr of one student | 10(37%) | 0 | 1(4%) | 1(4%) | 0 | 15(56%) | 17(63%) |
| total per acr-frequency | - | 7 | 1 | 17 | 11 | 40 | 76 |

*Table 12: Frequency of absence control report retrieval in 1991 (N=27) in number of schools and percentages*

Closer data analysis revealed that 8 schools (27%) in 1990 and 7 schools (23%) in 1991 did not make any acr even once every per 1-5 days! The other types of acr's were generated with a low frequency, but it has to be stressed that some of these acr's were retrieved next to other, more frequently produced acr's.
The degree of registrational use as a whole increased between 1990 and 1991. Differences between both years were tested by means of the Wilcoxon test and proved to be significant ($p<.10$).

### 9.2.2 Analytical ARS use

Next to using ARS for registering absent students the system can also be used to generate absentee statistics: standard statistics from the ARS menu and specific self-defined SQL-reports (by means of the Standard Query Language data elements can be brought in relation to each other).
Although the number of project schools decreased between 1990 and 1991 (from 30 schools to 27 schools), the total number of acr's that was retrieved by project schools with a certain frequency (varying between every 1-5 days to every 9 or more weeks) increased from 53 to 68. Three types of statistics were used most in both years, statistics on the number of absentees in the whole school, absentee statistics per root class and the extent of absenteeism per student. In 1990 and 1991 each of those three statistics was produced in about ten project schools. In 1991 the absenteeism statistic per grade proved to be generated by 9 schools as well. The other statistics were produced with a frequency that varied between 0 and 5 times in both years. In 1990 none of the schools used the possibilities to generate SQL reports. This had changed a little in 1991, six schools (22%) produced one or more SQL reports (with a total of 10 reports for all schools). Producing SQL reports is not easy, which maybe explains the limited number of generated SQL reports. Although users had received some training in using SQL, this query language may not be user friendly enough to enable many schools to benefit from this.
Most statistics were produced with a frequency of once every 9 weeks, or less frequently, which is not strange since the nature of statistical analyses implies that they are carried out on data that cover considerable long periods.
Surprisingly many ARS schools (40% in 1990 and 33% in 1991) proved to generate no statistic at all which means that the development of an anti-truancy policy based on ARS data was impossible in these schools. Schools that did produce statistics (60% of the schools in 1990 and 67% in 1991) generated a number of statistics that in 1990 varied between one and seven, whereas the range in 1991 was one to eleven.

However, Table 13 shows that most schools retrieved two or three statistics. Only 1 or 2 schools retrieved a number of ARS statistics higher than 2 or 3.
The Wilcoxon test concerning the degree of difference of analytical ARS use between 1990 and 1991 did not point to a significant difference between both years.

| | | number of statistics | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| number of | 1990 | 12 | 2 | 9 | 2 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 |
| schools | 1991 | 9 | 1 | 6 | 6 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |

*Table 13: Number of statistics used per school in 1990 (N=30) and 1991 (N=27)*

9.2.3 Developing anti-truancy policy-measures

To what degree ARS schools developed policy-measures to reduce the extent of absenteeism on the basis of data retrieved from ARS was also studied. As examples of ARS-based anti-truancy policy-measures taken by project schools, one can think of a school making a timetable that does not stimulate absenteeism, reserving more staff time for registering and handling absentees, intensifying student counselling etc. A comparison of the data concerning the academic year 1989-1990 with the 1990-1991 data showed that despite a decrease (from 29 to 27) in the number of project schools, the number of developed policy-measures increased (see Table 14) from 25 to 30.

| | number of policy-measures | | | | | total of policy |
|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 9 | measures |
| number of schools 1989-1990 | 13 | 9 | 5 | 2 | 0 | 25 |
| number of schools 1990-1991 | 11 | 9 | 6 | 0 | 1 | 30 |

*Table 14: Number of anti-truancy policy-measures, developed on the basis of ARS data in the academic years 1989-1990 (N=29) and 1990-1991 (N=27)*

In both years 16 schools (55% and 59% respectively) developed one or more policy-measures, so 45% of the schools in 1989-1990 and 41% in 1990-1991 did not develop any policy measure at all. In both school years taken anti-truancy policy-measures concerned two of four of the Marx policy areas, namely the resources (most policy-measures) and the general pedagogic-didactic area of policy-making (see Table 15).

| policy area | number of policy-measures | | | | | total number of policy-measures |
|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 6 | |
| resources 1990 | 16 | 10 | 3 | 0 | 0 | 16 |
| general pedagogic-didactic 1990 | 21 | 7 | 1 | 0 | 0 | 9 |
| resources 1991 | 15 | 8 | 3 | 1 | 0 | 17 |
| general pedagogic-didactic 1991 | 20 | 5 | 1 | 0 | 1 | 13 |

*Table 15: Number of schools that took ARS-based anti-truancy policy-measures in 1990 (N=29) and 1991 (N=27) in two areas of policy-making*

Especially resources policy-measures like adapting the procedure for absence registration and handling and developing other student punishment actions occurred rather frequently. In the general pedagogic-didactic field of policy-making measures were taken (four in 1990 and six in 1991) to improve student care in general and care for problem students in particular. In the other areas of policy-making (subject content and educational profile), almost two years after the introduction of ARS, no policy measure had been developed. Neither the test of the differences between 1989-1990 and 1990-1991 concerning the number of resources-oriented policy-measures, nor concerning the number of general pedagogic-didactic policy-measures showed a significant difference between both school years. If policy-measures were taken this was mainly done at school management level (see Table 16). At other school levels almost no activity existed in developing ARS-based anti-truancy policy-measures. However, it may be that plans were developed at various levels within the school organization that were presented to school management, who finally took certain measures (or not).

| | number of anti-truancy policy-measures per area of policy-making | | | | | |
|---|---|---|---|---|---|---|
| | resources | | general pedagogic-didactic | | total per organization level | |
| organization level | 1990 | 1991 | 1990 | 1991 | 1990 | 1991 |
| - school office/ caretaker | 2 | 4 | 0 | 0 | 2 | 4 |
| - school management | 12 | 11 | 7 | 9 | 19 | 20 |
| - school board | 0 | 0 | 0 | 0 | 0 | 0 |
| - project group consultations | 0 | 0 | 2 | 0 | 2 | 0 |
| - truancy consultations | 1 | 1 | 0 | 3 | 1 | 4 |
| - representative advisory body/general teacher consultations/parents' council | 0 | 1 | 0 | 1 | 0 | 2 |
| - student counselling consultations | 1 | 0 | 0 | 0 | 1 | 0 |

*Table 16: Number of ARS-based anti-truancy policy-measures in the resources and general pedagogic-didactic policy-making area at various school organization levels in 1990 (N=29) and 1991 (N=27)*

### 9.3 Factors that stimulate ARS implementation

#### 9.3.1 Regression-analyses

In order to determine to what extent the quality of ARS (Block B in Figure 9 in section 7.3.2), characteristics of the implementation process (C1-variables in Figure 9) and of participating schools (C2-variables) influenced the degree to which ARS was used (this concerns the second research question), two stepwise regression analyses were carried out. Since the relation between the number of variables and the number of cases was unfavourable, the number of independent variables was reduced. This was done by combining variables into compound variables on the basis of the content of variables, which resulted in four compound variables. A compound variable score consists of the sum of the z-scores for each of the variables a compound variable consists of. The number of variables each compound variable consists of differed, therefore the variance of one compound variable was bigger than the variance of another. As a result the compound variables were not comparable initially and therefore had to be standardized (z-scores). The four compound variables comprise the following variables:

- compound variable 1, the degree to which school staff was motivated and encouraged to use ARS (variables C1.1, C1.2, C1.3, C2.1 and C2.2 in Figure 9);
- compound variable 2, the degree of support (satisfaction), (variables C1.4, C1.6, C1.11);
- compound variable 3, the degree to which hardware and software problems with ARS occurred (variables C1.5, C1.12, C1.14);
- compound variable 4, the degree to which a school met positive conditions for ARS use before it was implemented (variables C2.3, C2.4, C2.5 and C2.9).

The four compound variables were used as possible predictors in two regression analyses for 1990 and 1991. The dependent variable in the first regression analysis was the total score for registrational and analytical ARS use. In this regression analysis five predictors were involved: the four compound variables mentioned above and variable B (innovation quality). In Figure 10 this regression-model is shown.

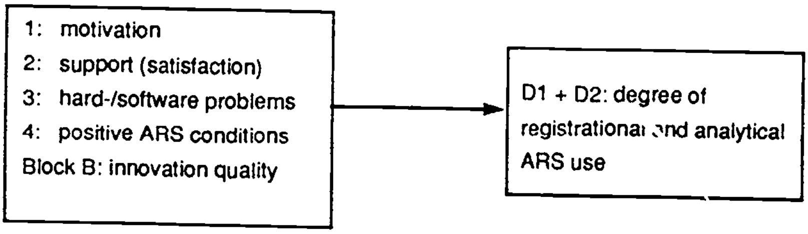



*Figure 10: Regression model of the degree of registrational and analytical ARS use on implementation influencing factors*

The four compound variables were also involved as predictors in the second regression analysis in which the dependent variable was the degree of anti-truancy policy-making on the basis of ARS output (D3 in Figure 9 in 7.3.2). Figure 11 shows the second regression model.

'Innovation quality', the fifth predictor in the first regression analysis was replaced by the variable 'school staff meeting frequency' (C2.8). This was because it was expected that school staff meeting frequency would correlate stronger with the extent to which

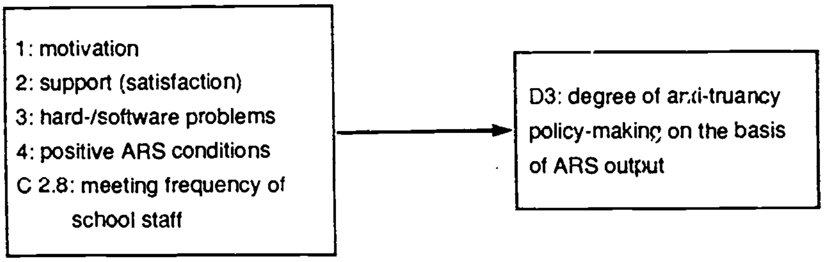



*Figure 11: Regression model of the degree of anti-truancy policy-making, on the basis of ARS-output on implementation influencing factors*

ARS is used for developing an anti-truancy policy than 'innovation quality' (the latter variable was expected to correlate stronger with registrational and analytical ARS use). Table 17 contains the results of the regression analyses for 1990 and 1991.

| Implementation influencing factors | registrational and analytical ARS use | | | | anti-truancy policy based on ARS | | | |
|---|---|---|---|---|---|---|---|---|
| | 1990 | | 1991 | | 1990 | | 1991 | |
| | ß | s.e. | ß | s.e. | ß | s.e. | ß | s.e. |
| Motivation | .66 | (.15) | | | | | | |
| Support (satisfaction) | | | | | | | | |
| Hard-/software problems | | | | | | | | |
| Positive ARS conditions | .42 | (.15) | | | | | | |
| Innovation quality | | | | | | | | |
| Meeting frequency school staff | | | | | | | | |
| Explained variance | 48% | | · | | · | | · | |

*Table 17: Regression analyses of ARS use on implementation influencing variables for 1990 (N=29) and 1991 (N=26); ß-values, standard errors (s.e.) and explained variance (p<.05)*

For the 1990 data two strong predictors for the degree of registrational and analytical ARS use were found (p<.05): the degree to which school staff was motivated to use ARS and the extent to which a school met positive conditions for ARS use before it was implemented. Those two predictors account for 48% of the variance in the sum of the degree of registrational and analytical ARS use. 'Motivation' accounts for 31% of the variance and 'positive ARS-conditions' adds 17% to the explained variance. The accompanying ß-values are high, respectively .66 for 'motivation' and .42 for 'positive ARS-conditions'. Thus, during the first stage of the implementation process (in 1990 project schools had used ARS for about eight months) the degree to which schools were motivated to use ARS and the extent to which they were encouraged to do so proved to be important. The fact that the compound variable 'positive conditions for ARS use' in 1990 proved to be a second predictor implies that schools in that year also differed conceming the degree to which:

- school staff thought that schools could combat truancy (C2.5);
- schools already combated absenteeism before ARS was introduced (C2.4);
- they registered and handled absenteeism in a way similar to the ARS procedure (C2.3);
- students were counselled (C2.9).

The results of the 1990-analysis imply that the three other compound variables did not explain any variance in ARS use, which is remarkable since it means that neither the quality of ARS, nor the support(satisfaction) of schools, nor the degree to which schools had to cope with hardware and software problems proved to make any difference on the extent of registrational and analytical ARS use. However, from this finding it must not be concluded that these variables are of no importance for implementing ARS successfully. In a number of cases relations could probably not be found due to there being little variation between schools in the scores on these compound variables, because some variables hardly varied between schools (like the degree of support satisfaction and the perception of the innovation quality). Conceming the reliability of instruments as a possible cause for not finding more predictors the following can be stated. Most variables were measured by means of one question which means that reliability of those items could not be computed. In a number of other cases more than one item was used to measure a variable. Appendix 7 shows the reliability of these scale-variables. In four cases (variable B, C1.11, C2.1, C2.3 in Figure 9, section 7.3.3) the reliability of the scales was satisfying (varying between .70 and .94). In the case of C2.5 (including 2 variables) the reliability was lower. These two variables had a low reliability: .40 (1991) and .39 (1988), and .52 (1991) and .56 (1988) respectively. Except for these latter variables there is no reason to assume that the reliability of instruments were the cause that variables did not prove to be predictors for ARS use.

The regression analysis with the dependent variable 'degree of anti-truancy policy' did not produce any significant ($p<.05$) results for the 1990 data which is probably linked to the fact that ARS schools hardly developed anti-truancy policy-measures (13 of 29 schools did not develop any policy measure and almost all schools developed only 1 or 2 policy-measures). Thus, there was little variance in the scores on the dependent variable.

The stepwise regression analysis for the 1991 data (the schools had used ARS for about 20 months then) did not yield any significant ($p<.05$) results. None of the five predictors could be regarded as promoting registrational and analytical ARS use, nor policy-making on the basis of ARS data. Two factors that predicted registrational and analytical ARS use to a high degree in 1990 did not predict the sum of registrational and analytical ARS use in 1991 anymore. As mentioned above, the two predictors in the 1990 data may be especially important during the first phase of the innovation process. Another possible explanation may be that there is more variance between schools concerning the sum of registrational and analytical ARS use in 1990 than in 1991. In 1990 the standard deviation was 357 (mean = 1177, maximum score = 1545), in 1991 it was 270 (mean = 1246, maximum score = 1570).

The 1991 results concerning ARS use for the development of anti-truancy policy-measures are in keeping with the results of the same analysis for the 1990 data. No predictor for 'policy-making ARS use' could be found, which is possibly due to the fact that variance in the score for anti-truancy policy development on the basis of ARS-data in 1991 was very limited (11 of 27 schools took no, nine schools one, six schools two and one school developed 9 policy-measures). Variance between schools on this variable was therefore probably not large enough to find a predictor.

### 9.3.2 Relations between B- and C-variables on the one hand and D-variables on the other

#### 9.3.2.1 Hypotheses 1-4 and 10-12

Hypotheses 1 to 4, as well as hypotheses 10 to 12 (see section 7.3.3) concern assumed relations between variables from the B-, C1- and C2-block on the one hand and ARS usage on the other. These hypotheses assume that if schools have a higher score on a variable that is considered to influence ARS implementation (B-. C1- or C2-block variables), it will be used more intensely in those schools. The hypotheses were tested by means of the described regression analysis which showed that two compound variables promoted registrational and analytical ARS use in 1990:

- the degree to which school staff were motivated and encouraged to use ARS (variables C1.1, C1.2; C1.3, C2.1 and C2.2);

- the extent to which schools met positive conditions for ARS use before it was implemented (variables C2.3, C2.4, C2.5 and C2.9).

Therefore hypotheses 2, 10 and 12 were confirmed for the variables C1.1-C1.3, C2.1-C2.5 and C2.9 for the 1990 data, but the findings did neither confirm hypotheses 1, 2 as far as variable C1.4, C1.10-C1.12 and C1.14 are concerned, nor hypothesis 3, 4, and 11.

#### 9.3.2.2 Hypotheses 5-9 and 13 concerning the relation between C2-variables and anti-truancy policy development

*Hypothesis 5, 6 and 13*

The hypotheses 5 to 9 and 13 (see 7.3.3) concern relations between variables from the C2 block on the one hand and anti-truancy policy development on the other. Hypothesis 5 states that the more a school consults the more it will develop anti-truancy policy-measures. However, data analysis did not confirm this assumption. The Pearson Product Moment correlation between the average school consultation frequency and the degree to which schools develop anti-truancy policy-measures is very low and not significant (-.10 and .03 in 1990 and 1991 respectively) which again is possibly connected with limited variance in the dependent variable 'degree of anti-truancy policy-making'. Hypothesis 6 assumes a similar relation between the extent of consultation at various school levels and the degree to which anti-truancy policy-measures are taken at those levels. This hypothesis was only tested for the school management level because no, or almost no, policy-measures had been developed at other school levels. Again low (-.15 and .03) and not significant PM-correlations were found, probably again as a result of little variance in the dependent variable.

Hypothesis 13 states that it is expected that more teacher-oriented anti-truancy policy-measures are taken in schools if individual teachers are counselled more in those schools. The degree to which schools counselled teachers varied but regardless of the extent to which teachers were coached, schools did not develop anti-truancy policy-measures concerning teachers. Therefore hypothesis 13 was rejected.

*Hypothesis 7-9, relations between school organization characteristics and ARS-based anti-truancy policy-making*

In the theoretical framework a relation was assumed between school organization features and the degree to which ARS is used for developing anti-truancy policy. Hypotheses 7, 8 and 9 (see section 7.3.3) express this assumption. First it is described how the research data were used to test those hypotheses, subsequently the results of the analysis are presented.

The strategy used

School organization variables that are distinguished within Marx's theory were chosen to determine the degree to which a school is segmental, line-staff or fraternal. This led to a selection of 17 variables:

- the consultation frequency at school management level, in upper and lower school divisions, departments, and the sum of the consultation frequency in upper and lower school divisions;
- the degree of influence of school board, school management, school divisions and departments in the resources area of policy-making;
- the degree of influence of school management, school divisions and departments in the general pedagogic-didactic field;
- the degree of influence of departments and teachers in the subject content area;
- the degree of student counselling;
- the degree of teacher counselling.

Subsequently clusters of schools were constructed by means of cluster analysis (Everitt, 1974) which resulted in three clusters. Cluster analysis (Ward's method, using the squared euclidean distance measure) was executed after the raw scores for the aforementioned variables had been transformed into z-scores (with mean 0 and variance 1) to give each variable the same weight in the cluster analysis. To interpret the clusters, only mean cluster scores on variables were used that differ significantly from 0 ($p<.05$). For this purpose it was investigated if the mean cluster score lies outside the interval around 0 (the interval $[-1.64/\sqrt{n};+1.64/\sqrt{n}]$, with n being the number of schools in a cluster.

Contrast analysis

To determine on which variables the clusters differ significantly from each other ($p<.05$), the three clusters were compared by means of contrast analysis on the basis of the mean scores on the 17 variables mentioned. After this the variables characteristic for a cluster were known and could be used to characterize the clusters. It is now indicated which variables this concerns and how the mean score of a cluster on a variable lies to scores on the same variable in other clusters.

cluster 1 (9 schools):

1. The influence of departments in the resources policy area: the highest mean score in this cluster compared to other clusters.
2. The consultation frequency within the lower school division: the mean score on this variable is much higher in this cluster than in other clusters.
3. The sum of consultation frequencies within the lower and upper school divisions: the mean score on this variable is much higher in this cluster than in other clusters.

cluster 2 (17 schools):

1. The consultation frequency within the lower school division: in comparison with the other two clusters a very low mean score within this cluster.
2. The consultation frequency within the upper school divsion: in comparison with the scores on this variable in the other two clusters a very low mean score within this cluster.
3. The sum of consultation frequencies within the lower and upper school division: a very low mean score in comparison with the other two clusters.

cluster 3 (4 schools):

1. The influence of school management in the resources area of policy-making: the lowest mean score of the three clusters within this cluster.
2. The influence of departments in the resources area of policy-making: the mean score within this cluster is much lower than in the other two clusters.
3. The consultation frequency at school management level: the mean score on this variable in this cluster is much higher than within the other two clusters.
4. The percentage of lesson periods used for student counselling: in comparison with the other two clusters this cluster has the highest mean score for this variable.

To test hypotheses 7, 8 and 9 it was determined to which degree each cluster possessed the characteristics of each of the Marx ideal types (segmental, line-staff, fraternal). In their pure form the Marx models were not found in the three clusters, but some differences existed between the clusters as a result of which one cluster possessed more features of a certain Marx model than the other clusters. Cluster 1 has features of the fraternal model within this cluster. Much consultation takes place. If compared to the other clusters within this cluster, most consultation takes place within the lower and upper school divisions. Moreover, influence of departments in the field of resources is strong, which is especially characteristic for fraternal schools. A feature of the second cluster is that the frequency of consultation within the lower and upper school divisions is very low. As a result of that, this cluster has some, although not very strong, segmental characteristics. It is difficult to interpret and label the third cluster. A high consultation frequency at school management level points to the segmental school model. However, little influence from school management in the resources area is in strong contrast with that feature. The fact that departments have little influence in the resources field points to characteristics of segmental or line staff schools. The fact that many resources are used for student counselling points more in the direction of a line staff, or fratemal school. All these features mean that the third cluster cannot be labelled unequivocally on the basis of Marx's theory. For that reason this cluster was excluded from the cluster analyses.

In hypothesis 7, 8 and 9 a relation is assumed between the three Marx models and:

- the extent of anti-truancy policy-making;
- the policy area in which anti-truancy policy-measures are developed.

Analysis of variance was used to investigate whether cluster 1 and 2 differ conceming the extent of anti-truancy policy-making on the basis of ARS, and also with regard to the areas policy-measures are taken in. Since schools had only developed resources and general pedagogic-didactic measures, differences between both clusters could not be studied regarding the other two fields of policy-making (subject matter and educational profile). Detailed results of the analysis of variance can be found in Visscher & Bos (1991). Here it must be confined to the finding that both clusters of schools neither differ significantly conceming the extent of anti-truancy policy-making, nor with regard to the magnitude of policy development in the resources and the general pedagogic-didactic field. So, more fraternal schools, contrary to hypotheses 7 and 9, did not prove to be more active in ARS-based anti-truancy policy-making. The question why hypotheses 7 and 9 (hypothesis 8 could not be tested because the research data did not point to a line-staff cluster) were rejected will be addressed in section 9.7.2.

### 9.4 Changes to absenteeism rates

To answer the third research question, four absence rates were studied: the percentage of disallowed absence of a school, the percentage of allowed absence of a school, the percentage of truants that play truant 1-2, 3-5, or 6-8 lessons on one school day and finally the percentage of students of a school truanting one or more lessons on a school day. The absence rates were measured in 1988 (the pre-test), 1990 and 1991 (post-tests) in experimental and control schools. For each absence rate the differences between control group and experimental group conceming the difference scores (for instance the percentage of disallowed absence in 1991 minus the percentage of disallowed absence in 1988) were determined.

*Disallowed absence*

The disallowed absence difference score 1990-1988 expresses how the disallowed absence rate developed between these two years. Table 18 shows the results of the Mann-Whitney test of the difference scores of the experimental and the control group.

| difference scores | control group (N=17) M | experimental group (N=22) M | U | one-tailed significance of U | Prob. |
|---|---|---|---|---|---|
| T1 - T0 (1990-1988) | 18.4 | 21.3 | 159 | .78 | .57 |
| T2 - T1 (1991-1990) | 20.5 | 19.6 | 179 | .42 | .48 |
| T2 - T0 (1991-1988) | 20.4 | 19.7 | 180 | .43 | .48 |

*Table 18: Results of Mann-Whitney test of disallowed absence rate difference scores T1 - T0, T2 - T1 and T2 - T0; mean rank (= M), Mann-Whitney statistic (= U) and probability that observations from the experimental group exceed observations from the control group (= Prob.)*

In Table 18 it is shown that when the T1-T0 difference scores of the control group and experimental group are compared by means of the Mann-Whitney test, the mean rank of the experimental group is higher (21.3) than the mean rank of the control group (18.4). For the T2-T1 and T2-T0 difference scores it is the other way around, the mean rank of the control group is then higher. The probability that a randomly chosen disallowed absence difference score T1-T0 from the experimental group exceeds a randomly chosen disallowed absence difference score T1-T0 from the control group is .57. For the T2-T1 and T2-T0 difference scores this probability is .48 which means that the probability is greater (.52) that a randomly chosen difference score from the control group is higher than a random score from the experimental group, than the probability that a randomly chosen difference score from the experimental group is higher than a score from the control group (.48). The disallowed absence difference scores do not differ significantly ($p<.05$) between both research groups. In other words, if both groups are compared, neither in the period 1988-1990, nor in the periods 1990-1991 and 1988-1991 did there prove to be a significant difference between these research groups in how the degree of disallowed absence developed. So, despite using ARS, experimental schools, when compared with control schools, could not reduce disallowed absence systematically between 1988 and 1991.

*Allowed absence*

Table 19 depicts the results of the Mann-Whitney test of the allowed absence difference scores. The probability that a randomly chosen allowed absence difference score from the experimental group exceeds a randomly chosen allowed absence difference score from the control group is .49 (T1-T0), .58 (T2-T1) and .60 (T2-T0) respectively. Comparison of the allowed absence difference scores of the experimental and of the control group shows that experimental schools and control schools did not differ significantly ($p<.05$) concerning the development of allowed absence rates between 1988 and 1991. So, in comparing project schools with non-project schools, the use of ARS did not account for a higher reduction in allowed absence.

| difference scores | control group (N=17) M | experimental group (N=22) M | U | one-tailed significance of U | Prob. |
|---|---|---|---|---|---|
| T1 - T0 (1990-1988) | 20.3 | 19.8 | 182 | .45 | .49 |
| T2 - T1 (1991-1990) | 18.2 | 21.4 | 156 | .80 | .58 |
| T2 - T0 (1991-1988) | 17.8 | 21.7 | 149 | .85 | .60 |

*Table 19: Results of Mann-Whitney test of allowed absence rate difference scores T1-T0, T2-T1 and T2-T0; mean rank (= M), Mann-Whitney statistic (= U) and probability that observations from the experimental group exceed observations from the control group (= Prob.)*

*Percentage of students that play truant 1-2, 3-5 or 6-8 lessons*

A third absence rate that was determined to analyse trends in absenteeism as a result of introducing ARS concerns the average percentage of students of a school who on a specific day play truant during 1-2, 3-5 or 6-8 lessons. The results of the Mann-Whitney test of the difference scores concerning this measure are presented in Table 20. The probability that a randomly chosen observation from the experimental group exceeds a randomly chosen observation from the control group is more often (for five of nine difference scores) smaller than the probability that a random difference score from the control group exceeds a random experimental group difference score. None of the difference scores shows a significant ($p<.05$) decrease or increase in this absence rate. So, if ARS schools and control schools are compared, the former did not succeed in reducing significantly the number of students that did not attend 1-2, 3-5, or 6-8 lessons between 1988 and 1991.

| difference scores | control group (N=17) M | experimental group (N=22) M | U | one-tailed significance of U | Prob. |
|---|---|---|---|---|---|
| 1-2 lessons 1990-1988 | 17.3 | 21.3 | 141.5 | .86 | .60 |
| 1-2 lessons 1991-1990 | 21.9 | 16.5 | 120.0 | .07 | .35 |
| 1-2 lessons 1991-1988 | 17.8 | 20.9 | 149.0 | .80 | .58 |
| 3-5 lessons 1990-1988 | 20.8 | 18.4 | 156.0 | .26 | .44 |
| 3-5 lessons 1991-1990 | 16.9 | 20.8 | 135.0 | .85 | .60 |
| 3-5 lessons 1991-1988 | 19.6 | 19.4 | 176.5 | .48 | .49 |
| 6-8 lessons 1990-1988 | 21.4 | 18.0 | 147.0 | .18 | .41 |
| 6-8 lessons 1991-1990 | 15.8 | 21.7 | 115.0 | .95 | .66 |
| 6-8 lessons 1991-1988 | 19.8 | 19.3 | 174.0 | .45 | .47 |

*Table 20: Results of Mann-Whitney test of the difference scores T1-T0, T2-T1 and T2-T0 for the percentage of truants truanting 1-2, 3-5, or 6-8 lessons; mean rank (= M), Mann-Whitney statistic (= U) and the probability that observations from the experimental group exceed observations from the control group (= Prob.)*

*Truancy ratio*

The last computed absenteeism rate is the percentage of students of a school that truants one or more lessons on a specific school day. The analysis of the truancy ratio difference scores (see Table 21) did not reveal any significant ($p<.05$) differences between experimental and control schools. So, the differences in the decrease (or increase) of the truancy ratio between the experimental and the control group are not systematic, but must be interpreted as random fluctuations.

From the results conceming the four absence rates it must be concluded that no significant difference was found between both research groups conceming the reduction of, or increase in, one of these absence rates between 1988 and 1991. In section 9.7.3 the question is addressed why ARS use did not produce a systematic reduction of the extent of absenteeism in experimental schools.

| difference scores | control group (N=17) M | experimental group (N=22) M | U | one-tailed significance of U | Prob. |
|---|---|---|---|---|---|
| T1 - T0 (1990-1988) | 17.7 | 20.8 | 146.5 | .81 | .58 |
| T2 - T1 (1991-1990) | 21.5 | 15.8 | 111.0 | .06 | .34 |
| T2 - T0 (1991-1988) | 18.1 | 18.0 | 151.0 | .49 | .50 |

*Table 21: Results of Mann-Whitney test of the truancy ratio difference scores T1-T0, T2-T1 and T2-T0; mean rank (= M), Mann-Whitney statistic (= U) and probability that observations from the experimental group exceed observations from the control group (= Prob.)*

*An additional exploration*

Because of the aforementioned results research data were also studied in another way. On the basis of changes in disallowed absence rates project schools were divided into four subgroups:

1. schools in which disallowed absenteeism increased between 1988-1990 and between 1990-1991 (n=3);
2. schools in which disallowed absenteeism decreased between 1988-1990 and between 1990-1991 (n=3);

3. schools in which disallowed absenteeism increased between 1988-1990, but decreased between 1990-1991 (n=8);
4. schools in which disallowed absenteeism decreased between 1988-1990, but increased between 1990-1991 (n=8).

The four groups were compared to explore whether they contrasted with each other regarding their scores on context variables (variable F1-F5 in Figure 9), ARS use (registrational (D1), analytical use (D2) and the number of anti-truancy policy-measures based on ARS (D3)). If this would be the case these differences might be connected with differences between the four groups concerning the changes realized in disallowed absenteeism rates between 1988 and 1991. Since the number of schools in each group is small, one has to be careful when interpreting the results of a comparison of both groups. The exploration was executed to generate some ideas that may be tested in future studies. Unfortunately no unequivocal differences between the four groups were found that may be connected with differences in the way disallowed absenteeism developed in each group.

## 9.5 Relation between ARS use, context variables, non-ARS policy-measures and the change in absenteeism rates

Since it was shown in the previous section that no significant changes occurred in the size of absenteeism there was no use in answering the fourth research question (to what extent changes in absence rates must be attributed to ARS use). However, in section 7.3.3 hypotheses 14 and 15 are formulated concerning the relation between ARS use and reducing the size of absenteeism. In both hypotheses it is stated that a more intensive use of ARS produces a stronger reduction of absenteeism rates. Although in general no systematic reduction of absence rates was found, it was investigated whether a more intense ARS usage led to a stronger reduction of absenteeism rates. To test hypotheses 14 and 15 correlations were computed between three forms of ARS use (registrational, analytical and anti-truancy policy-making) and a number of absence difference scores that express the degree to which absenteeism changed between 1988 and 1991 (see Table 22).

Thirty correlations were computed and tested on a .05 significance level. Two correlations proved to be significant which approximately may also be expected by chance ($\alpha$ = .05 = 5 of 100 = 1,5 of 30). So the results should be interpreted very cautiously. Only the degree to which in the school year 1990-1991 anti-truancy policy-measures were taken in the whole school on the basis of ARS data correlated significantly (positively) with the extent to which the size of disallowed absence changed between 1990 and 1991 (r=.50). So, in that period more anti-truancy policy development went together with a stronger increase in the degree of disallowed absence. These relations are curious since schools only proved to be able to develop anti-truancy policy-measures to a limited degree (see section 9.2). Moreover, it is strange that more policy development is connected with an increase in the size of absenteeism. The other two (registrational and analytical) forms of ARS use neither in 1990 nor in 1991 correlated significantly with absence difference scores. So, hypotheses 14 and 15 were not confirmed by the research data. A more intense registrational and analytical use of ARS, and more intensive anti-truancy policy-making did not go together with a stronger reduction in absenteeism.

Other aspects of ARS use that were planned to be studied in connection with the development of absenteeism rates concem the *scope* (oriented towards one student, a group of students or all students) of anti-truancy policy-measures and the *Marx areas of policy-making* in which policy-measures were developed. The goal was to investigate whether the area in which anti-truancy policy-measures were developed and their scope made any difference to how absenteeism rates changed. However, since all anti-truancy policy-measures taken proved to have a general scope (no group or individual student oriented policy-measures were taken) the relation between the scope of policy-measures and the degree of change in absence rates could not be studied. Table 22 shows that the number of resources policy-measures taken in 1990 correlates significantly with the disallowed absence difference score 1991-1990: as more resources policy-measures were developed in that academic year, disallowed absence increased more in the period 1990-1991. However, this relation cannot be defended: more policy-measures produce more, instead of less absenteeism. General pedagogic-didactic policy-measures developed in 1990 and in 1991, did not correlate significantly with one of the absence difference scores. Anti-truancy policy-measures aimed at subject contents and educational profile had not been taken by schools. Therefore no correlations between these and absence difference scores could be computed.

| | disallowed absence difference score 1990-1988 | allowed absence difference score 1990-1988 | disallowed absence difference score 1991-1990 | allowed absence difference score 1991-1990 | disallowed absence difference score 1991-1988 | allowed absence difference score 1991-1988 |
|---|---|---|---|---|---|---|
| - registrational ARS use 1990 | -.05 | .01 | | | | |
| - registrational ARS use 1991 | | | .25 | -.32 | .13 | .00 |
| - analytical ARS use 1990 | -.06 | -.29 | | | | |
| - analytical ARS use 1991 | | | .04 | .09 | -.14 | -.25 |
| - anti-truancy policy development in the whole school, based on ARS 1990 | .28 | -.23 | | | | |
| - anti-truancy policy development in the whole school, based on ARS 1991 | | | .50* | .22 | .11 | -.04 |
| - resources policy-measures 1990 | .20 | -.11 | | | | |
| - resources policy-measures 1991 | | | .49* | .12 | .12 | -.19 |
| - general pedagogic-didactic policy measures 1990 | .05 | -.27 | | | | |
| - general pedagogic-didactic policy measures 1991 | | | .11 | -.12 | -.02 | -.07 |

* = significant (p<.05)

Please note: In the first column is indicated whether a variable was measured in 1990 or 1991.

*Table 22: Pearson Product Moment Correlations between three forms of ARS usage, policy-measures in two areas and absence difference scores (N=22)*

- *Context variables, non-ARS-based policy-measures and the change in absenteeism rates*

The results of analysing correlations between context variables (F block variables in Figure 9, section 7.3.2), non-ARS-based policy-measures (variable block G) and changes in absence rates (variables E1-E4) are included in Table 23. Seventeen correlations proved to be significant. Since 102 correlations were computed and tested on a .05 significance level, on the basis of chance one could expect about five ($\alpha$ = .05 = 5 of 100) significant correlations. Although the number of significant correlations proved to be considerably higher than what could be expected on the basis of chance, one must be cautious when interpreting the significant correlations, since the danger of chance capitalization exists when so many correlations are computed. This is especially because in most cases correlations between a context variable, or non-ARS-based policy-measures on the one hand and absence difference scores on the other were computed three times (because the absence difference scores had been computed in three different years). In a number of cases a correlation between a context variable or the non-ARS policy measure variable and an absence difference score was significant for one absence difference score, whereas the same variable did not correlate significantly with the same absence difference score for other years. If a variable correlates significantly with absence difference scores for various periods the relation is much more convincing.

Table 23 shows four of the seven times the variable school size was computed it correlated significantly with allowed absenteeism difference scores. The bigger schools were, the more the degree of allowed absenteeism could be reduced (-.37, -.43, -.46, -.56). No significant correlations were found between changes in the extent of disallowed absenteeism and school size.

Moreover, the extent of allowed absence could be reduced more as the percentage of students of a school from ethnic minorities (in general and more specific Turkish or Moroccan) was bigger in five of the twenty times these correlations were computed (-.42, -.45, -.54, -.48, -.56). The significant correlations give the impression that a student population consisting of large numbers of ethnic minorities, including Turkish and Moroccan goes together with a stronger reduction in allowed absence. Nevertheless, despite project schools having many students from ethnic minorities, it was shown in section 9.4 that the extent of allowed absenteeism in general could not be reduced systematically. The degree of disallowed absenteeism was also reduced more when schools had more students with a lower socioeconomic status (ses) in one of the six times that this variable was computed (-.37). Ethnic minorities probably have a lower socioeconomic status, therefore this correlation is not surprising. The same

| | disallowed absence difference score 1990-1988 | allowed absence difference score 1990-1988 | disallowed absence difference score 1991-1990 | allowed absence difference score 1991-1990 | disallowed absence difference score 1991-1988 | allowed absence difference score 1991-1988 |
|---|---|---|---|---|---|---|
| - school size 1988 | -.12 | -.37** | | | .09 | -.35 |
| - school size 1990 | .00 | -.43** | -.07 | -.05 | -.09 | -.46** |
| - school size 1991 | | | -.15 | -.18 | -.10 | -.56** |
| - percentage Turkish/Moroccan students 1988 | -.13 | -.10 | -.05 | -.23 | -.19 | -.30 |
| - percentage Turkish/Moroccan students 1991 | | | -.17 | -.42** | .02 | -.45** |
| - percentage students with foreign nationality 1988 | -.10 | -.33 | .11 | -.25 | .05 | -.54** |
| - percentage students with foreign nationality 1991 | | | -.17 | -.48** | .14 | -.56** |
| - SES low 1990 | .14 | -.07 | -.37** | .05 | -.34 | -.02 |
| - SES middle 1990 | .01 | .35 | .09 | -.40** | .13 | -.02 |
| - SES high 1990 | .03 | .38** | -.13 | -.43** | -.14 | -.02 |
| - town centre 1988 | -.23 | .06 | .04 | -.18 | .27 | -.10 |
| - old neighbourhood 1988 | .06 | .03 | -.07 | -.31 | -.03 | -.24 |
| - truancy encouraging environment 1988 | -.23 | -.12 | .23 | .18 | .08 | .04 |
| - school type 1988 | .27 | -.33* | .00 | -.10 | .27 | .40** |
| - non-ARS policy-measures 1990 | .25 | -.30 | .06 | -.31 | .32 | -.56** |
| - non-ARS policy-measures 1991 | | | .35 | -.05 | .32 | -.39 |
| - extent of disallowed absence 1988 | | | -.27 | | -.60** | |

* = significant (p<.10)
** = significant (p<.05)

Please note: In the first column is indicated whether a variable was measured in 1988, 1990 or 1991.

*Table 23:* *Pearson Product Moment correlations between context variables, non-ARS-based policy-measures on the one hand and absence difference scores on the other*







BEST COPY AVAILABLE

goes for allowed absenteeism and an average ses: schools with more average status students reduced their allowed absenteeism to a stronger degree (-.40) in one of six cases. The variable high ses correlated significantly twice of six times (.38, -.43) with an allowed absence difference score. The first correlation implies that schools with higher ses students reduced absenteeism more, whereas the second correlation indicates that such schools were less able to do so.

None of the school location features (town centre, old neighbourhood, truancy stimulating environment) correlated significantly with an absence difference score. The variable higher (higher means general secondary schools) school type did go together with a stronger reduction in allowed absenteeism two of six times (-.33, -.40), which contrasts with what one would expect, since absenteeism is often lower in schools with a higher academic status (see e.g. Bos, Ruijters & Visscher, 1990) as a result of which it is probably more difficult to reduce its size further in those schools.

Non-ARS-based policy-measures to reduce absenteeism (taken in 1990) correlated significantly (-.56) with the allowed absence difference score 1991-1988. The other ten times this correlation was computed it was not significant.

The last computed correlations are the ones between the extent of disallowed absenteeism in 1988 (when schools started to use ARS) and the disallowed absence difference scores 1991-1988 and 1991-1990. If the extent of disallowed absenteeism was higher in 1988, schools proved to be significantly more able to reduce disallowed absenteeism in the period 1988-1991 (-.60). The same variable did not correlate significantly with the disallowed absence difference score 1991-1990.

### 9.6 Other effects of ARS use

The principal, the school employee responsible for coordinating the implementation of ARS, and the ARS operator were asked whether introducing ARS had led to other positive and/or negative effects than possible changes in absenteeism rates (the fifth research question). On the basis of their responses the mean score of every school has been computed for every positive and negative effect.

*Positive effects*

Table 24 shows to what extent positive effects occurred according to school staff. A percentage represents the portion of schools that perceived an effect as occurring to a certain degree. The order of ranking column indicates the position of each effect in the order of ranking of all effects. This position is based on the mean (M) of an effect which was determined by multiplying the percentages in a column with 1 (not at all), 2 (small), 3 (fair), 4 (strong), or 5 (very strong), adding the five products of a percentage and dividing the sum by 100.

Having a better insight into truancy figures proved to be the strongest positive effect in 1990; according to 80% (36,7% + 43,3%) of the schools this effect occurred (very) strongly. In 1991 this effect was also (very) strong but it was ranked third then, because some other effects were perceived as occurring stronger in 1991. Another effect that seemed to occur strongly in 1990 was that computing the number of absences per student for student reports took less time. On average 70% of the schools perceived this effect as occurring (very) strongly and in the opinion of more

| **positive effects** | | **not at all %** | **small %** | **fair %** | **strong %** | **very strong %** | **M** | **order of ranking** |
|---|---|---|---|---|---|---|---|---|
| a. truants are tracked down | 1990 | 6,7 | 20 | 56,7 | 16,7 | 0 | 2,8 | 6 |
| more | 1991 | 7,4 | 3,7 | 22,2 | 48,1 | 18,5 | 3,7* | 5 |
| b. quicker reaction to | 1990 | 0 | 10 | 46,7 | 36,7 | 6,7 | 3,4 | 4 |
| truancy | 1991 | 3,7 | 7,4 | 25,9 | 44,4 | 18,5 | 3,7 | 5 |
| c. better insight into | 1990 | 0 | 3,3 | 16,7 | 36,7 | 43,3 | 4,2 | 1 |
| truancy figures | 1991 | 3,7 | 3,7 | 11,1 | 51,9 | 29,6 | 4 | 3 |
| d. computing truants for | 1990 | 0 | 3,3 | 26,7 | 23,3 | 46,7 | 4,1 | 2 |
| reports means less work | 1991 | 3,7 | 0 | 7,4 | 70,4 | 18,5 | 4 | 3 |
| e. improved registering and | 1990 | 0 | 10 | 13,3 | 56,7 | 20 | 3,9 | 3 |
| handling of absences | 1991 | 3,7 | 0 | 18,5 | 37,0 | 40,7 | 4,1 | 2 |
| f. trends in truancy can be | 1990 | 3,3 | 13,3 | 36,7 | 43,3 | 3,3 | 3,3 | 5 |
| better discovered | 1991 | 0 | 0 | 0 | 77,8 | 22,2 | 4,2* | 1 |
| g. registering and handling | 1990 | 10 | 56,7 | 26,7 | 3,3 | 3,3 | 2,3 | 7 |
| absences takes less time | 1991 | 3,7 | 29,6 | 37,0 | 25,9 | 3,7 | 3,0* | 8 |
| h. less complaints from | 1990 | 33,3 | 60,0 | 6,7 | 0 | 0 | 1,7 | 8 |
| parents concerning truancy | 1991 | 3,7 | 7,4 | 63,0 | 18,5 | 7,4 | 3,2* | 7 |
| i. less complaints from | 1990 | 90 | 10 | 0 | 0 | 0 | 1,1 | 9 |
| neighbourhood and police | 1991 | 3,7 | 22,2 | 66,7 | 7,4 | 0 | 2,8* | 9 |

* The average score for this effect in 1991 is significantly <u>higher</u> than in 1990 (Wilcoxon test; $p<.05$).

*Table 24: The percentage of schools in 1990 (N=30) and in 1991 (N=27) that perceived positive effects of ARS use to a certain degree, mean (= M) and order of ranking according to the mean.*

than 26% of the schools it occurred to a fair degree. In 1991 this effect was even stronger: about 90% of the schools perceived it as (very) strong. Since one other effect appeared even stronger in 1991, effect d. moved down to third place in order of ranking.

According to about 77% of the schools absence registration and handling had improved in 1990 to a (very) strong degree as a result of using ARS. This is approximately similar to 1991, when it was the second strongest effect. In 1990 in the opinion of more than 43% of the schools they could, as a result of ARS use, react more quickly to truancy to a (very) strong degree. According to about 47% of the schools this effect appeared to a fair degree. In 1991 the picture was somewhat different: in the opinion of about 63% of the schools this effect occurred (very) strongly, whereas according to more than 26% of the schools this effect appeared to a fair degree. The last effect that in 1990 in the view of a considerable percentage of schools appeared to a (very) strong degree was the improved possibility to discover truancy trends. According to about 47% of the schools this effect occurred (very) strongly; in the opinion of almost 37% it appeared to a fair degree. In 1991 this effect was even strongest, since in that year it was a (very) strong effect in the opinion of all schools.

It is remarkable that in 1991 according to 67% of the schools truants were tracked down more to a (very) strong degree as a result of using ARS, whereas this effect in 1990 only occurred in the opinion of almost 17% of respondents.

To determine the extent to which differences between the scores for 1990 and for 1991 are significant the Wilcoxon test for matched pairs (N=27) was used ($p<.05$). The findings showed that in 1991, compared to 1990, in the perception of school staff truants were tracked down more, truancy trends could be determined better, absence registration and handling took less time and parents and the neighbourhood/police complained less about truancy. The other differences between 1990 and 1991 concerning effects must be interpreted as random fluctuations.

*Negative effects*

Table 2? contains the negative effects that in the opinion of school staff occurred to a certain degree as a consequence of using ARS.

The general picture shows that none of the negative effects was experienced as occurring to a (very) strong degree by many schools. The sum of the columns 'strong' and 'very strong' in 1990 varied between 0% and 10%, in 1991 between 3,7% and 18,5%. The percentages for the column 'fair' are also low. In both years 'more work for registration and handling' is the strongest negative effect: 36,7% (1990) and 48,1%

| negative effects | | not at all % | small % | fair % | strong % | very strong % | M | order of ranking |
|---|---|---|---|---|---|---|---|---|
| a. more boring work | 1990 | 36,7 | 50 | 6,7 | 6,7 | 0 | 1,8 | 3 |
| | 1991 | 18,5 | 48,1 | 22,2 | 11,1 | 0 | 2,3 | 2 |
| b. ARS output is <u>not</u> used | 1990 | 76,7 | 23,3 | 0 | 0 | 0 | 1,2 | 6 |
| | 1991 | 18,5 | 59,3 | 18,5 | 3,7 | 0 | 2,1* | 6 |
| c. the number of truants of teachers/subjects is analysed more intensely | 1990 | 53 3 | 43,3 | 3,3 | 0 | 0 | 1,5 | 4 |
| | 1991 | 14,8 | 55,6 | 22,2 | 7,4 | 0 | 2,2* | 4 |
| d. uncertainty concerning quality of ARS | 1990 | 23,3 | 50 | 20 | 3,3 | 3,3 | 2,1 | 2 |
| | 1991 | 14,8 | 55,6 | 22,2 | 3,7 | 3,7 | 2,3 | 2 |
| e. registering and handling absences means more work | 1990 | 6,7 | 46,7 | 36,7 | 10 | 0 | 2,5 | 1 |
| | 1991 | 3,7 | 29,6 | 48,1 | 11,1 | 7,4 | 2,9 | 1 |
| f. those responsible for absence handling feel checked more | 1990 | 76,7 | 20 | 3,3 | 0 | 0 | 1,3 | 5 |
| | 1991 | 14,8 | 63,0 | 14,8 | 7,4 | 0 | 2,2* | 4 |

* The average score for this effect is significantly <u>higher</u> in 1991 than in 1990 (Wilcoxon test; $p<.05$).

*Table 25: The percentage of schools in 1990 (N=30) and in 1991 (N=27) that perceived <u>negative</u> effects of ARS use to a certain degree, mean (= M) and order of ranking according to the mean.*

(1991) of the schools think that this effect occurred to a fair degree, whereas in the opinion of respectively 10% (1990) and 18,5% (1991) of the schools this effect appeared (very) strongly. This finding is remarkable since it means that ARS use in the perception of some school staff did not cause less, but more work for absence registration and handling. In other words the positive effect 'improvement of absence registration and handling' seems to go hand-in-hand with 'more work for absence registration and handling'. This is possibly due to the fact that more attention was paid to combating absenteeism, which led to more time needed for absence registration and handling. Satisfying is that the other undesired effects of ARS use, mentioned in Table 25, did not appear in most schools to a (very) strong or fair degree.
The Wilcoxon test of the differences between 1990 and 1991 (N=27 for both years) showed that in the perception of school staff three negative effects increased

significantly between 1990 and 1991: non-use of ARS-output, a more intense analysis of the number of truants of teachers/subjects and that those responsible for absence handling felt checked more. However, although these effects became stronger between 1990 and 1991; few school staff perceived them as occurring (very) strongly.

*Extent of ARS use in connection with other positive and negative effects of using ARS*
The relation between the degree of ARS use and the extent to which other positive and negative effects of ARS use occurred were studied by computing PM-correlations between each positive/negative effect and registrational ARS use. Only the major conclusion of this analysis is presented here, readers interested in more detailed findings are referred to Visscher and Bos (1991). Correlation analysis showed that if ARS was used more intensively in a registrational way, according to the respondents (especially when ARS had been used for a considerable period) this led to improved absence registration and handling, and more, quicker and better actions taken against truants. Moreover, registering absentees become more efficient then. At the same time the amount of work for absence registration and handling became less the more ARS was used.

### 9.7 Conclusions and discussion

#### 9.7.1 Magnitude of ARS use

The central question is how and to what degree ARS proved to be used in project schools when the use of ARS as measured is compared with the ideal use of ARS.

Registrational use
The research data for registrational ARS use shows that while this proved to have developed most, not all schools used ARS completely in this way. About 90% of absentees in both years were entered in almost all schools. In most (80% - 85%) schools 90% of staff responsible for absence handling received absence control reports (acr's), the other 20% (1990) - 15% (1991) of schools in fact did not use absence control reports for absence handling. About 30% of schools in 1990 and in 1991 tracked down less than 50% of absentees-without-reason. In about 23% (1990) and 11% (1991) of the schools reasons-for-absence were (almost) not entered into ARS Seven schools (23%) in 1990 and two schools (7%) in 1991 did not use one of the essential acr's (the acr per tutor, school type grade or per class). In about 50% (1990) and 30% (1991) of the schools school staff could track down absentees quickly

(between 1 or 2 days) because they retrieved absence control reports every 1-2 days. Thus, in 50% (1990) and 70% (1991) of the schools this was impossible. In about 27% (1990) and 23% (1991) of the schools no acr was retrieved within one to five school days. A positive research finding was that the comparison of registrational ARS use in the years 1990 and 1991 proved that this ARS use had grown significantly ($p<.10$).
The fact that 15% - 20% of the schools did not use control reports, about 30% did not track down many absentees-without-reason, and 50% (1990) and 70% (1991) of the schools did not retrieve an absence control report every 1 or 2 days, and therefore could not react quickly to absenteeism (about 25% did not do this every 1-5 days) is especially important. These schools did not execute a number of activities that are essential when using ARS in a registrational way, and in trying to reduce absenteeism. The fact that many schools could not react quickly to absenteeism because they did not retrieve an absence report to track down absentees every 1-2 days is possibly the reason that students are not discouraged enough in playing truant. A quarter of the schools did not even react to absenteeism once in a school week!

Analytical use

The second form of ARS use, analytical ARS usage, had not developed to a high degree in all project schools. About 60% (1990) and 67% (1991) of the schools produced one or more (in most cases 2 or 3) ARS menu statistics on which they maybe based policy-measures to reduce absenteeism. Forty-three per cent (1990) and 48% (1991) of the schools retrieved a number of ARS menu statistics that varied between 1 and 3, whereas 17% (1990) and 19% of the schools in both years produced more than three statistics. Approximately 40% (1990) and 33% (1991) of the schools did not generate any ARS menu statistic, so these schools could not develop an ARS-based anti-truancy policy. In 1990 SQL was not used at all to retrieve specific self-defined statistics. In 1991 SQL usage had developed a little in 22% of schools. The fact that the SQL tool was not used much may be caused by SQL being complicated for school staff and users who had not received enough training in this. So a considerable group of schools did not make use of ARS to generate data on absenteeism that could be used to analyse pattems in absenteeism as well as relations between absenteeism and other variables. These schools only used ARS for registering absentees. The degree to which ARS was used for analytical purposes had not grown significantly between 1990 and 1991.

Anti-truancy policy development

Anti-truancy policy development on the basis of ARS data had not developed much either in project schools. In 1990 and in 1991 sixteen schools (55% (1990), 59% (1991)) took one or more anti-truancy policy-measures based on ARS data, whereas 45% (thirteen schools) in 1990 and 41% (eleven schools) in 1991 of the schools did not develop any policy measure. If policy-measures were taken this was not done very intensely. Of the schools that developed policy-measures, most schools (48% in 1990 and 52% in 1991) took one or two measures. Developed policy-measures were mainly taken at school management level and only in two of four of the Marx policy areas: resources and general pedagogic-didactics. So, no policy was made with regard to the contents of subjects and educational profiles of schools. Adapting the procedure for absence registration and handling and new student punishment actions proved to be policy-measures that were often taken. These measures were probably taken when ARS was introduced, which made new absence procedures necessary by focusing on absenteeism and as a result led to other punishment strategies. No significant growth in the magnitude of anti-truancy development was observed between both years.

Analytical ARS use and developing ARS-based anti-truancy policy-measures are strongly linked. If a school does not retrieve ARS statistics (analytical use), it cannot base its anti-truancy policy on such ARS data. However, retrieving ARS reports does not necessarily lead to policy-measures meant to reduce absenteeism. Analytical ARS use was not very intense. Therefore it is not surprising that schools did not prove to be strong developers of ARS-based anti-truancy policy-measures. An interesting question is of course why a considerable number of schools (40% - 45%) did not use ARS data to base anti-truancy policy-measures on (and linked to that why they did not use ARS in an analytical way) and why policy-measures were mainly taken at school management level and in the fields of resources and general pedagogic-didactics. First of course must be pointed to the fact that schools are often considered to be professional bureaucracies (Mintzberg, 1979) in which professionals (teachers) operate autonomously and are dominant. School management in most schools restricts itself to policy-making in the area of resources and does not interfere with the teaching process. Schools therefore are frequently called executive organizations (e.g. Van der Krogt en Verhaaren, 1986), since executives themselves determine to a high degree what happens. Policy-making at the level of the whole organization is limited in these organizations, especially concerning the teaching process. This probably explains why in ARS schools no policy-measures were taken towards subject matter and educational profile. Since many policy-measures proved to be resources measures (next to some general pedagogic-didactic measures) it is not surprising that those policy-measures were mainly taken by school management, who is often geared towards resources administration. Moreover, in the theoretical framework (7.3.2) of this study anti-truancy policy development was expected at the level of school management and special bodies responsible for truancy related matters, like student counsellors and truancy consultation at school level. At the other school levels little anti-truancy activity was expected because truancy in many schools was expected to be part of daily school life that is combated by some school organs and staff (like school management tutors, special bodies) whose task it is to tackle this problem. The finding that the special bodies did not take many policy-measures can mean that these were really not active, or that they proposed policy-measures to school management who after that took the measures if they considered them valuable.

Another school characteristic often mentioned in literature (Cohen et al., 1972; Weick, 1982) that might be connected with the limited degree of anti-truancy policy development is that decision making in this type of organization is often not very decisive. When trying to solve problems it is difficult to detect cause and effect, and power 'games' of those involved in the decision-making process frequently hinder decisive decision making. Maybe it was difficult for schools to study the influence of truancy-related factors (cause and effect) and to take anti-truancy policy-measures on which all staff agree.

Possibly part of the problem can be solved by training users. This may for instance apply to using SQL, which is a rather complex tool for retrieving data from a database. Supporting and counselling users in using this tool may enable them to retrieve specific information they need on absenteeism. User support directed towards interpreting statistics, using this information for decision making and developing anti-truancy policy-measures may be another way of reaching the desired situation in which schools use ARS at higher levels than only registrational. It is not realistic to expect schools to be able to carry out these activities without having received any assistance and training in executing them. So far user support was mainly directed towards ARS use for daily absentee registration. More training in analysing, interpreting and using analytical data may enable schools to improve their computer behaviour.

Possibly the policy area, the field of absenteeism plays a role as well. Schools regardless of their varying organizational features were not very active in developing an anti-truancy policy. It may be that schools in general consider absenteeism to require mainly administrative activities, of which the implementation of ARS and the realizing of necessarily involved measures (like changing the procedure for absence registration) are the most important ones (and in many cases the only ones). In addition some schools gave extra attention to formulating new sanctions (in case of absenteeism) and student counselling, because participation in the ARS-project led to extra attention for the problem of absenteeism and stimulated schools to combat truancy. Analysing absenteeism pattems and relations between absenteeism and other variables by using the Standard Query Language did not take place in most schools and was not a basis for intensive policy-making, neither conceming subject matter and educational profile, nor resources and general pedagogic-didactic matters. Linking absenteeism with features of the educational school structure, subject contents, general school resources (e.g. timetable) and the general pedagogic-didactic side of a school in many schools simply did not occur possibly because absenteeism was mainly supposed to be a question of a good administrative procedure for registering and handling absentees. The fact that policy development conceming educational profile and subject contents did not occur is in harmony with the theoretical framework of this study (see section 7.3) in which it was predicted that such policy-measures were supposed to be too radical (entering the territory of autonomous teachers) and far reaching and schools were not expected to link truancy with these topics.

9.7.2 Factors that stimulate ARS implementation

Studying the degree to which variables influenced the extent to which ARS was used for registering, analysing absenteeism data, and anti-truancy policy-making showed that two factors were important during the first the phase of ARS implementation. The degree to which school staff was motivated and encouraged to use ARS seemed to play an important role for the degree of registrational and analytical usage which is in harmony with other studies (e.g. Bennet & Lancaster, 1986, and Piercy, 1987). So, a school staff motivated to use ARS is a good basis for implementing ARS. If school staff are not motivated the role of others like school managers and ARS-coordinators to stimulate other staff to use ARS is important. The second factor that proved to be important during the first stage of ARS implementation process is the compound variable 'positive conditions for ARS use' which comprises a number of variables that are in line with using a computer-assisted attendance registration system, like the degree to which:

- truancy in the perception of school staff can be combated;
- schools combating truancy before ARS was introduced;
- schools registering and handling absentees in a similar way to the ARS procedure;
- students were counselled in project schools.

The influence of this compound variable may imply that introducing ARS during the first phase of the implementation process will not produce the same level of ARS usage in every school because not all schools will meet the positive conditions for ARS use to the same extent. Therefore, when ARS is implemented, substantial attention must be paid to these factors.
For the second stage of the innovation process (the period 1990-1991) no predictor for registrational and analytical ARS use was found, which may mean that the influence and importance of the two aforementioned predictors on ARS use had decreased in 1991. Another explanation may be that variance in the degree to which ARS was used had gone down considerably between both years.
The other variables did not explain any variance in ARS use. However, from this finding it must not directly be concluded that those variables are of no importance for implementing ARS successfully. In some cases maybe no variance in ARS use was explained by those variables because schools hardly varied on them. Schools for instance did not differ much regarding implementation support and their perception of the quality of ARS. In both years no predictor was found for the extent of ARS-based anti-truancy policy-making, this was possibly connected with there being little variance in the dependent variable.

In hypotheses 1 to 4 and hypotheses 10 to 12 (see 7.3.3) some relations are assumed between variables on the one hand from block B, C1 and C2 and ARS use on the other. Higher scores on the former variables are assumed to go together with more ARS use. These hypotheses were tested by means of regression analysis and were confirmed for the variables included by the two aforementioned predictors (compound variables): variables C1.1-C1.3, C2.1-C2.5 and C2.9. Some (parts of) hypotheses were not confirmed: hypothesis 1,2 (for variables C1.4, C1.10-C1.12 and C1.14), hypothesis 3,4 and 11 (see section 7.3.3).
Relations between C2 variables and developing anti-truancy policy-measures are stated in hypotheses 5-9 and 13 (see 7.3.3). Research data did not indicate that more consultation in the school as a whole, or at school management level, went together with more anti-truancy policy-making at those school levels. In other words, hypotheses 5 and 6 were not confirmed, which again may be connected with the fact that the anti-truancy policy-making variable showed very little variance. Hypotheses 7 to 9 concern relations stated between several school organizational characteristics on the one hand and the size of anti-truancy policy-making on the other (the so-called Marx models). Analysis of variance made clear that the two clusters of schools that were found neither differed significantly concerning the extent of anti-truancy policy-

making, nor with regard to the extent of anti-truancy policy-making in the resources and in the general pedagogic-didactic field of policy-making. So, no differences between more fratemal and more segmental clusters of schools were found in the degree of anti-truancy policy-making and in the areas in which they developed policy. In other words, hypotheses 7 and 9 were rejected.

That schools' behaviour could not be forecasted by Marx's theory, may be connected with various factors. First the research data question the validity of the theory of Marx because the data did not prove that schools with more segmental features were less active concerning anti-truancy policy development than schools with more fratemal characteristics. Moreover, the clusters of schools did not differ with regard to the degree to which anti-truancy policy was made within the resources and general pedagogic-didactic area of policy-making. It is imaginable that the theory of Marx is defended against this criticism by the objection that the clusters indeed have some features of the Marx models, but that the ideal types do not emerge strongly. The clusters might not possess the characteristics of the Marx models strong enough to confirm the hypotheses. However, this reasoning must be rejected, because ideal types that are not based on empirical data like the Marx models will never be completely found in reality. If a certain cluster possesses the school organization features of one Marx model more than of another one, and another cluster looks more like another Marx model, then differences between these clusters should appear from the degree to which, and area in which, anti-truancy policy is made in each cluster. This was not the case.

In section 9.7.1 some possible explanations were given why project schools in general did not use ARS data for developing anti-truancy policy-measures.

9.7.3 Development in absenteeism rates

Four absence rates were studied: the percentage of disallowed absence of schools, the percentage of allowed absence of schools, the percentage of truants of a school truanting 1-2, 3-5, or 6-8 lessons and the percentage of students truanting one or more lessons on a specific school day. Difference scores (1990-1988, 1991-1990, 1991-1988) were computed and experimental and control schools were compared on the basis of these. The control group did not perfectly match the experimental group (see section 8.2.2). Because of that the comparison of both groups of schools on changes in absence rates was a perilous undertaking. However, it was the best that could be done since it was impossible to create research groups that matched better. Especially when the comparison had shown that absenteeism had gone down in experimental schools, it would have been difficult to make plausible that ARS, instead of features of the research groups, had caused the reduction in absenteeism.

The results of comparing both research groups strongly indicated that ARS did not produce a decrease in absence rates in the experimental group. The comparison of the experimental and control group showed that significant improvements in absence rates in the research group did not occur. Moreover, because of the imperfect match between experimental and control schools changes in absence rates were also studied *in experimental schools* only (for details see Visscher and Bos, 1991). This comparison of the size of absenteeism at the time of the pre-test and two post-tests in experimental schools did not show a significant reduction in absenteeism rates either. On the basis of analysing developments on the extent of absenteeism in these two ways it must be concluded that there are strong indications that ARS use did not bring about a systematic reduction in the size of absenteeism.

An important question is of course why this study did not show that using ARS goes hand-in-hand with a significant reduction in absenteeism. A number of possible explanations are mentioned.

Firstly ARS simply may not be powerful and influential enough to reduce absenteeism. Petzko (1990) in her study of American high schools also found that technological innovations of absence registration did not produce lower absenteeism rates. If ARS could not help to reduce absenteeism rates this may mean that its added value mainly concerned improving the efficiency of absence registration (e.g. computing the number of truants for student reports more quickly in a computer-assisted way; see 9.6).

The fact that ARS use did not bring about a reduction in absenteeism may also be connected with characteristics of the student population of ARS schools. Petzko (1990) studied variables that determine the levels of school absence rates and concluded that especially school external factors are important. The percentage of minorities in a school proved to be by far the most important factor. This finding is in keeping with a research result from the pre-test of this study (Bos, Ruijiers en Visscher, 1990) showing that the percentage of minorities explained 42% of the variance in school absence rates of ARS schools. A considerable number of project schools had many minorities: over 30% for 56% of ARS schools in 1991. Petzko states that important points of action for reducing absenteeism lie outside schools. In her opinion the role of schools in combating absenteeism is not very big and, moreover, if schools develop anti-truancy policy-measures they should take different measures for students of different age categories. If this also applies to Dutch schools these schools need a system like ARS for pattern analysis (concerning the absence of various age groups) to be able to develop a differentiated anti-truancy policy for various age groups.

If school external factors like characteristics of the family situation are so influential schools must pay attention to them and, where possible, try to influence them in such a way that truancy is reduced. However, that is difficult and time consuming for school staff who in the first place are responsible for teaching. Besides, one may question how far schools should and can go in trying to change the world outside the school building. In the theoretical framework, following Bos, Van Kesteren, Stoel & Vermeulen (1990) distinguish four truancy causes: the individual student (e.g. not motivated), the family (family problems), the school (e.g. uninteresting lessons or a truancy stimulating timetable), the educational system (continuous selection and assessment) and society (e.g. no jobs). Schools of course must pay attention to the individual student and the school as potential truancy causes. Possibly they can also try to change the influence of the family and the educational system to a certain degree but this in many cases will not be easy. Schools cannot influence truancy stimulating aspects of society.

Another possible reason for the failed reduction in the extent of absenteeism may be the way in which ARS was used by project schools. Registrational ARS use proved (see 9.2) to be the most developed form of ARS use, but not all schools used ARS in a totally registrational way. For instance, 15%-20% of the schools did not use absence control reports to track down absentees-without-reason and (as a result) less than 50% of the absentees were tracked down in about 30% of schools. Besides, many schools did not retrieve an absence control report quickly enough to rapidly react to absentees: about 25% of the schools did not retrieve an absence control report within 1-5 school days, and 50%-70% not within 1-2 days. About 33% (1990) and 40% (1991) of the schools did not retrieve ARS menu statistics, the others retrieved only a few ARS menu statistics, whereas retrieval of self-defined SQL-reports did almost not occur, probably due to the fact that using this query language is complicated and requires considerable training. Since statistical reports should be the base for developing an ARS-based anti-truancy policy, it is not surprising that about 45% (1990) to 41% (1991) of the schools did not develop any ARS-based anti-truancy policy measure and that most schools that took policy-measures only took one or two measures. In section 9.7.1 some possible explanations were given for the fact that schools did not use ARS data intensely for developing anti-truancy policy-measures.

Did schools only use the system to replace the manual way of absence registration which means that a student who had been disallowed absent, just like in the pre-ARS period, was punished and/or in some cases, counselled, or was ARS also used to investigate and eliminate general truancy causes and specific individual causes? Research data show that most schools did not try to analyse trends and general relations between truancy and other variables. To what degree schools discovered the real reason for absent students cannot be said on the basis of the research data. Data on how individual students who played truant were treated would be interesting but are not available since within the time available for this study it was not possible to collect such process data. However, data concerning the extent of analytical and policy supporting ARS use give the impression that the innovative value of implementing ARS was not as extensive as it potentially could have been. Schools did not use ARS intensively in an analytical and policy supporting way and although some of them adapted their absence registration procedure, the difference between the old and new procedure was not very big. The mean score on variable C2.3 ('similarity to ARS procedure') was 40 (standard deviation 3.1, maximum theoretical score 60) which means that schools already worked in an ARS manner to a considerable extent (on average two third of the maximum score) before ARS was used. This may imply that ARS use did not comprise a big change for schools and possibly because of that did not produce the desired reduction in absenteeism. Schools would possibly have reduced absenteeism if they had utilized ARS more intensely in all possible ways, and ARS use would therefore have been more innovative.

Other causes for not realizing a reduction in absenteeism may be linked to the selectivity of the research group. Many project schools proved to be schools for (individual) lower vocational education and were small (see section 8.2.2). It may be that it was especially difficult to reduce absenteeism in these schools because of the fact that absenteeism in small schools is also controllable without ARS and/or these have many students from ethnic minorities who play truant regardless because of external factors (e.g. home characteristics). As mentioned before the degree to which schools with many minorities can influence the extent of absenteeism may be limited. Since ARS schools had a considerable number of minority students, maybe for that reason absenteeism could not be reduced systematically in project schools.

The selection of experimental schools may have played a role in another way. Schools in the four cities had been contacted and those that were willing became project schools. Such schools were maybe motivated to participate in the project for various reasons like the desire for reducing absenteeism, or the prospect of receiving precious computer hardware and software as well as user support for free. It is imaginable that features of the research group caused absenteeism not be reduced significantly because these schools already paid so much attention to reducing absenteeism that a further reduction was difficult.

The way in which the size of absenteeism was measured also possibly played a role in connection with the fact that absenteeism rates could not be reduced. As described in 8.1.3, the extent of absenteeism was determined by comparing the degree of absenteeism in experimental and control schools on one school day. As such this study gives information on the development of the size of absenteeism at that one day only. Maybe this measurement was not enough to obtain a fair picture of the development of the degree of absenteeism in project schools. A different means (during a longer period and at more times of the schoo' year) of measuring the extent of absenteeism was impossible since it would have overburdened schools, but maybe would have produced other results.

### 9.7.4 Relations between ARS use, policy areas, context variables, non-ARS policy measures and the change in absenteeism rates

Since the extent of absenteeism was not reduced significantly, there was no use in answering the fourth research question (to what extent changes in absenteeism rates must be attributed to ARS use). Nevertheless, correlations were computed between changes in absenteeism rates in a certain period and other variables, like the extent of ARS use, the (Marx) policy areas in which anti-truancy policy-measures were taken. context variables and non-ARS-based policy-measures. This was done to test a number of hypotheses formulated in section 7.3.3 and to investigate whether changes in the extent of absenteeism correlated with certain other variables.

Hypotheses 14 and 15 state that it is expected that a more intense ARS use goes together with a stronger reduction in absenteeism, but the research data did not confirm these. There are also no indications that anti-truancy policy-measures in a specific area (resources, general pedagogic-didactic, subject contents and educational profile) lead to a stronger reduction in absenteeism. When the failed reduction of the extent of absenteeism was discussed in section 9.7.3 some possible causes were mentioned for the fact that ARS use did not produce a systematic reduction of absenteeism.

In section 7.3.3 it was announced that relations between some other variables would be explored. About 100 correlations between context variables (block F in Figure 9), non-ARS-based policy-measures (block G) on the one hand and absence difference scores on the other were computed. Since the danger of chance capitalization in such a case is big the significant correlations must be interpreted cautiously. The correlations showed that if schools were bigger the size of allowed absenteeism was reduced more. Schools with more ethnic minorities including Turkish and Morrocan students also reduced allowed absenteeism more significantly than other schools. Nevertheless, it must be stressed that despite these significant correlations the Mann-Whitney test of the differences in the development of absenteeism rates between experimental and control schools showed (see section 9.4) that no significant reduction of absenteeism was realized. None of the school location variables correlated significantly with an absence difference score. In other words, no school location variable went together with a strong decrease or increase in absenteeism. Finally, if the extent of disallowed absenteeism in a school was higher in 1988 (when ARS was introduced) disallowed absenteeism could be reduced more in the period 1988-1991 in such a school.

### 9.7.5 Other effects

When the theoretical framework was presented it was stressed that criticism of technological determinism ('information technology always leads to certain effects') states that the effects of implementing information technology depend on the characteristics of the organization that uses the technology, the automation process plus features and characteristics of the information system. Looking at the positive and negative effects that occurred according to ARS users gives the impression that, independent of the features of project schools, the way in which the information system and the automation process were shaped had an impact that was considered positive by users.

The introduction and use of ARS in the opinion of school staff led to a considerable number of other positive effects. Some of them were perceived as occurring (very) strongly by many respondents:

- better insight in truancy figures;
- computing the number of truants for student reports takes less time;
- improved registering and handling of absentees.

According to respondents some effects occurred less strongly (especially in 1990), but still considerably:

- react more quickly to truancy;
- discover truancy trends better;
- track down truants more.

Next to these positive effects some negative effects occurred as well, however none of these was experienced as occurring (very) strongly by many respondents. The strongest effect was that registering and handling absentees means more work ((very) strong according to 10% in 1990 and 18,5% in 1991). Remarkably, in the opinion of some school staff ARS did not cause less, but more work. However, research data also indicated that according to many school staff (70% - about 90% of the schools) ARS use resulted in timesaving as far as computing the number of absentees for reports is concerned (see Table 24 effect d.). All other potential negative effects almost did not occur as a result of ARS use. Perceptions are subjective, may be invalid and therefore these findings must be used carefully. It is for instance striking that in the opinion of about 50% (1990) and 100% (1991) of the schools, truancy trends could be discovered better, whereas in both years respectively 40% and 33,3% of the schools did not retrieve any statistic to analyse absenteeism (see section 9.2)! Nevertheless perceptions of school staff concerning other effects of ARS usage are important. In the theoretical framework Ivies et al. (1983) were cited as saying that a 'good' information system perceived by its users as a 'poor' system is a poor system. Therefore the perceived other effects are encouraging. It may be that perceived effects like improved registering and handling of absence, better insight in absence figures, tracking down truants more quickly will, in the long term, reduce the extent of absenteeism. The fact that a considerable number of valuable positive effects grew between 1990 and 1991 gives the impression that their influence increases as ARS is used longer, which may imply that their continued effect on absenteeism rates will appear after considerable time (when the other effects have grown to a certain level).

## CHAPTER 10 SUMMARY AND CONCLUDING OBSERVATIONS

### 10.1 Summary

In this thesis three interrelated studies are reported upon:

1. a pilot study (chapter 2);
2. the SCHOLIS-project, directed at designing SCHOLIS, a computer-assisted system for school administration (chapters 3-6);
3. the evaluation of the implementation of a computer-assisted Absentee Registration System (chapters 7-9).

The pilot study on the state-of-the-art of computer-assisted school administration and management (CASA) was carried out from February 1985 - February 1986. The idea was to explore a new area and to determine which research and development topics required attention in that field. The pilot study led to the SCHOLIS-project, which was intended to produce a high-quality school information system for secondary schools to the extent that a number of problems as observed in the pilot study would be removed. The third study comprised the evaluation of the implementation of one element of the developed information system, the absence registration module. More information on each study is now given.

*The pilot study*

The pilot study consisted of making an inventory of available school administrative computer applications and their features, exploring foreign experiences and developments in the field of CASA, and studying automation processes and their impact in pioneer schools. From the pilot study it was learned that many schools expected valuable gains from computer-assisted administrative and management information systems, and that this form of computer usage was growing rapidly. However, since it was also noticed that CASA was not free from problems, recommendations were formulated to optimize computer-assisted school administration in the Netherlands (see section 2.3.4). These included combining forces in developing high-quality systems, executing a thorough analysis of schools as a basis for information system construction, developing widely usable systems, governmental support of schools, studying automation processes and their effects in schools and evaluating school administrative software.

*The SCHOLIS-project*

As indicated the SCHOLIS-project was the follow-up to the pilot study. School administrative computing was regarded as lagging far behind when compared to computer usage in other types of organizations. A new generation of computer-assisted school information systems for secondary (general secondary and/or pre-university education) schools was regarded as necessary in order for schools to grow to higher levels of CASA and to improve their efficiency and effectiveness. The Department of Computer Science, the Department of Education of the University of Twente, and the Centre for Education and Information Technology joined together in the SCHOLIS-project which was carried out between October 1985 - December 1988. The SCHOLIS-project goals (section 3.2) may be regarded as attempts to remove the shortcomings of CASA in the Netherlands.

In chapter 3 the project strategy that was used to design and develop the desired school information system and to study conditions for and effects of system use is broadly presented. The fourth chapter describes in more detail how the so-called school information system framework (SISF) was designed. A SISF comprises all school activity subsystems (e.g. student registration or financial registration) and shows their input and output and mutual relations in terms of information and/or material flows between them. Moreover, within each SISF subsystem its constituting activities are described and the role the computer can play in their execution is determined. As such the SISF formed the basis for developing SCHOLIS software.

The strategy for designing the SISF consisted of the following:

- constructing hypothetical reference models of information dependencies between school organization processes as a basis for analysing the information housekeeping of schools;
- testing the reference models by analysing general and/or pre-university secondary schools;
- drafting elementary activities comprising every organizational activity subsystem, on the basis of the analysis, for each project school;
- verifying the draft descriptions by presenting them to school staff and adapting them as a result of feedback;
- designing a general draft school information system framework of Dutch general and/or pre-university secondary schools, consisting of activity subsystems and their constituting elementary activities;
- collecting feedback from school staff on the proposed activity subsystems and elementary activities;
- defining the final SISF.

The most important design results are presented in the fifth chapter by describing the computer support possible in each of the subsystems of the SISF. Subsequently the results are reflected upon in three ways:

1) the number of specific elementary activities (non-formalizable, manual, machine, man-machine activities) comprising each designed activity subsystem is assessed;
2) the way in which school management can benefit from computer use is discussed;
3) the degree to which certain computer functions (updating the database, information retrieval and production of documents, decision making support, decision making, communication) can be used within various school organizational processes as distinguished by Mintzberg (1979) is determined.

In section 5.4 it is explained how the designed school information system framework was used within the next phases of the SCHOLIS-project, i.c. developing information system prototypes and end systems, implementing those and studying system use and its effects.

Chapter six reflects upon the nature of the SISF design strategy used and on other project activities carried out after the SISF became available by first comparing it to the design and the developmental approach as distinguished by Ganzevoort (1985) and then to the so-called regulative cycle of Van Strien (1975). In retrospect the designers of SCHOLIS operated in a manner that strongly resembled Ganzevoort's design approach, and the strategy also possessed some features of the Ganzevoort developmental approach. The SCHOLIS-project method was compared to Van Strien's so-called regulative cycle.

Finally the merits and demerits of the design strategy were discussed by considering the time element and the input required from users. Further by firstly analysing a complex school and then by analysing less complex schools, the number of schools that could be analysed, using reference models, designing elementary activities, and the cooperation of people from different scientific backgrounds.

*The ARS-project*

Chapters 7, 8 and 9 constitute the third element of this thesis, the evaluation of the implementation of the Absentee Registration System (ARS) module of SCHOLIS. Five research questions guided the evaluation study:

1. To what degree is ARS used by project schools?
2. Which factors stimulate a successful implementation of ARS?

3. To what extent did absenteeism rates change in experimental and control schools between 1988 and 1991?
4. To what extent can possible changes in absence rates be attributed to ARS use?
5. Did ARS use bring about other effects than potential changes in absenteeism rates?

The characteristics of ARS are revealed by describing the support it can give. It is also explained how the research framework was constructed and which variables as a result of this were studied in connection with implementing ARS. The hypotheses formulated in the research framework are summarized in section 7.3.3 thereafter the method used for answering the five research questions is presented in chapter 8 by describing the quasi-experimental design of the study, the research instruments and respondents, the way in which data were collected, processed and analysed, and the characteristics of research groups.

Chapter 9 presents the evaluation study results. Although ARS use (see the first research question) for daily absence registration and handling proved to have been most developed, not all schools used ARS completely in this way. Where they did not, a number of activities essential for using ARS in a registrational way and for trying to reduce absenteeism were omitted. For instance 15% and 20% of schools (in 1990 and 1991 respectively) did not use absence control reports to track down absent students, about 30% of schools in both years did not track down many of their absentees-without-reason, and 50% (1990) and 70% (1991) did not retrieve an absence control report every 1 or 2 days (about 25% did not do this every 1-5 days), as a result of which they could not react to absenteeism quickly.

The other two forms of ARS usage, analytical use and developing anti-truancy policy-measures based on ARS data, are closely interrelated. If a school does not retrieve ARS statistics (analytical use) to analyse absenteeism trends and relations between absenteeism and other variables, it cannot develop anti-truancy policy-measures based on such statistics. Analytical ARS use was not intense. About 60% (1990) to 67% (1991) of schools retrieved ARS menu statistics (in most cases 2 or 3 statistics), whereas the other 40% and 33% of schools did not retrieve any ARS menu statistic on which they could base anti-truancy policy-measures. Specific self-defined statistics that could be retrieved by means of a query language were hardly generated. Schools did not prove to be strong developers of ARS-based anti-truancy policy-measures. About 55% (1990) and 59% (1991) of schools developed one or more (in most cases one or two) ARS-based policy-measures to reduce absenteeism, whereas 45% and 41% did not develop any measure. The question why analytical ARS use and ARS-based anti-truancy policy-making did not develop to a high degree is addressed in section 9 7.1.

Answering the second research question showed that two factors proved to be important for the degree of registrational and analytical ARS usage in 1990, when ARS was used for 8 months in project schools: 1. the extent to which school staff was motivated to and/or encouraged to use ARS; and 2. the degree to which a school met a number of conditions that are considered to be positive for ARS use. No predictor was found for the extent of registrational and analytical ARS use when ARS had been used for some 20 months in 1991. Neither after 8 nor after 20 months was a predictor found for the extent of ARS-based anti-truancy policy-making.
Relations between configurations of school organizational characteristics (the so-called Marx models) on the one hand and the size of anti-truancy policy-making on the other were also investigated. When a cluster with fraternal schools and one with segmental schools were compared using variance analysis, no differences could be detected concerning the degree of anti-truancy policy-making, nor concerning the areas in which anti-truancy policy-measures had been developed. Section 9.7.2 includes a discussion of the reasons why Marx's theory could not forecast schools' behaviour.

The third research question is the most important one since it was hoped that ARS use would lead to a reduction in absenteeism rates. Four absence rates were studied to answer this question: the percentage of disallowed absence of schools, their allowed absence percentage, the percentage of truants truanting 1-2, 3-5, or 6-8 lessons per day and the percentage of students truanting one or more lessons on one school day. Difference scores (1990-1988, 1991-1990, 1991-1988) were computed for each absence rate and experimental and control schools were compared on the basis of the difference scores. The results showed no significant decrease in absence rates as a consequence of ARS use. A number of possible explanations for the failed reduction in absenteeism rates is presented in section 9.7.3.

There was no point in answering the fourth research question since the extent of absenteeism was not reduced significantly. Nevertheless, correlations were explored between changes to absenteeism rates on the one hand and the extent of ARS use on the other, the areas in which anti-truancy policy-measures were taken, context variables and non-ARS based policy-measures to reduce absenteeism. The correlations showed that a more intense use of ARS did not go together with a greater reduction in absenteeism and that the area in which anti-truancy policy-measures were taken did not make any difference to the degree of absenteeism reduction. Moreover, if schools were bigger and also if the student population of a school included more students from minorities (in general and more specifically Turkish/Morrocan) absenteeism proved to be reduced more strongly. No school location variable (e.g a truancy stimulating environment, an old neighbourhood) was linked to a stronger decrease or increase in absenteeism. Finally, if the extent of disallowed absenteeism of a school was higher at the time ARS was introduced in 1988, disallowed absenteeism was reduced more in the period 1988-1991 in such a school.

The last research question concerns possible other effects of ARS usage than changes in absenteeism rates. Evaluation study findings give the impression that the way in which the ARS information system and the automation process were developed had a positive impact according to ARS users. In the opinion of school staff, implementing ARS led to a considerable number of other positive effects. Some of these were perceived as occurring (very) strongly by many respondents, i.e. better insight into truancy figures, computing the number of truants took less time, and improved registering and handling of absentees. Other effects in the opinion of respondents occurred less strongly, but still considerably: reacting more quickly to truancy, discovering truancy trends better and tracking down truants more.
Although some negative effects occurred, none was experienced by many staff as occurring (very) strongly. According to 10% (1990) and 18,5% (1991) of schools the strongest negative effect (registering and handling absenteeism takes more work) occurred (very) strongly. These user perceptions regarding other effects of ARS use are encouraging since it is known (Ivies et al., 1983) that they determine the extent of system usage.

### 10.2 Some concluding observations

At the end of this thesis some concluding remarks are made on the results of the projects reported upon, and on the basis of the experience gained the following topics are discussed: the requirements for projects like these, the role of SCHOLIS in schools operating more autonomously, ways in which schools can develop their ability of computer-assisted policy-making, the role of the government in stimulating school administrative computing, and finally research required for the future.

*SCHOLIS-project goals and results*

First the results of the SCHOLIS-project are compared with the initial SCHOLIS-project goals as formulated in section 3.2. The first project goal of making a fundamental analysis by an interdisciplinary team of the information housekeeping of AVO/VWO schools, and determining the support the computer can offer was realized. Although the time required for analysing schools in depth meant that the number of such schools could not be large, the results of the three schools analysed proved to be a good basis for designing the school information system framework. The limited number of analysed schools was not a big problem because the designed framework was tested by developing prototypes and implementing those in a larger group of schools. Moreover, the developed information system offers schools to a certain degree the opportunity to adapt the information system to their specific features and needs.

Valuable results of analysing schools from an information processing viewpoint and from designing a school information framework consist of a portrayal of how schools collect, store, process and use all kinds of administrative and management data, as well as a desired design for a computer-assisted school information housekeeping. These project outputs can be used (e.g. for developing school administrative computer applications), assessed and adapted now, whereas at the start of the SCHOLIS-project detailed literature on the information processing characteristics of schools was non-existent.

It cannot be said with certainty whether the SCHOLIS system will have a long life (a subgoal of the first project goal in section 3.2) but the fact that considerable time has been paid to analysing schools and determining the possible computer support, in combination with the flexible basis of SCHOLIS (a fourth generation programming language and a relational database), give high hopes.

The second SCHOLIS-project goal of developing prototypes in a professional manner using up-to-date tools has been realized to a certain degree. Prototypes were developed by means of a fourth generation programming language for a number of subsystems from the school information system framework (see Figure 4 in section 5.2): enrollment registration, grouping students into classes, principal student data administration, absenteeism, student guidance and counselling, test scores, final examinations, deletion and timetable registration. Although all subsystems from the Information system framework have been designed in a written form, prototypes could not be constructed for the other subsystems within the SCHOLIS-project because a) project time did not allow for this; b) prototype development had not been planned for certain subsystems because their complexity would make it impossible to incorporate them within the project (e.g. for educational planning which includes timetable construction and for financial planning); c) other available school administrative software was already suitable for these subsystems (e.g. for personnel registration, financial registration and capacity planning). After the SCHOLIS-project expired, interfaces were developed to connect already existing professionally developed software (e.g. for financial registration, personnel registration and timetabling) with the SCHOLIS database, so that schools could also use the applications. Moreover, when the SCHOLIS-project lapsed, software was developed for other SCHOLIS subsystems (e.g. book fund registration and capacity planning).

The degree to which the developed prototypes suit the desires and characteristics of any school using the system (this is an aspect of the second SCHOLIS goal) cannot be said with any certainty since the number of schools now using SCHOLIS is only a fraction of all schools that potentially can use it. Besides, research to determine this could only be carried out regarding the Absentee Registration System (ARS), which showed that schools were positive about ARS features. Concerning the user opinion with regard to other applications, only a subjective impression can be given. However, the fact that about a 100 schools use SCHOLIS proves the system is acceptable to them. The experience gained with prototypes and end systems that were implemented in non-project schools was also positive. The use of these systems did not create substantial problems in these schools, which gives the impression that subsystem designs were general enough to enable non-project schools to benefit from the systems. Moreover, SCHOLIS is flexible in the sense that it offers schools the opportunity to adapt it to their specific desires and situation. Schools can for instance determine how many test scores they would like to register, how student report scores will be computed, and what the student report will look like. They can also obtain answers to school-specific management queries where the standard menu does not provide this information.

The third SCHOLIS-project goal of optimizing prototypes, testing, and implementing end systems with a high probability of acceptance was achieved for the subsystems prototypes were developed for. Prototypes were tested in schools and when they became stable were transformed into end systems, implemented in project schools and later also introduced in non-project schools. The prototyping strategy was satisfactory since it offered users the opportunity to influence prototype characteristics, and as a result of using fourth generation software development basis prototypes could be adapted relatively easily. The intensive test and optimization of prototypes in schools finally led to end systems that proved to be acceptable for schools that had not participated in prototype development. However, some schools of course will always have specific desires that a standard system, which always is a compromise, does not possess.

Transforming stable prototypes into end systems proved to be more difficult than expected. After intensive negotiations with various companies one company was selected for this, but since the required end systems were not produced another company had to be asked to do this. Inviting companies to develop a strategy for cooperating with SCHOLIS-project staff, negotiating with potential partners, selecting a company, arranging cooperation in a sound juridical way, familiarising the partner with SCHOLIS, and finally working together demanded a lot of time, energy, skills and know-how and was therefore not easy. Nevertheless, plans finally became reality. SCHOLIS became available as an end system that could be bought by schools. As such the project is a good example of how universities and private companies can cooperate and complement each other. The former can take care of the analysis, design and evaluation stages better, while the latter are better equipped for making innovations suitable for the commercial market, and for system distribution and maintenance. The SCHOLIS-project has shown that cooperation of both parties can lead to instruments that are valuable for educational practice. In fact this is the most satisfying result of all project activities. The system has been developed in the desired way, is already being used in about a 100 schools, is sold, marketed and maintained by a private company (something that does not happen frequently with educational innovations) and has acquired a good market position at a time when various school administrative software packages have been withdrawn from the market. The available system can be used in local and wide area networks and enables schools to grow to higher stages of CASA (the integration and stabilisation stage of Zisman, see section 3.1). Moreover, the information system basis (the thorough analysis, the flexible programming language and the modular system architecture) means that future expansion and adaptation of the information system will probably not create enormous problems. Hopefully subsystems designed 'on paper', for which no prototypes could be developed yet, will be realized in the near future and valuable other software modules will be connected with the SCHOLIS database as well. Such a development will expand the SCHOLIS system contents and the support the system can offer.

The fourth and last project goal, studying the way in which SCHOLIS is used and investigating conditions for, and effects of, system use has been achieved for the absenteeism registration system (ARS). Studying the implementation and impact of information systems longitudinally is essential but seldom done. Thanks to the Dutch government who funded a three-year ARS evaluation this goal could be executed and resulted in valuable insights into the characteristics of this type of implementation processes, the degree of information system use, factors determining implementation success and the impact of system use. However, such an empirical study could only be carried out for one information subsystem, the use of all other developed subsystems unfortunately could not be evaluated empirically.

*Complexity and magnitude of the projects*

When the SCHOLIS-project was started, project initiators realized that their plans were ambitious but they did not know that designing, building, and implementing information system prototypes and end systems, supporting users, selling and maintaining end systems, and finally evaluating system use longitudinally would be that difficult and demand so many resources. The information analysis in schools resulted in an enormous quantity of data on the information housekeeping of schools that had to be analysed and used to describe the school information housekeeping of project schools as well as designing the desired computer-assisted school information housekeeping. Cooperation with and the input from project schools was intense. It included information analysis, feeding back design proposals to schools, implementing prototypes and investigating user opinions on prototype features, end system implementation in project schools and collecting research data when evaluating system use and the impact of one subsystem. Working so intensely with project schools was valuable, time consuming for both schools and project staff and not always free from problems because of the different goals of schools and project staff, the geographical distance between the two and problems with implemented provisional systems.

Developing and evaluating a system like SCHOLIS required the input of people with different academic backgrounds. A large group of people was needed to realize the plans:

- a project steering group comprising 3 members;
- a part-time project coordinator and (for part of the project) an external assistant-coordinator for one day a week;
- four part-time staff members for the information analysis;
- five full and part-time computer scientists for developing prototypes;
- an implementation team comprising two staff members who supported schools (for two days a week) with installing and using prototypes and who solved any related problems;
- three full or part-time staff members cooperating with a large group of students (involved in data collection and data entry) carrying out the evaluation study;
- two companies working on transforming prototypes into end systems.

Since the Ministry of Education funded the projects, contacts between project staff and the Ministry were intense. Moreover, some SCHOLIS-project staff had to work with a consultancy bureau for a certain period in order to determine the relevance of the SCHOLIS-project, since other companies selling school administrative software doubted the need for the SCHOLIS-project). For the aforementioned reasons executing the SCHOLIS-project was a complex task requiring frequent coordination between internal staff involved as well as between SCHOLIS staff and external bodies.

*Using SCHOLIS in more autonomous schools*

The Dutch government is decentralising a number of competences to schools, as a result of which schools are becoming more autonomous in certain areas (e.g. finance and personnel). More autonomy for schools implies that schools themselves will have to develop and evaluate school policy in areas where previously the government decided what was done. The role of a system like SCHOLIS in more autonomous schools may be important since the system can provide schools with information that can be used for organizational analysis, policy-development and evaluation. SCHOLIS enables pattern analysis, investigating the relationship between factors, as well as simulating alternative policy-measures (e.g. alternative personnel or budget allocations), something which is hardly possible in a non-computer-assisted situation. The potential of SCHOLIS in providing schools with management information can increase since a number of subsystems from the school information system framework still have to be developed and the decentralisation of competences to schools means that new computer applications need to be developed. The flexible basis of SCHOLIS and the fact that a private company takes care of its maintenance means that no serious maintenance (including expansion) problems are likely. In short, SCHOLIS can be a powerful tool for more autonomous schools needing information for policy-development and evaluation. However, the potential role of SCHOLIS should be placed in perspective. The ARS evaluation study and experience gained in the sixties and seventies with sophisticated (usually computerized) management information systems have shown that the use of information in organizations is complicated (McPherson, Crowson & Pitner, 1986). A number of authors have pointed to the complexity of the information and communication element of administrative control and as such have relativized the role of computerized systems. Feldman & March (1981) have shown that the link between the information collected within organizations and the problems involved may be quite weak and that in many instances information is collected that cannot be used. Other information is only gathered and processed to justify decisions already made. Moreover, the measurable receives much more attention than that which cannot be measured.

Mintzberg (1973) has characterized some features of the management process. In his opinion managers rely heavily upon verbal face-to-face information (including gossip, hearsay and speculation), in contrast to formal (like computer-assisted) reporting and communications. They only partly behave according to the stereotyped image of rational problem solvers making a thorough analysis of problems and causes, generating alternative solutions and elaborating the most suitable solution. In reality managers encounter frequent interruptions and changes to the focus of their attention, and decision-making is often done during brief periods. Getting information rapidly can be more important for them than getting it absolutely right. Moreover, the information must be tangible and address specific problems. Thus the degree of usage of aggregated, computer-generated information should be seen in this context.

In connection with the aforegoing Sproull and Zubrow (1981) hold a plea for a *behaviorally* grounded information system. Such a system addresses many modes of collecting information (including personal observation and conversation), communication from a variety of sources (e.g. students, parents, teachers, principals) and varying forms of use (like symbol management and problem solving). In their opinion the fact that administrators rely heavily on observation and face-to-face communication implies that these modes should be systematically incorporated into their evaluation procedures. Only part of the information used can be produced by the computer and therefore other ways of collecting and processing data, including non-rational ones, are used as well.

The usage of computerized information systems is also influenced by certain organizational features of schools. Therefore, some of these school characteristics are discussed now.

Schools can vary concerning their policy-making capacity and a school can also be more able to develop policy in one specific area (e.g. resources) than in another (see the discussion of school characteristics in section 7.3.2). Schools' policy-making capacity in various fields will probably influence the degree to which they will benefit from computer data. If a school did not possess policy-making ability before the computer, its arrival will not change this at once.

The complex relation in educational organizations between cause and effect (especially regarding the teaching process) also relativizes potential computer use. To determine causes of problems like high truancy rates or low test scores which are influenced by many factors is very difficult. Although the computer can show trends and relations between variables, what is caused by what will often remain unsure and as a result

computer data in many cases will not point clearly to what needs to be done in order to solve a problem.
The literature (Cohen, March & Olsen, 1972; Weick, 1982) on decision-making in schools does not portray them as being very decisive policy-makers (see chapter 9). Cohen, March & Olsen have shown that decision-making situations in such institutes often function as 'garbage cans', in which every participant throws in his individual (instead of organizational) problems and goals. This in combination with the aforementioned difficulty of determining cause and effect leads to complicated decision-making processes. Therefore decisions are often put off, or only those decisions are taken that neither threaten any participant, nor solve a particular problem. Moreover, according to Weick the link between decisions and their execution is not strong in schools. In short, the decision-making characteristics in schools imply that policy-making and execution in a computerized situation will be often difficult to accomplish. Relativizing the role of computer-assisted information systems does not imply that these systems are of no importance to policy-making in connection with decentralization. As McPherson, Crowson & Pitner (1986) state, discovering what has been done by collecting information remains the sine qua non of rational managerial control. Putting the potential role of management information systems in perspective was done to show that it should not be expected that these systems will make decentralization something to be easily accomplished. Computerized systems can help schools in coping with this, but next to these systems other modes of data collection and use will also be needed and benefited from. How schools functioned before they used the computer will probably determine the impact and value of the system, rather than the computer determining the quality of school organizations.

*Training computer-assisted policy-making*

The results of the ARS evaluation project showed that by and large schools did not benefit very much from the power of ARS to support policy-making. Next to the reasons discussed under the previous heading this may also have been caused by the fact that the support given to project schools mainly focused on improving registrational use. Maybe the use of computer-assisted systems for policy-development is so complicated that schools need more support to develop it. Even if schools want to benefit from computer-assisted information systems for policy-making, installing these is probably not enough to enable them to benefit from the decision-support possibilities they offer. If schools want to use the computer for this they need to:

- decide which information they need for decision-making and would therefore like to retrieve from the system;

- retrieve data by means of the ARS menu, or by using a query language (the latter is much more complicated since it demands that schools define query statements);
- interpret retrieved data in such a way that the resulting information can be used for decision-making;
- use the information to develop, implement and evaluate school policy.

The second and third condition may be regarded as technical and thus require some training in retrieving and interpreting data. The first and last skills are probably harder to realize. It has already been indicated that schools in general are not considered to be strong policy-makers and evaluators and that installing a computer-assisted system will not automatically transform them into either. Schools need to evaluate school processes critically, to detect problems and causes (if possible) and to try to design, implement and evaluate remedies. Since this in many cases will require organizational development it will probably be a long-winded matter and demand energy from both schools and from those who support them. Policy-making in the resources area will probably be easier than in more sensitive and controversial fields like subject content and didactics, general pedagogic-didactic matters and educational profile (see section 7.3.2). It would be interesting and valuable to investigate whether it is possible to train schools in the skills that are a prerequisite for computer-supported policy-making and, if this proved possible, which training characteristics were the most successful.

*Government suppon*

A number of school information systems can be bought by schools. However, the computer is not yet used intensively by all Dutch schools. Some have installed local area networks and use the computer in all possible areas, whereas others only use a stand alone computer for a few registrational purposes like word processing and test scores registration. Schools can benefit from modern information technology and in the future will probably need it increasingly, for instance as a result of the trend towards decentralizing policy-making. However, the limited financial resources of schools form a barrier: buying and using these systems is too expensive for many schools, certainly if a local area network is planned. Thus the role of the (Dutch) government is important. A government that is aware that computer-assisted school information systems are an important prerequisite for running schools has to create the conditions to enable schools to use these. Funding the SCHOLIS-project and as such determining where the computer can support schools, and developing computer applications is one way of doing so. However, this is not sufficient to promote school administrative computing. The government could, for instance, support the developing of applications not yet

realized by allocating funds to vendors of software packages. It could also support schools by providing them with special resources for school administrative computing. Dutch schools are becoming more autonomous concerning financial resources which means they could spend more on school administrative computing. However, if the total sum of money allocated to a school remains the same, schools cannot use funds for administrative computing for other important matters. If computer-assisted school administration and management are not just considered to be something extra, then it must be made financially possible for schools.
Another possible way of promoting school administrative computing could be the creating of the right conditions for implementing school information systems and for training users to use these systems in registrational and management supportive ways. The ARS evaluation study showed that both forms of system use are far from easy and require careful attention. Just like the government creates possibilities for instruction-related training it could create opportunities for schools to develop their skills in using computer administration.
That schools need information and support concerning CASA is shown among others by the fact that the reports of the pilot study, the SCHOLIS-project, and the ARS evaluation study have been bought by many schools (some of the reports have been reprinted several times) and schools frequently ask for CASA-information. If schools are eager to innovate in this field, then a government that wants them to manage their organization professionally should accept the consequences and assist schools in achieving this.

*Research needed*

School administrative computing has become a new research and design area during the last decade. When the pilot study was executed in 1985 CASA did not exist on a large scale and literature mainly included descriptions of software development activities and of the support available applications offered (e.g. Schmidt-Belz, 1980; Brands, 1983; Bird, 1984). This has changed, which can for instance be concluded from the fact that the *Journal of Research on Computing in Education* in 1991 published a special issue called *Computer Assisted School Administration and Management: An International Analysis* (editors Visscher, Spuck & Bozeman, 1991) in which authors from seven countries on the basis of an analysis framework (Visscher, 1991) analysed the developmental stages CASA had gone through in their country, discussed the areas in which the computer can provide support and presented research data on the development, use and impact of school administrative information systems. The special issue concluded with a state-of-the-art article (Visscher and

Spuck, 1991) in which the CASA situation in seven nations is discussed, as well as desirable strate ,ies for developing and implementing CASA and research questions that need to be addressed.

Investigating system usage and effects of school information subsystems is difficult and requires many resources. The group of schools in which such studies are executed has to be fairly large to be able to draw general conclusions. All project schools have to receive a rather costly computer-assisted information system as well as support for system implementation. Longitudinal projects (which are often necessary) including process studies to determine system use also demand large sums of money. Although the aforementioned factors make this type of study not easy to realise, research projects are essential that provide a better insight on, among others:

- advantages and disadvantages of various strategies for designing school information systems;
- characteristics of good information systems in terms of the support they offer and other features that are judged positively by users;
- features of implementation processes that are crucial for successful implementation;
- the way in which the nature of school organizations and school management interact with information system characteristics;
- the extent and the way in which various computer applications are used within schools plus the desired (e.g. an increased problem-solving capacity) and undesired effects this produces.

## REFERENCES


AG-REPORT (1985). Management magazine van de Automatiseringsgids [Management Magazine of the Automation Guide], bijlage bij nr. 41, 19-37

Ahituv, N., & Neumann, S. (1982). Principles of Information Systems for Management. Dubuque, Iowa: Wm. C. Brown Co Publishers.

Babeliowsky, M. (1986). Voortijdig schoolverlaten in Amsterdam [School drop-out in Amsterdam]. Amsterdam: SCO.

Bailey, J.E., & Pearson, S.W. (1983). Development of a tool for measuring and analyzing computer user satisfaction. Management Science, 29(5), 530-545.

Baum, Th. (1978). Surveys of absenteeism: a question of timing. Educational Research, 20(3), 226-230.

Bemelmans, Th.M.A. (Ed.) (1984). Beyond Productivity: information systems development for organizational effectiveness. Amsterdam: Elsevier Science Publishers.

Bennet, J., & Lancaster, D. (1986). Management Information Systems in Further Education: some observations on design and implementation. Journal of Further and Higher Education, 10(3), 35-49.

Benson, D.H. (1983). A field study of end-user computing. Communications of the ACM, 26(10), 776-784.

Bergsma, M. (1986). Implementatie van technologische innovaties en factoren die daarop van invloed zijn [Implementation of technological innovations and factors that influence this]. Ph.D. thesis. Enschede: Department of Education, University of Twente.

Berman, P., McLaughin, M.W., Bass, G., Pauly, E., & Zellman, G. (1977). Federal programs supporting educational change, Vol. VII: Rand Corporation: Factors affecting implementation and continuation. Santa Monica, CA.: Rand Corporation.

Bird, P. (1984). Micro computers in school administration. London: Hutchinson.

Bjöm-Andersen, N. (Ed.) (1980). The human side of information processing. Amsterdam: North Holland Publishing Company.

Bjöm-Andersen, N., Eason, K., & Robey, D. (1986). Managing computer impact. New Yersey: Ablex Publishing Corporation.

Blacker, F., & Brown, C. (1986). Theory and Practice in Evaluation. The case of the new information technologies. In Bjöm-Andersen, N. & Davis, G.B., Information Systems Assessment. Amsterdam: North Holland Publishing Company.

Bos, K.Tj., van Kesteren, B.J., Stoel, W.G.R., & Vermeulen, C.J.A.J. (1990). Schoolverzuim: maatregelen die scholen (kunnen) nemen [Truancy: measures that schools (can) take]. Amsterdam: Swets & Zeitlinger.

Bos, K.Tj., Ruijters, A.M., & Visscher, A.J. (1990a). Truancy, drop-out, class-repeating and their relation with school characteristics. Educational Research, 32(3), 175-185.

Bos, K.Tj., Ruijters, A.M., & Visscher, A.J. (1990b). Absenteeïsme in het voortgezet onderwijs [Absenteeism in secondary education]. Pedagogische Studiën, 67(8), 341-354.

Bosse, L. (1978). Hoe als organisatie om te gaan met automatisering [How an organization should handle automation]. In R. van de Vlist (Ed.), Organisaties en computers. Deventer: Kluwer.

Brands, J.A. (1983). Enkele aspecten van het werken met computers op school [Some aspects of working with computers in school]. MESO, 14(3), 25-28.

Breiling, A., Haunhorst, H., & Mambrey, P. (1983). Informationssysteme für den Schulbetrieb [Information systems for school administration]. Schulpraxis, 3(6), 36-39.

Buchanan, D.A., & Broddy, D. (1983). Organizations in the computer age. Aldershot: Gower Press.

Camillus, J.C., & Lederer, A.L. (1985). Corporate Strategy and the design of Computerized Information Systems. Sloan Management Review, Spring, 35-42.

Capper, L. (1986). Post-implementation Assessment of Information Systems Applications: Notes from Personal Experiences. In Björn-Andersen, N. & Davis, G.B., Information Systems Assessment. Amsterdam: North Holland Publishing Company.

Cohen, M.D., March, J.G., & Olsen, J.P. (1972). A garbage-can model of organizational choice. Administrative Science Quarterly, 17, 1-25.

Cook, T.D., & Campbell, D.T. (1979). Quasi-experimentation, design and analysis. Chicago: Rand McNally.

Cornelis, P.A., & van Oorschot, J.M. (Eds.) (1986). Automatiseren met een menselijk gezicht [Automating with a human face]. Deventer: Kluwer.

Cyert, M., & March, J.G. (1963). A Behavioral Theory of the Firm. Englewood Cliffs: Prentice-Hall.

Essink, L.J.B., & Romkema, H.M. (1989). Een computerondersteund schoolinformatiesysteem voor het avo/vwo; deel II: De functionele beschrijvingen [A computer-assisted school information system for general secondary and pre-university schools; part II: The functional descriptions]. Enschede: Department of Education, University of Twente.

Essink, L.J.B., & Visscher, A.J. (1989a). Een computerondersteund schoolinformatiesysteem voor het avo/vwo; deel I: Analyse en informatiesysteemraamwerk [A computer-assisted school information system for general secondary and pre-university education; part I: Analysis and information system framework]. Enschede: Department of Education, University of Twente.

Essink, L.J.B., & Visscher, A.J. (1989b). Een computerondersteund schoolinformatiesysteem voor het avo/vwo; Bijlagen bij deel I; Het informatiesysteemraamwerk [A computer-assisted school information system for general secondary and pre-university schools; Appendices of part I: The information system framework]. Enschede: Department of Education, University of Twente.

Feldman, M.S., & March, J.G. (1981). Information in Organizations as Signal and Symbol. Administrative Science Quarterly, 26, June, 171-186.

Fullan, M. (1982). The meaning of educational change. New York: Teachers College Press.

Fung, A.C.W. (1988). Trends and developments in computer-aided school administration. Proceedings Microcomputers in Education Conference. Hong Kong, A-20 - A-28.

Ganzevoort, W. (1985). Ontwerpen en ontwikkelen, de veranderkundige dimensies van het organiseren [Designing and developing, the change dimensions of organizing]. M&O, 1(39), 56-67.

Gross, N., Giacquinta, J.B., & Bernstein, M. (1971). Implementing Organizational Innovations: a sociological analysis of Planned Educational Change. New York: Basic Books.

Hammink, R.J. (1979). Administratieve automatisering in Nederland 1976-1981 [Clerical automation in the Netherlands 1976-1981]. Amsterdam: NIVO.

Havelock, R.G. (1969). Planning for innovation through dissemination and utilization of knowledge. Ann Arbor: Center for Utilization of Scientific Knowledge of the Institute for Social Research.

Hedberg, B. (1980). Using computerized information systems to design better organisations. In N. Bjõrn-Andersen (Ed.), The Human Side of Information Processing. Amsterdam: North Holland Publishing Company.

Hirschheim, R., & Smithson, S. (1986). A Critical Analysis of Information Systems Evaluation. In Bjõrn-Andersen & Davis, G.B., Information Systems Assessment. Amsterdam: North Holland Publishing Company.

Huntington, F. (1983). The microcomputer in the administrative office. AEDS Journal, 17, 90-97.

Ivies, B., Olson, M.H., & Baroudi, J.J. (1983). The measurement of user information satisfaction. Communications of the ACM, 26(10), 785-793.

Jones, K., & Dukes, T. (1983). Microcomputers in school administrative management. Educational Technology, 23(3), 38-39.

Karweit, N. (1973). Rainy days and Mondays. An analysis of factors related to absence from school. Baltimore (Maryland): John Hopkins University.

Keen, P.G.W. (1981). Information systems and organizational change. Communications of the ACM, 24(1), 24-33.

Kempen, P.M. (1976). Automatisering: een veranderingsproces [Automation: a change process]. Managers en computers: de computer als managementinstrument (pp. 1200-1 - 1200-25). Alphen aan den Rijn: Samsom.

Khandwalla, P.N. (1977). The design of organizations. New York: Harcourt Brace.

Kwon, T.H., & Zmud, R.W. (1987). Unifying the fragmented models of information system implementation. In Boland, R.J. & Hirschheim, R.A., Critical issues in information systems research. Chichester: John Wiley & Sons.

Lancaster, D. (1985). The response to and impact of Information Technology in Schools and Colleges: the key individuals. Educational Management and Administration, 13, 140-145.

Lucas, H.C. Jr. (1975). Why information systems fail. New York: Columbia University Press.

Malany, G.D., & Grives, J.E. (1986). Microcomputers in graduate school administration. Journal of Educational Technology Systems, 15(1), 91-115.

Malmberg (1984). Een schooladministratie is niet zomaar wat gegevens verwerken [A school office is not just a matter of processing some data]. Den Bosch: Malmberg Publishing Company.

Marshall, D.G. (1982). Purchasing a microprocessor system for administrative use in schools. AEDS Journal, 15, 193-214.

Marx, E.C.H. (1975). De organisatie van scholengemeenschappen in onderwijskundige optiek [The organization of comprehensive schools from an educational point of view]. Groningen: Wolters-Noordhoff.

Mayntz, R. (1984). Information Systems and Organizational Effectiveness: The Social Perspective. In Bemelmans, Th., Beyond Productivity Information Systems Development for Organizational Effectivenss. Amsterdam: Elsevier Science Publishers.

McPherson, R.B., Crowson, R., & Pitner, N.J. (1986). Managing Uncertainty: administrative theory and practice in education. Columbus: C.E. Merril Publishing Company.

Mertens, P. (1986). The NSI-Project: Nutzen und Schaden der Informationsverarbeitung. Working paper for the IFIP WG 8.2 Working Conference on Information Systems Assessment.

Miniware (1985). School 2000: effectief schoolmanagement [School 2000: effective school management]. Maastricht: Miniware Software House.

Mintzberg, H. (1973). The nature of managerial work. New York: Harper & Row.

Mintzberg, H. (1979). The structuring of organizations. Englewood Cliffs: Prentice Hall.

Mumford, E. (1980). The participative design of clerical information systems - two case studies. In N. Björn-Andersen (Ed.), The Human Side of Information Processing. Amsterdam: North Holland Publishing Company.

Mumford E., & Weir, M. (1979). Computer systems in work design - the ETHICS method: effective technical and human implementation of computer systems. London: Associated Business Press.

Nath, R. (1989). Associations between User Training and Information Systems Success. International Journal of Information Management, 9, 259-265.

Nolan, R.L. (1975). Managing the crisis in data processing. Harvard Business Review, 57(2), 115-126.

Nolan, R.L. (1977). Restructuring the data processing organisation for data resource management. In B. Gilchrist (Ed.), Information Processing 77, Proceedings of IFIP Congress 77. Amsterdam, The Netherlands: North Holland Publishing Company.

O'Brien, C.J., Merriam, E., Rule, D.L., & Chapman, D.W. (1989). Information Systems Adoption: a study in implomentation. New York: University at Albany.

Olson, M.H., & Lucas, H.C. (1982). The impact of office automation on the organization: Some implications for research and practice. Communications of the ACM, 25(11), 838-847.

Pearson, S. (1977). Measurement of computer user satisfaction. Ph.D. thesis, Tempe: Arizona State University.

Petzko, V.N. (1990). The relationship of characteristics of large, metropolitan high schools to school attendance rates. Ph.D. thesis, Minnesota: University of Minnesota.

Piercy, N. (Ed.) (1987). Management Information Systems. New York: Nichols Publishing Company.

Pogrow, S. (1983). Education in the computer age: issues of policy, practice and reform. Beverly Hills: Sage Publishers.

Robey, D. (1979). User Attitudes and Management Information Use. Academy of Management Journal, 22(3), 527-538.

Robey, D., & Bakr, M.M. (1978). Task redesign: Individual moderating and novelty effects. Human Relations, 38(8), 689-701.

Robey, D., & Zeller, R.F. (1978). Factors affecting the success and failure of an information system for product quality. Interfaces, 8(2), 70-75.

Rodriguez, J.I. (1977). The Design and Evaluation of a Strategic Issue Competitive Information System. Ph.D. thesis. Pittsburg: University of Pittsburg.

Rogers, E.M. (1983). Diffusion of innovations. New York: The Free Press, MacMillan Publishing.

Rogers, E.M., & Shoemaker, F.F. (1971). Communication of Innovations. New York: The Free Press, MacMillan Publishing.

Romkema, H.M. (1986). Beoordelen van de vierde generatie software pakketten PC/FOCUS en ORACLE op hun geschiktheid voor prototypen [Evaluating the fourth generation software packages PC/FOCUS and ORACLE on their suitability for prototyping]. Enschede: Department of Computer Science, University of Twente.

Rutter, M., Maughan, B., Mortimore, P., Ouston, J., & Smith, A. (1979). Fifteen thousand hours. Cambridge: Harvard University Press.

Scheepmaker, B. (1964). Organisatie en automatisering [Organisation and automation]. Utrecht/Antwerpen: Spectrum.

Schein, E.H. (1969). Process consultation: its role in organization development. Reading, MA: Addison-Wesley.

Schmidt-Belz, B. (1980). Computer für die Schulverwaltung, eine Diskussion bisheriger Entwicklungen [Computer for school administration, a discussion of the developments up to now]. Bonn: Gesellschaft für Mathematik und Datenverarbeitung.

Splittgerber, F.L., & Stirzaker, A. (1984). Computer technology for administrative information and instructional management in school districts. Educational Technology, 24(2), 36-38.

Sproull, L.S., & Zubrow, D. (1981). Performance information in schools systems: perspectives from organization theory. Educational Administration Quarterly, 17(3), 61-79.

Spuck, D.W., & Atkinson, G. (1983). Administrative use of the microcomputer. AEDS Journal, 17, 83-90.

Stasz, C., Bikson, T.K., & Shapiro, N.Z. (1986). Assessing the forest service's implementation of an agencywide information system: An exploratory study. Santa Monica, CA.: Rand Corporation.

Strassman, P.A. (1985). Information Pay off. New York: The Free Press.

Talley, S. (1983). Selection and acquisition of administrative micro computer software. AEDS Journal, 17, 69-82.

Tomasso, C. (1982). Computers in school administration. Media in education and development, 16(3), 113-115.

Tomasso, C. (1984). SCAMP Project, background paper. Glasgow: School Computer Administration & Management Project.

Tomasso, C. (1985). What's in a name - SCAMP. In K. Duncan & D. Harris (Eds.), Computers in Education, proceedings of the IFIP TC3 4th world conference on computers in education (pp. 989-994). Amsterdam: North-Holland Publishing Company.

Uhlig, R.P., Farber, D.J., & Bain, J.H. (1979). The Office of the Future: communication and computers. Amsterdam/New York: North Holland Book Company.

van Herk, L.J. (1985). Korte beschrijving van het geautomatiseerd schoolinformatiesysteem Schoolfact [Brief description of the automated school information system Schoolfact]. Amsterdam: Computer Management Group.

van Hulzen, J.J.P., & de Moel, R.P. (1987). Gedrags-/prestatiekarakteristieken van informatievoorziening [Behavioral/performance characteristics of information supply]. Informatie, 29(3), 254-261.

van Marwijk Kooij-von Baumhauer, L. (1984). Scholen verschillen [Schools differ]. Ph.D. thesis. Rotterdam: Erasmus University.

van Strien, P.J. (1975). Naar een methodologie van het praktijkdenken in de sociale wetenschappen [Towards a methodology for practice-oriented thinking in social sciences]. Nederlands Tijdschrift voor de Psychologie, 30, 601-619.

van Weenen, B. (1980). Computer, arbeid en organisatie [Computer, labour and organisation]. Alphen a/d Rijn: Samsom.

van der Krogt, F.J. (1983). Probleemoplossing in scholen [Problem solving in schools]. Ph.D. thesis. Leiden: State University of Leiden.

van der Krogt, F.J., & Oosting, J. (1988). Relaties tussen scholen en hun omgeving: een onderzoek naar de exteme contacten en het arbeidsmarktbeleid van MBO-scholen [Relations between schools and their environment; a study of external contacts and labour market policy of MBO-schools]. Enschede: Centre for Applied Research on Education, University of Twente.

van der Krogt, F.J., & Verhaaren, F.J.L.M. (1986). Beleidsvorming in professionele instellingen: ritueel of bezieling? [Policy-making in professional institutions: ritual or inspiration?], M&O, 40, 454-469.

van der Vlist, R. (Ed.) (1978). Organisaties en computers [Organisations and computers]. Deventer: Kluwer.

Visscher, A.J. (1988). The computer as an administrative tool: Problems and impact. Journal of Research on Computing in Education, 21(1), 28-35.

Visscher, A.J. (1991). School Administrative Computing: a Framework for Analysis. Journal of Research on Computing in Education, 24(1), 1-19.

Visscher, A.J., & Bos, K.Tj. (1991). Evaluatie van het gebruik van een computerondersteund absentieregistratiesysteem. Een longitudinaal onderzoek in scholen voor voortgezet onderwijs in de periode 1988-1991 [Evaluation of the use of a computer-assisted attendance registration system. A longitudinal research project in secondary schools between 1988 and 1991]. Enschede: Centre for Applied Research on Education, University of Twente.

Visscher, A.J., & Spuck, D.W. (1991). Computer-Assisted School Administration and Management: the State of the Art in Seven Nations. Journal of Research on Computing in Education, 24(1), 146-168.

Visscher, A.J., Spuck, D.W., & Bozeman, W.C. (Eds.) (1991). Computer Assisted School Administration and Management: An International Analysis. Special issue of the Journal of Research on Computing in Education, 24(1).

Visscher, A.J., & Vloon, W.J. (1986a). Schooladministratie en schoolmanagement met behulp van de computer: mogelijkheden en effecten [School administration and management by means of the computer; possiblities and effects]. Enschede: Department of Education, University of Twente.

Visscher, A.J., & Vloon, W.J. (1986b). Administratie, management en computers: zeven schoolbeschrijvingen [Administration, management and computers: seven school descriptions]. Enschede: Department of Education, University of Twente.

Vloon, W.J. (1986). De computer in de school: de school in de computer: het gebruik van de computer voor administratie en management op scholen [The computer in the school: the school in the computer; the use of the computer for school administration and management]. 's-Gravenhage: Staatsdrukkerij.

Võllmar, H. (1985). De organisatie-aspecten van de automatisering [The organizational aspects of automation]. Leiden: Stenfert Kroesse.

Vries, G.C. de, & Peetsma, Th. (1987). Voortijdig schoolverlaten en spijbelen in het voortgezet onderwijs. Resultaten van onderzoek betreffende het schooljaar 1984-1985 [Drop-out and truancy in secondary education. Results of research concerning the school year 1984-1985]. Amsterdam: SCO.

Weick, K.E. (1982). Administering Education in Loosely Coupled Schools. Phi Delta Kappan, 673-676.

Wentink, T., & Zanders, H. (1985). Kantoren in actie [Offices in action]. Deventer: Kluwer.

Witsenboer, J.A. (1985). Prototyping: een evaluatie [Prototyping: an evaluation]. Enschede: Department of Computer Science, University of Twente.

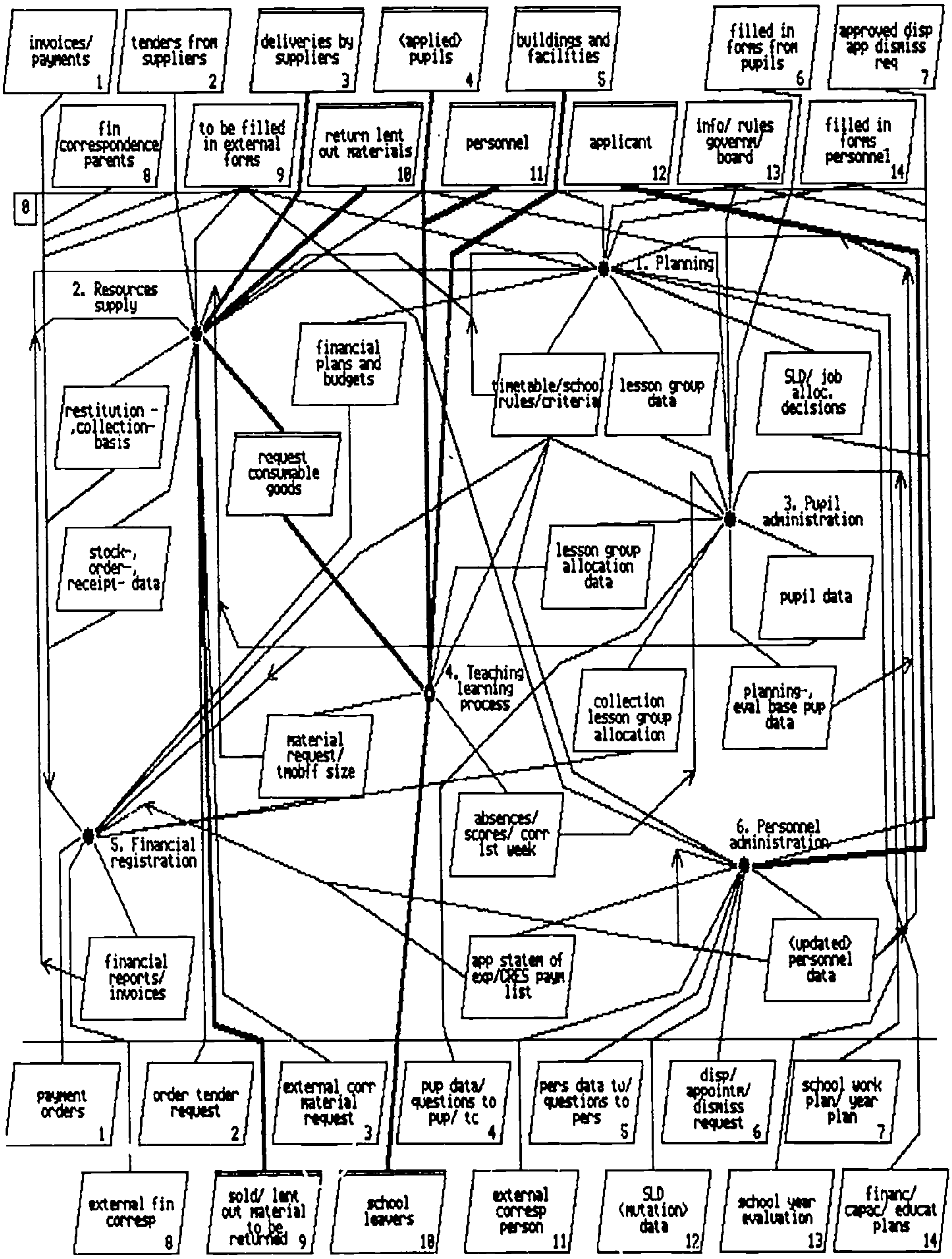
Witziers, B. (1992). Coõrdinatie binnen scholen voor voortgezet onderwijs [Coordination within secondary schools]. Enschede: Department of Education, University of Twente.

Zanders, H.L.G. (1986). Ervaringen bij automatisering. Een analyse van persoonlijke kenmerken [Experiences with automation. An analysis of personal characteristics]. In Segers, J.H.G. & Bijnen, E.J. (Eds.), Onderzoeker: reflecteren en meten. Tilburg: Tilburgse Universiteitsdrukkerij.

Zisman, M. (1978). Office Automation or Evolution? Sloan Management Review, Spring 1978.

## Appendix 1: School diagram

Diagram : A-schema
Name : School

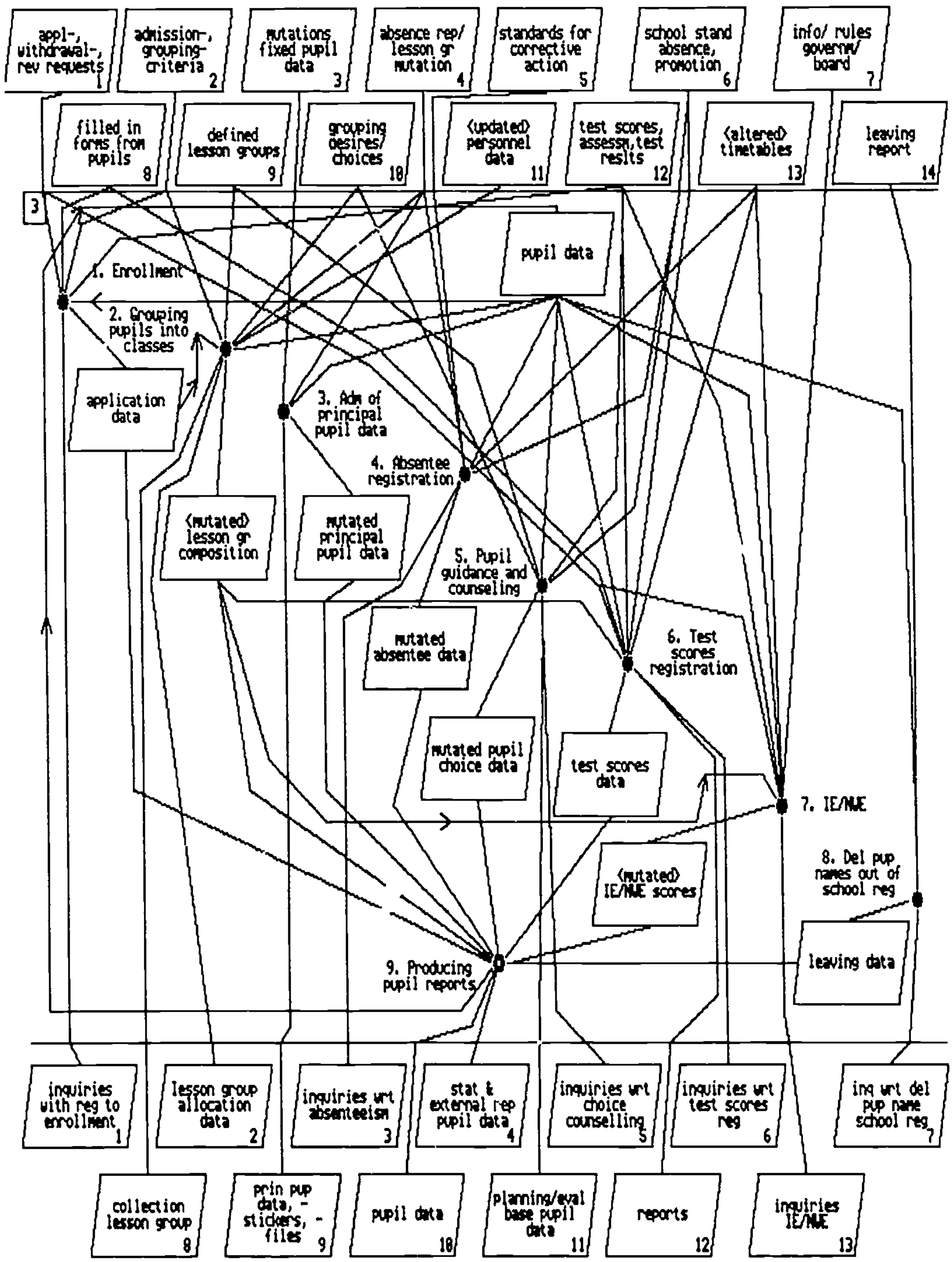





BEST COPY AVAILABLE

Appendix 2: Pupil administration diagram

Diagram : A-schema
Name : 3 Pupil administration








BEST COPY AVAILABLE

Appendix 2.1: Diagrams of pupil administration subsystems

Diagram : A-schema
Name : 3.1 Enrollment

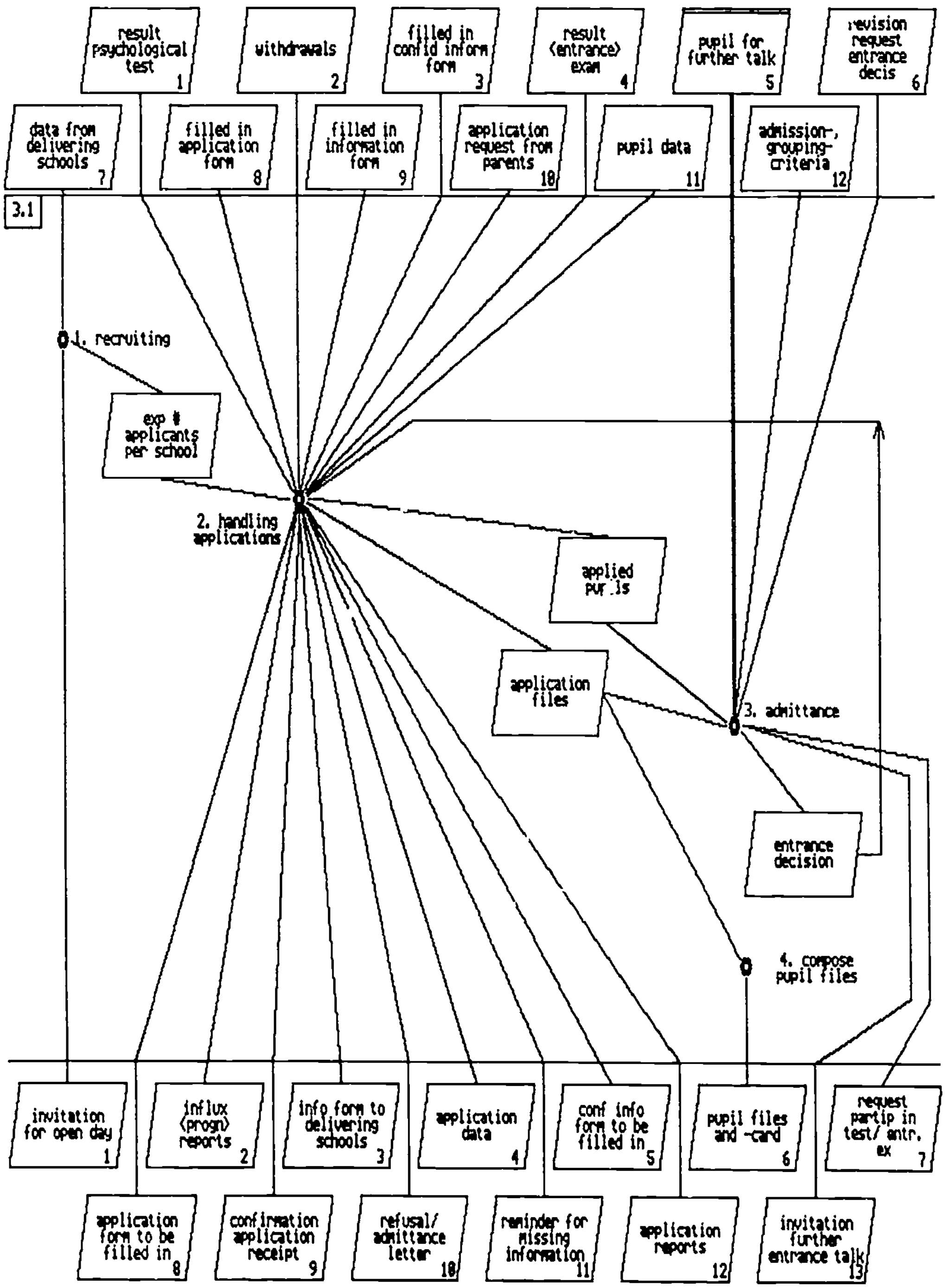
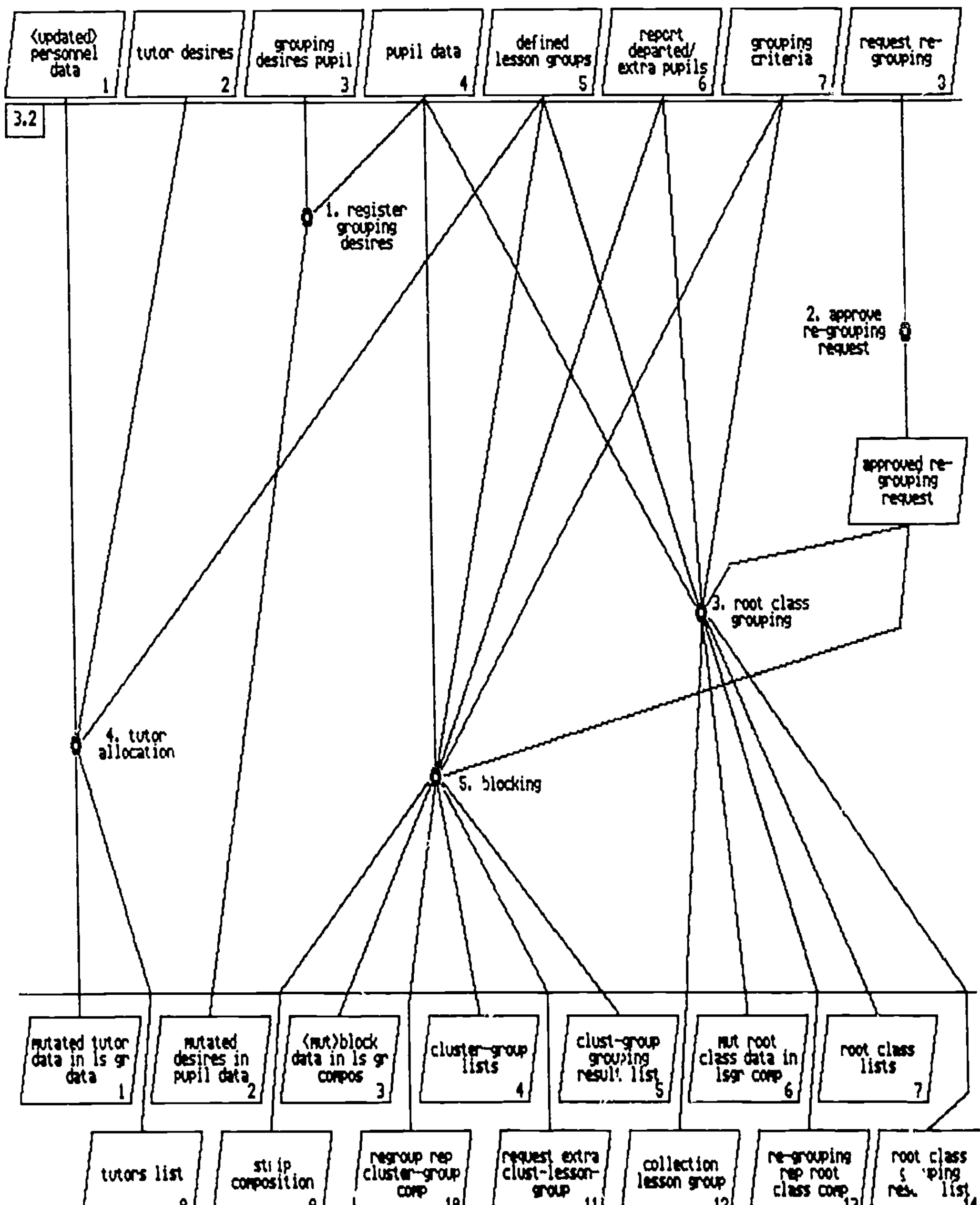


Diagram : A-schema
Name : 3.2 Grouping pupils into classes






 BEST COPY AVAILABLE

Diagram : A-schema
Name : 3.3 Adm of principal pupil data

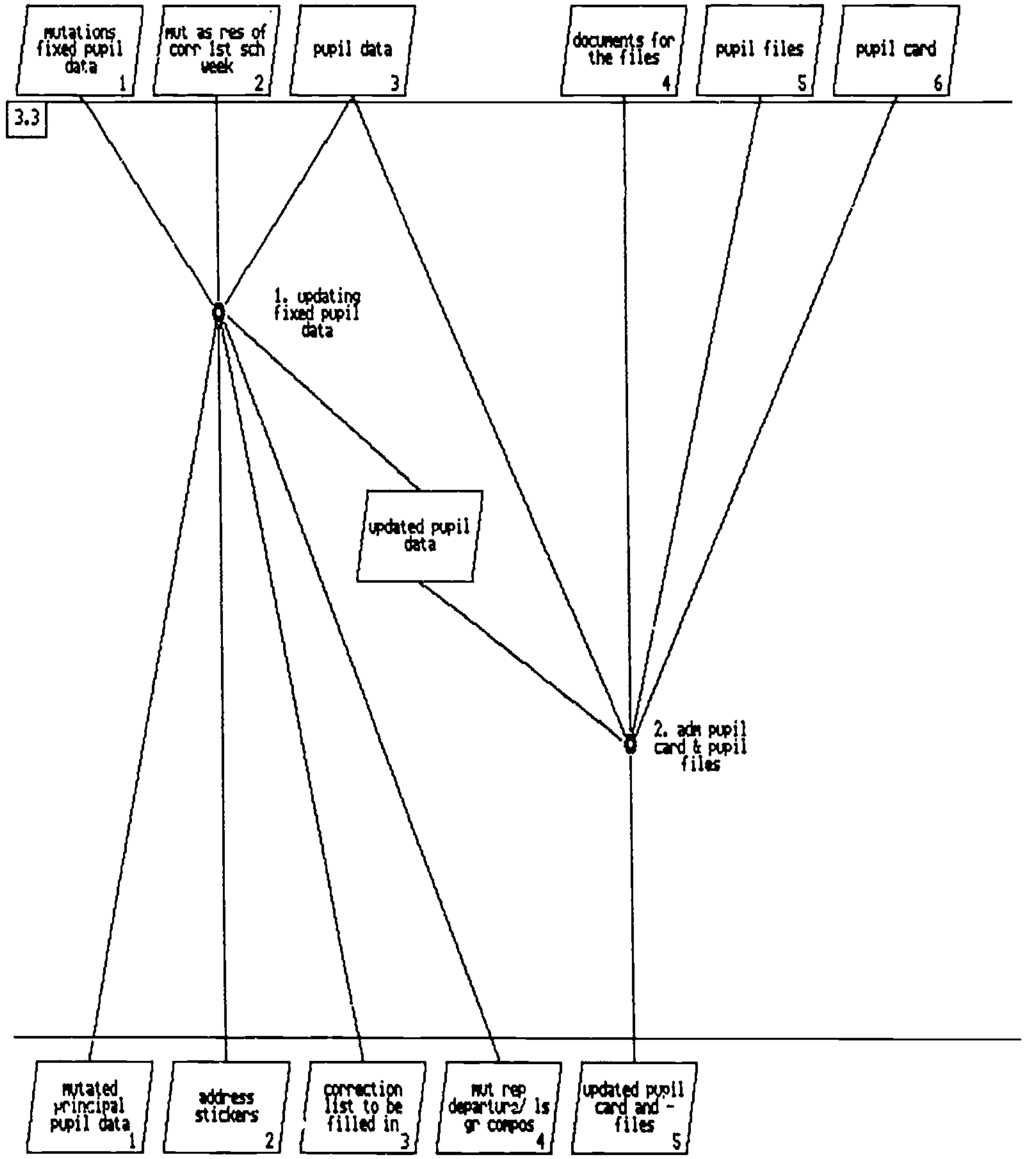


Diagram : A-schema
Name : 3.4 Absentee registration

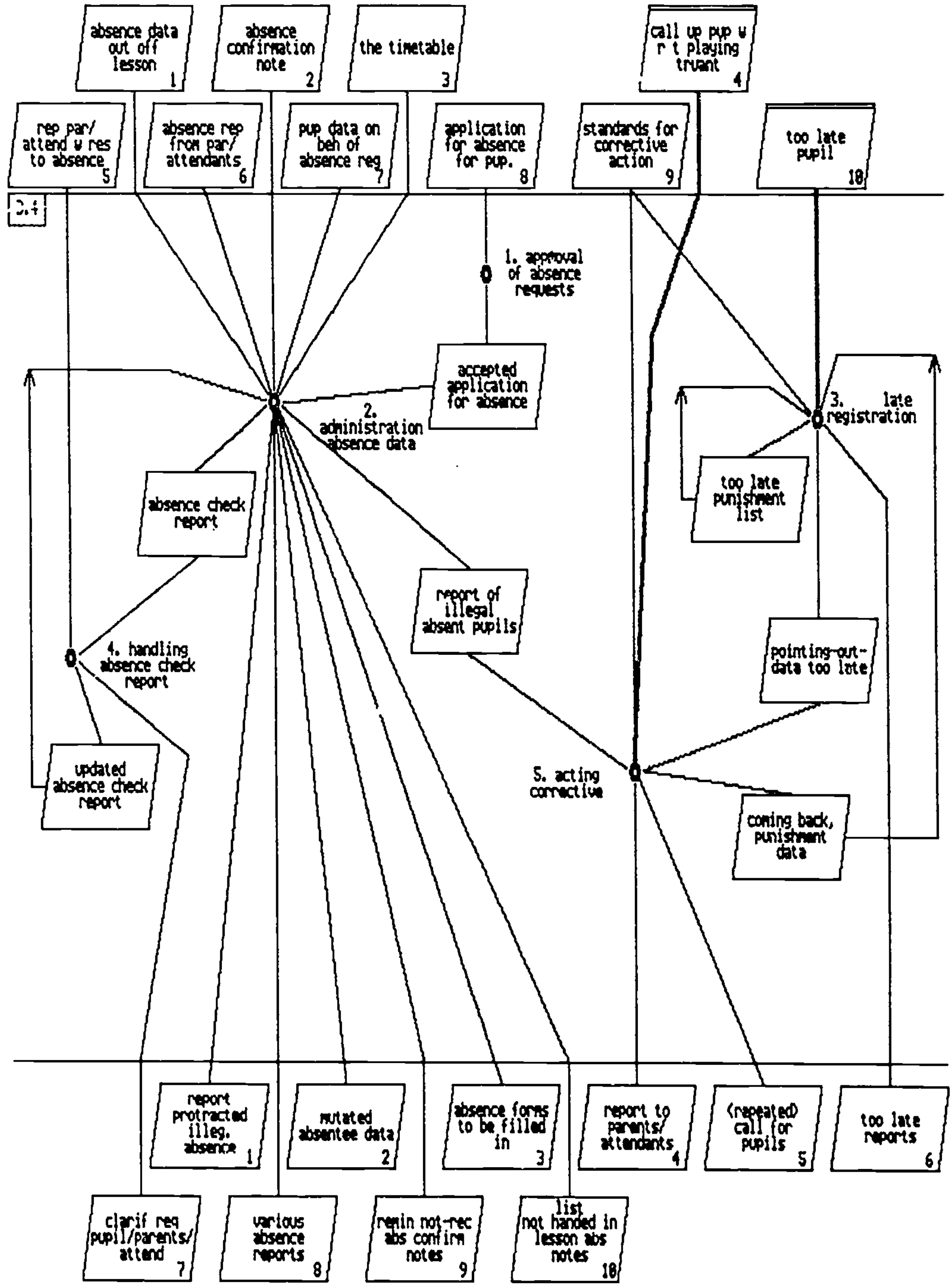


Diagram : A-schema
Name : 3.5 Pupil guidance and counseling

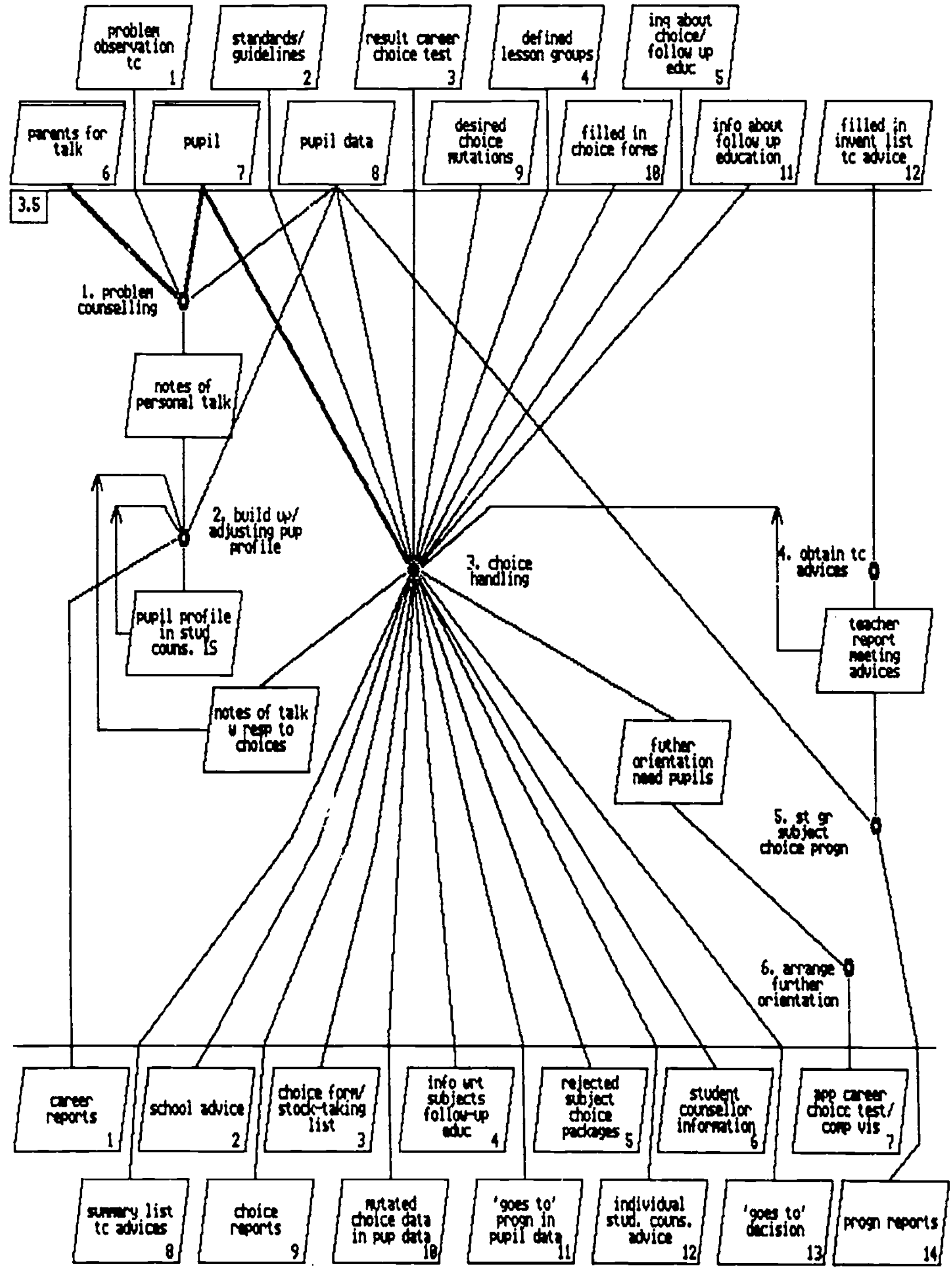
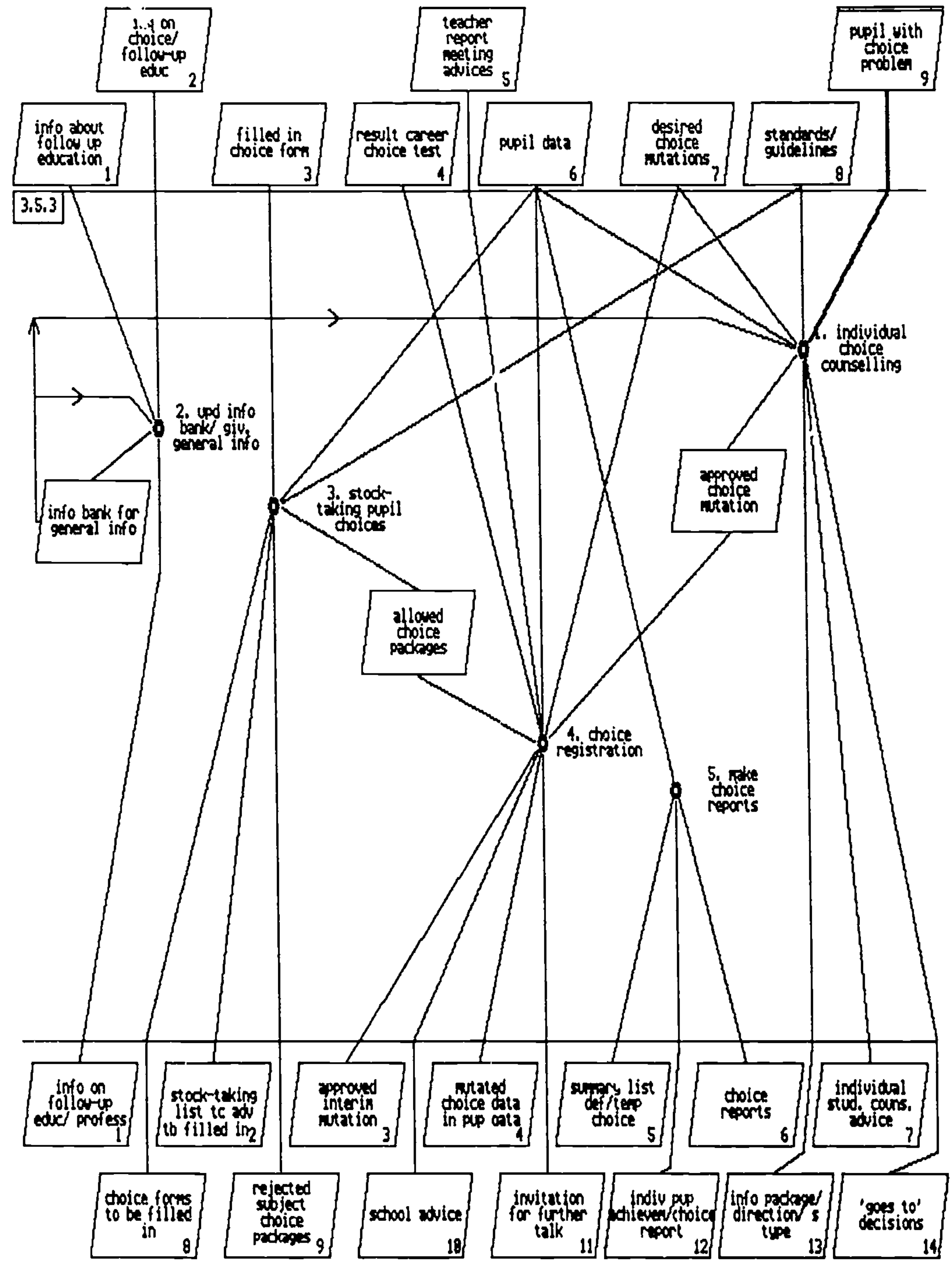


Diagram : A-schema
Name : 3.5.3 choice handling






235 BEST COPY AVAILABLE

Diagram : A-schema
Name : 3.6 Test scores registration

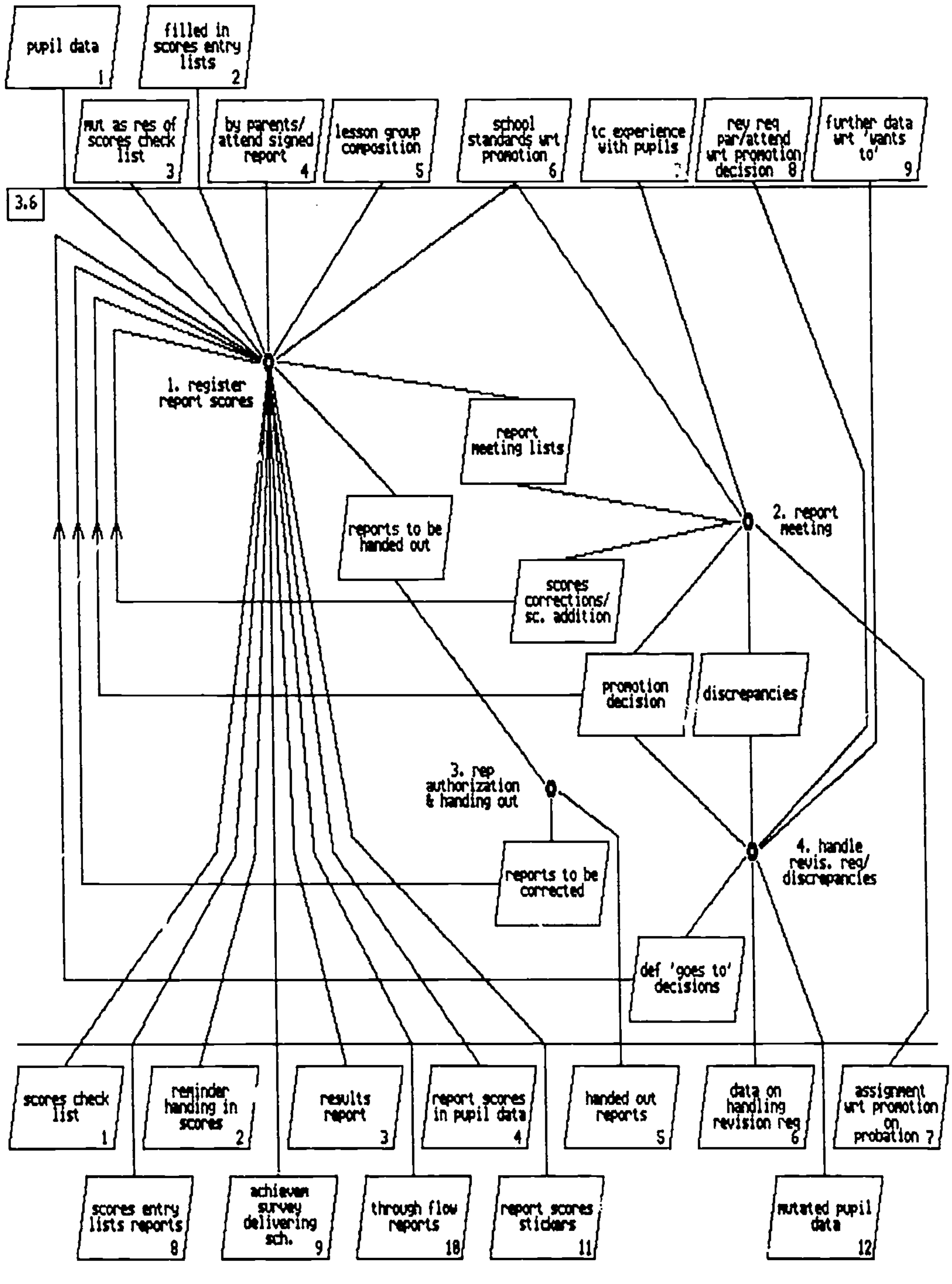


Diagram : A-schema
Name : 3.7 IE/NWE

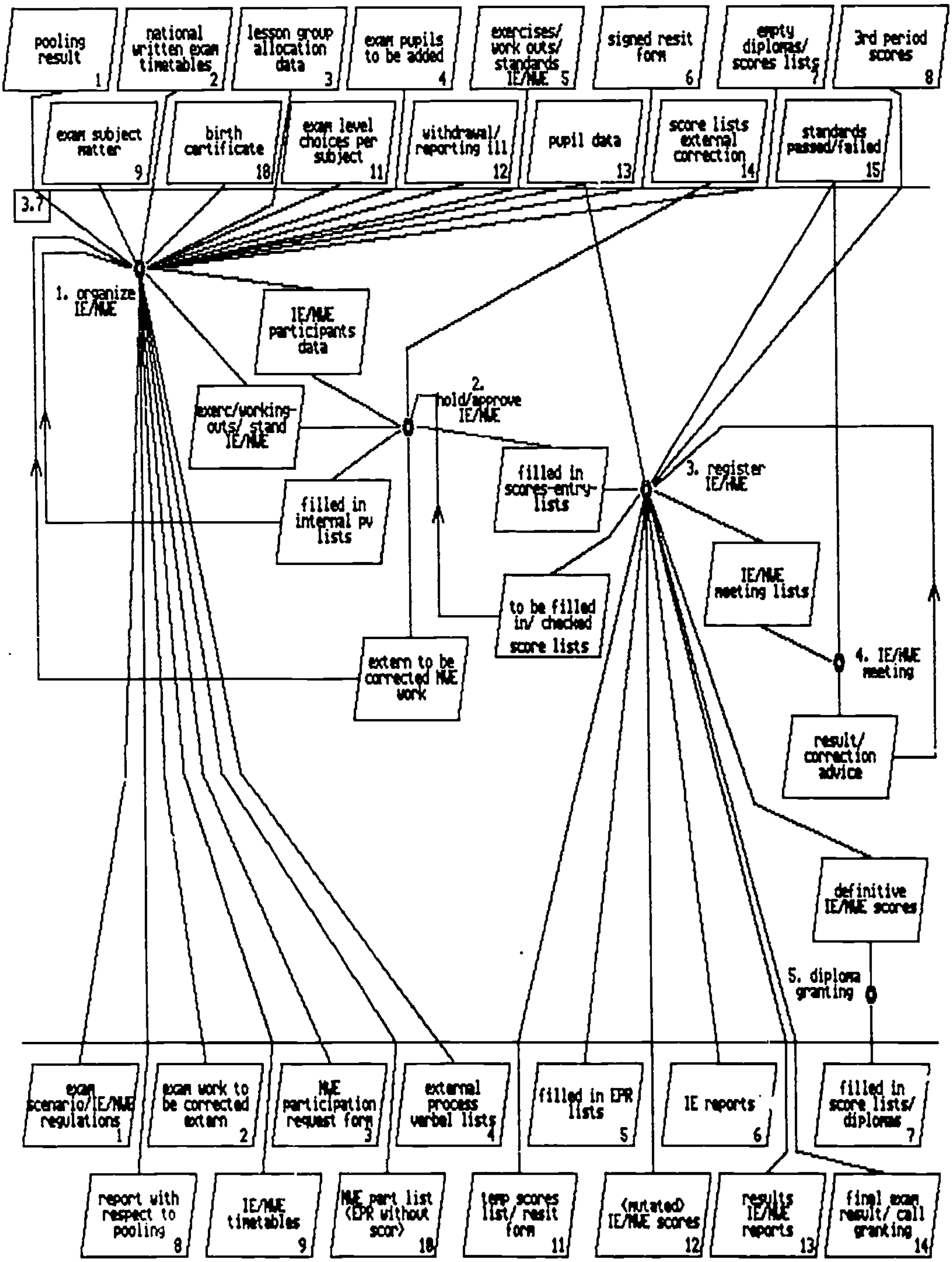
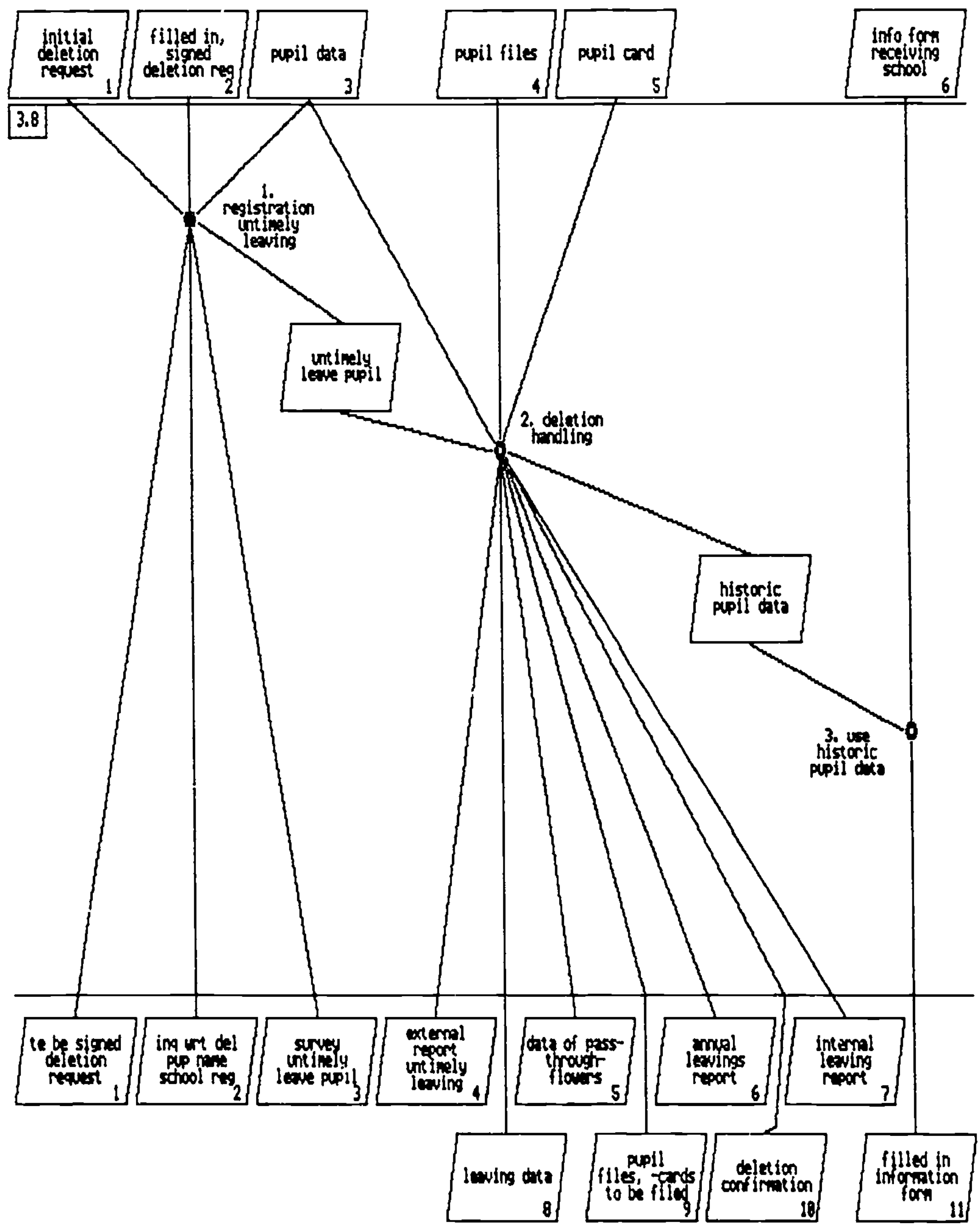


Diagram : A-schema
Name : 3.8 Del pup names out of school reg



**Appendix 2.2: Elementary activities of Absentee registration**

Before the elementary activities are presented first some general remarks on the way the Absentee registration subsystem is structured using a set of elementary activities.

Coming late is considered as a specific form of absence in this subsystem. Every student can be registered as late for every lesson period and late check reports can be made. In case of coming late during the first lesson period a student should always get a late note. It is assumed that students who come late are handled by the janitor, who gives them a note so that:

- a teacher does not have to register lateness (keeping the teaching time maximal);
- always having to do this has a preventive influence;
- a sound registration exists: teachers register the hour of arrival of students coming late and the janitor then checks for possible deviations between the hour of arrival in school and the arrival in the classroom.

A student who arrives late during the second, third, etc. lesson period in the proposed system should also get a late note from the janitor. If a student has been late more often than X times he/she should report himself to the janitor/deputy head, who will then punish the student.

Within the lower school grades a class book is used to register absenteeism, within the upper grades lesson absence notes which are collected by a janitor, or teacher-day-absence reports. On the latter teachers write down all absences for the lessons given after their last lesson period which is then sent to the absence registration staff.

The smallest absence period that can be registered is a lesson period. The school itself decides if it registers the absences of every lesson period or not. In some schools lesson absence notes are only collected during the first, third and fifth lesson period and for a lesson period during which a test is given.

In the proposed elementary activities teachers should hand-in a lesson absence note for every lesson period they take care of and for which the school has decided lesson absence notes should be handed in. So, teachers should also hand in lesson absence notes for a lesson period when there did not prove to be any absences!

In case of absenteeism a distinction is made between the absence reason, the type of lesson period during which a student was absent (normal, self-study, test), legal/illegal absence, and the state of an absence (handled/not handled, being considered). The school can use the whole alphabet for coding the reasons for absence, but for every letter used a reason should be agreed upon as well as whether the reason is legal or illegal.

Example of codes:

| | |
|---|---|
| G (= gone home ill), illegal | A (= absent), illegal |
| I (= ill), legal | P (= private), legal |
| D (= doctor), legal | L (= late), illegal |

'Absent' (code A) means:

1. a student played truant; in this case the state of an absence is 'handled' (handling code H)
2. reason unknown; the state of an absence is 'not handled' (code N), or 'being considered' (code B).

Sometimes 'private' is used as absence reason, namely when it is undesirable for a student's privacy that the absence reason is specified. Where 'private' it is assumed that the absence is legal.

An absence with a legal reason is always 'handled' (code H), only for an illegal absence the absence code can be B or N (not handled); together B and N include all not-handled absences.

The state of an absence (code H, N, B) is especially relevant for absence control reports (these list all absences about which an absence-deputy head of a specific school type grade should be informed and which he uses to track down absents-without-reason). When an absence has been handled, it can be cancelled from the absence control report. The school is free to decide whether it likes to have legal absences on the absence control report or only illegal absences.

<u>Elementary activities</u>

| A. <u>Coming late</u> | | **type of activity*** |
|---|---|---|
| 1a. | A student comes late and has to get a late note from the janitor. | out of scope |
| 1b. | Students report themselves to the janitor/teacher who writes a late note for them. | 2 |

---

* See Figure 2 in chapter 4 for an overview of all possible organizational activities: out of scope, non-formalizable (code 1), manual (code 2), automatizable (code 3), machine tasks (code 3a), man-machine tasks (code 3b).

| | | type of activity |
|---|---|---|
| 2a. | The janitor registers late students behind their names on the late list. | 2/3b |
| 2b. | A one-period late list is made for each root class. | 3b |
| 2c. | On the basis of the late list and school standards, the janitor decides which students have to come back and when. | 2 |
| 2d. | Every day the janitor produces a late/come-back list indicating students who have been late more often than X times and when and where they have to report themselves. | 2/3a |
| 2e. | The late/come-back list is sent to the deputy head to whom students have to report themselves. | 2 |
| 3. | The teacher writes down the hour of arrival in the classroom of a late student on a late note and/or in the class book c.q. on lesson absence notes. | out of scope |
| 4. | The late notes are brought to the janitor (including the notes that teachers have written themselves without the student first going to the janitor for a formal late note and without the student having been registered on the late list). Both types of notes register the hour of arrival of the student in the classroom. | out of scope |
| 5. | To register students who have come late in student data. | 3b |
| 6. | To produce reports per lesson group/school type grade of those students who arrive late (e.g. day and weekly reports), including the total number of times a student has been late. | 3a |
| 7. | To check if students who have to return do return on the basis of the come-back list, and then crossing them off when they do. | 2 |

| | | type of activity |
|---|---|---|
| 8. | To remind students who did not show up to report themselves and pass this information on to the deputy head. | 2 |

B. Other cases of absence

| | | |
|---|---|---|
| 9. | At the start of the school year every absence handler receives a booklet of absence notes.<br>Remark: instead of the usual informal notes a standard leave of absence note is proposed on which a specific or general leave of absence can be marked as well as which student and absence period it concerns. | out of scope |
| 10a. | A student applies for specific or general leave of absence. | out of scope |
| 10b. | Approval of specific leave of absence by deputy head. | 2 |
| 11. | To register authorized leave of absence (allowed leave) in advance. Every leave note registers the student's name, root class, date, absence reason and period. | 3b |
| 12. | At the start of the school year every teacher receives a pad with lesson absence notes. These are especially used in the higher grades. In the lower grades the class book is mostly used. | out of scope |
| 13. | Teachers fill in the class book or a lesson absence note and state whether the lesson was a test period or not. These notes are given to absence registration staff. | out of scope |
| 14. | To register parental absence reportings (e.g. parents call to report the illness of their child). | 3b |
| 15a. | A teacher reports a 'gone home ill' student to absence registration staff. | 2 |
| 15b. | To register a 'gone home ill' student in student absence data. | 3b |

**type of activity**

16. To process lesson absence notes/class book data:
- per lesson group per day (in lower grades on the basis of a class book);
- per teacher (absence reporting or gone home ill). 3b

If absences are reported, it is also registered whether they concern a test period or not.

17. To receive absence confirmation letters (e.g. an illness card). A student has to hand in an illness confirmation note where ill longer than one day, and where parents have not telephoned to report a student's illness. However, both criteria can be discussed, so the school itself has to 2 decide on this. In most schools a telephone call from the parents at the end of a sick period is considered to be sufficient.

If a school likes to work with illness cards/notes, this can be done in various ways:

1. after an illness report the school automatically sends an illness card to the parents with a request to sign and complete it;
2. on the first day after illness a student hands in a parental note.

On receipt of the illness note or card, or after a telephone call from the parents that the student has returned to school, the illness period can be registered 'closed'. This is done in elementary activity 19.

18. Remind students who have not handed in an absence confirmation note/card after they have returned to school to do so. This mainly is done 2 one or more times a week (it can only be done after the class book and lesson absence notes showing that a student is no longer absent are available).

19. Process the absence confirmation notes/card or 'well-again' telephone calls. 3b

A student is absent illegally until parents call or until the deputy head has called and registers a legal absence on the absence control report (which is returned to the janitor/school office) using an appropriate code.

type of activity

I (ill) is always legal (so ill indicates a reported and checked illness). Since the state of an absence has been 'handled' (a legal absence implies this) then the student concerned will not be included in absence control reports anymore. Without a well-again report/absence confirmation note, a student can extend his illness without being punished.

20. Make an absence control report for the deputy head. 3a

A number of absence control reports is distinguished here. Usually an absence control report contains all absences (day, date and absence period with reason) of the current and previous day, independent of the absences being legal/illegal and handled/not handled. The same list can be made, but then only containing the illegal absences that have not been handled (this with code N or B), which means all legal absences and all handled illegal absences have been left out. This list is a work list for the deputy head.
Next to absence control reports concerning the current and previous day one can also choose:
1. lists that only apply for a specific date (other than the current day);
2. lists that apply for a specific period.

21. The deputy head receives the absence control report, inquires and decides on the absence being legal/illegal, the state of an absence, the absence reason, the type of lesson period and the real absence period. 2
The deputy informs the janitor by means of the absence control report that lists which students have to report themselves, when and to whom. The janitor/deputy head updates the return list by stating when the student has reported himself/herself.

22. Process the data from the completed absence control reports in student absence data. All new information is processed, e.g. the new absence 3b
status, the new absence period, etc.

| | | type of activity |
|---|---|---|
| 23. | Check if teachers hand in lesson absence notes or have filled-in class books regularly and report the results (an overview of not received lesson absence data) to the deputy head. | 2/3a |
| 24. | The janitor/absence registration staff determine by means of the lesson absence notes and/or class book which of the students who had to report themselves to the deputy head have returned to school. This is done as soon as possible. When a school works with class books this can be done at the end of the day only. If a school likes to do this quickly, it must make sure to have this information as soon as possible from the lower and upper grades (e.g. collect the absence notes immediately after the first lesson period). It is also possible to do this by going to each classroom, although this can disrupt a lesson. Calling a student can be done by means of a note to the teacher, the intercom, or by going personally to the classroom. | 2 |
| 25. | Determine where student Z on day Y and lesson period X1 to Xn follows lessons (teacher, classroom, subject). | 3a |
| 26. | Produce absence reports which includes a multitude of sub-reports:<br>- total reports per period, per school type grade/student;<br>- a report per lesson group with per subject, per student, the number of lessons missed per student;<br>- a period report per school type grade, per subject/teacher combination, containing totals and frequencies;<br>- a comparison of certain school year periods for specific groups of students;<br>- various cross-sections which can be done for various groups of students (e.g. for all students with divorced parents). In fact these overviews are always split up for all categories used (gone home ill, legal, illegal, etc.). | 3a |
| 27. | To produce an absence report for lengthy absent students (on behalf of the compulsory education official). | 3a |

| | | type of activity |
|---|---|---|
| 28a. | To inform parents/guardians about absenteeism/arriving late of student(s). | 2 |
| 28b. | To invite parents/guardians for a talk on absenteeism. | 2 |
| 28c. | The deputy head discusses an absence, late problem with parents/ guardians. | out of scope |

## Appendix 3: Interaction of the school system with its environment

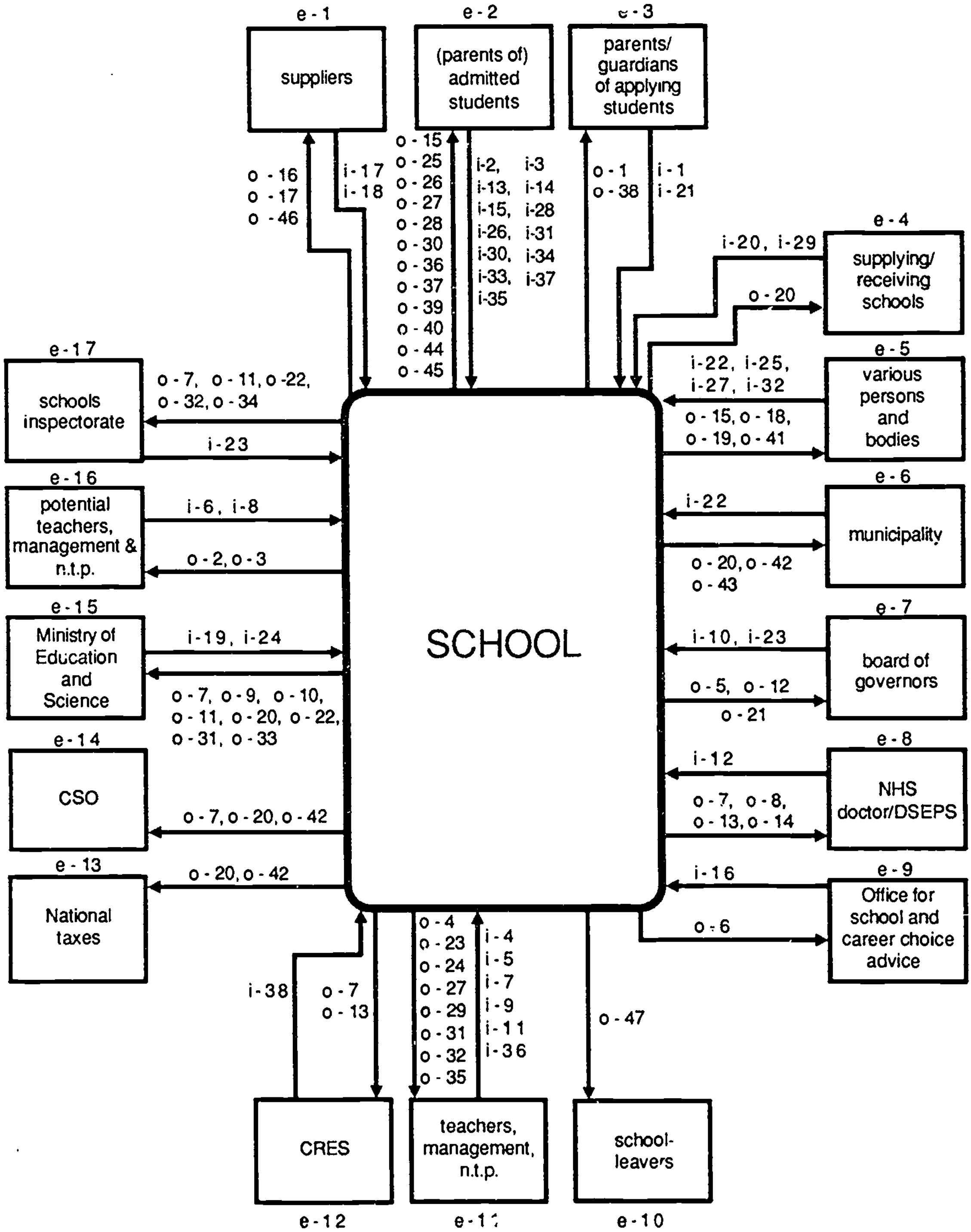
This diagram indicates the input and output of the school as well as the persons/bodies (the so-called external entities) that produce/receive output.

<u>Input</u>

i-1 means input set 1, i-2 means input set 2, etc.

- i-1: completed student application forms
- i-2: documents concerning the application of students: the confidential information form*, lists with test scores etc.
- i-3: preferences with regard to school type, school direction*, subjects (completed subject choice form), profession, follow-up training institute
- i-4: desires with regard to working hours, subjects to teach etc.
- i-5: changes in personal circumstances
- i-6: letter of application, c.v., request for information (from follow-up employers)
- i-7: various documents relevant for appointment like a certificate of good behaviour, degree of employee absenteeism due to illness, results of physical examination
- i-8: letters of application from non-teaching personnel
- i-9: certificates of competency
- i-10: appointment certificate
- i-11: an employee reporting ill or recovered
- i-12: decision of a National Health Service/DSEPS* doctor with respect to sick teachers as a result of physical examination
- i-13: application for absence and reporting absence (including illness) of student
- i-14: checking-out as participant of book fund
- i-15: payment tuition, book fund and the like
- i-16: results of school choice and choice-of-career test
- i-17: textbooks (from the book shop that supplies book-fund books), library books, magazines, other teaching materials, food, services (e.g. maintenance), audio-visual material
- i-18: invoices from suppliers

* When a concept is marked with a * it is explained in Appendix 5




Interaction of the school system with its environment i-19: information/material from the Ministry of Education and Science: examination material, guidelines/circulars concerning the required examination reporting to the government, criteria for school processes, agreement for expansion/merger and the like, curricular demands, final examination demands, list with second correctors* of the school

i-20: student data

i-21: parental contribution

i-22: occasional gifts, contributions

i-23: approved budgets/ alterations of budget proposals

i-24: subsidies from Ministry of Education and Science

i-25: other resources from various agencies

i-26: withdrawal for examination

i-27: marked examination work/ examination scores (including third period* scores)

i-28: decisions of parents concerning score-improvement*, profile-improvement*, re-examination, etc.

i-29: information form from receiving school

i-30: request for revision with respect to promotion-, or admittance-decision

i-31: request for alteration of subjects, classes, school type grades, etc.

i-32: incidental correspondence

i-33: birth certificate

i-34: returned book-fund books

i-35: alterations in personal student conditions (divorce parents, guardianship, marriage, death of parents, etc.)

i-36: letter of resignation, request for part time job or early retirement*

i-37: leaving reporting of student

i-38: salary payment lists

<u>Output</u>

o-1 means output set 1. o-2 output set 2, etc.

o-1: application form, information form to be completed

o-2: invitation for job interview

o-3: information about decision of the school with regard to applying personnel

o-4: invitation for teacher meeting

o-5: appointment proposal

o-6: request for choice of career test at Office and for school and career choice advice o-7: personnel data (new) teachers

o-8: illness reporting, personnel absence reporting

o-9: total report illness

o-10: alteration to appointment

o-11: statement of lesson period distribution*

o-12: dismissal proposal teaching/non-teaching personnel

o-13: dismissal reports

o-14: early retirement* requests

o-15: invoices to be paid

o-16: orders

o-17: payments to suppliers

o-18: advertisements

o-19: incidental correspondence

o-20: part of student data: influx per school type grade and municipality, the number of students with a foreign nationality, per birth year, religion, the number of boys/girls per school type grade, student flow data (including passes for examination)

o-21: budget proposal

o-22: school work plan*

o-23: task description, personnel evaluations and prescriptions

o-24: appointment confirmation

o-25: reports, various test score lists

o-26: book-fund book lists, school prospectus grade, promotion criteria, exam requirements, teacher lists, important data/regulations

o-27: class lists, various timetables

o-28: choice form (subjects, school types etc.) to be completed

o-29: information requests/absence reports

o-30: subject choice record, academic record

o-31: exam candidates data and exam results list, list with number of procès-verbals*

o-32: lesson period table, timetable

o-33: subsidy request: data for Ministry of Education and Science with respect to expansion, personnel formation, inventory: housing data, student numbers, number of teacher lesson periods, data with respect to clerical personnel

o-34: annual report including holiday periods, number of lesson days and lesson periods

o-35: school year schedule and holiday timetable

o-36: parent evenings timetable

o-37: study and choice of career advice

o-38: decision on student admission

o-39: information on study grant regulations, etc.

o-40: rules/information on internal final examinations and national written examinations

o-41: exam work to be marked by external bodies

o-42: untimely leaving of student report

o-43: absence data to compulsory education official

o-44: refund to parents/students (with respect to student leaving school)

o-45: book-fund books/materials

o-46: request for tenders

o-47: diplomas, exam score lists, credits

<u>External entities</u>

e-1 = external entity 1, e-2 = external entity 2, etc.

e-1: suppliers

e-2: (parents of) admitted students

e-3: parents/guardians of applying students

e-4: supplying/receiving schools

e-5: various persons and bodies

e-6: municipality*; the city as local authority (under the higher authority of government and province)

e-7: board of governors*

e-8: National Health Service doctor, Dutch State Employees' Pension Scheme

e-9: office for school and career choice advice

e-10: school-leavers

e-11: teachers, school management, non-teaching personnel

e-12: Central Registration of Educational Salaries

e-13: National taxes

e-14: Central Statistical Office

e-15: Ministry of Education and Science

e-16: potential teachers, management and non-teaching personnel

e-17: schools inspectorate

## Appendix 4: Overview of the hierarchy of A-diagrams in the SCHOLIS documentation

A(ctivity)-diagrams form an hierarchic structure that represents the connections between and the contents of complex activities and offers the possibility to give details of those activities. The first diagram presented is the so-called 'A-0-diagram' in which all school activity subsystems are presented (see Appendix 1). One of those activity subsystems concerns 'Student (Pupil) administration' (activity subsystem 3). This activity subsystem itself can also be drawn as an 'A- diagram': the 'A-3 diagram' (see Appendix 2). The A-3 diagram shows several Student (Pupil) administration activity subsystems (activity subsystems 3.1 to 3.9) and their mutual connections which are elaborated in the diagrams A-3.1 to A-3.8 (see Appendix 2.1). (Thus the A-3.5 diagram shows the details of the fifth activity subsystem of the A-3 diagram).
A-diagrams have been constructed for each activity (subsystem) marked with an *, the other activities are part of other diagrams, no separate diagrams have been drawn for them.

0 School*
1 Planning*
- 11 General school planning and evaluation
- 12 Capacity planning*
  - 121 Planning the lesson and task periods*
    - 1211 Planning the gross subject lesson periods need*
      - 12111 Planning the number of expected students per school type grade
      - 12112 Planning the number of expected students per school type grade subject
      - 12113 Planning the expected number of subject lesson groups
      - 12114 Planning the expected subject lesson period need per educational sector, per department
    - 1212 Planning the expected number of lesson and task periods to spend*
      - 12121 Planning the number of lesson periods by means of govemmental regulations
      - 12122 Planning the number of task periods by means of govemmental regulations

12123 Planning the desired period reserve

12124 Planning the discrepancy between the gross period need and the number of periods the school likes to spend, eliminating the discrepancy and determining the number of task periods and lesson periods to spend

1213 Planning the expected number of task periods to spend

1214 Planning the target management jobs

122 Planning the technical infrastructure

123 Planning the buildings and grounds

13 Educational planning*

131 Job allocation*

1311 Planning first and second level management lessons

1312 Planning the potential salary level-12 teachers

1313 Planning task periods per category

1314 Allocation of task and lesson periods*

13141 Allocation of management periods

13142 Allocation of first-level bound task periods

13143 Allocation of second-level bound task periods

13144 Allocation of lesson and free task periods

13145 Producing allocation forms and job alteration forms

1315 Consultation of teacher board/departments/school board

132 Timetabling/Timetable administration*

1321 Stock-taking and judging timetable needs

1322 Planning special timetable periods

1323 Placing lesson groups into the school timetable

1324 Changing the lesson group allocation

1325 Allocating classrooms to timetable periods

1326 Approval of timetables

1327 Timetable maintenance and lesson drop-out registration

133 School work plan development

14 Financial planning*

141 Drawing up an estimate proposal

142 Initial school estimate consultation

143 Determining department estimates

144 Approval of maintenance and investment plans

145 Determining/approving the school budget

146 Liquidity planning/planning the financial structure

2 Resources supply*

- 21 Handling request for goods*
  - 211 Judging requests
  - 212 Ordering and providing goods
  - 213 Order progress control
- 22 Receipt goods
- 23 Book fund administration*
  - 231 Book fund organization
  - 232 Book fund stock administration
  - 233 Needs assessment
  - 234 Book fund participants administration
- 24 Physical stock administration
- 25 Inventory administration

3 Student (Pupil) administration*

- 31 Enrollment*
  - 311 Recruiting
  - 312 Handling applications
  - 313 Admittance
  - 314 Compose student files
- 32 Grouping students into classes*
  - 321 Register grouping desires
  - 322 Approve regrouping requests
  - 323 Root class grouping
  - 324 Tutor allocation
  - 325 Blocking
- 33 Administration of principal student data*
  - 331 Updating fixed student data
  - 332 Administration of student card and student files
- 34 Absence registration*
  - 341 Approval of absence requests
  - 342 Administration of absence data
  - 343 Late registration
  - 344 Handling absence control report
  - 345 Acting corrective
- 35 Student (pupil) guidance and counselling*
  - 351 Problem counselling
  - 352 Building up/adjusting profile

353 Choice handling*

3531 Individual choice counselling

3532 Updating information bank and giving general information

3533 Stock-taking student choices

3534 Choice registration

3535 Make choice reports

354 Obtain teacher advice

355 Prognosis of the school type grade subject choice

356 Arrange further orientation

36 Test scores registration*

361 Register report scores

362 Report meeting

363 Report authorization and handing out

364 Handle revision requests/discrepancies

37 Internal final Examination/ National Written Examination (IE/NWE)*

371 Organize IE/NWE

372 Hold/approve IE/NWE

373 Register IE/NWE scores

374 IE/NWE meeting

375 Diploma granting

38 Deleting student names from school register*

381 Registration untimely leaving

382 Deletion handling

383 Use historic student data

39 Produce student reports

4 Teaching-learning process

5 Financial registration*

51 Determining tariffs for educational tools out of book fund and parental contribution

52 Managing/registering payments and receipts

53 Updating insurance, maintenance list and depreciation lists

54 Updating ledger

55 Subsidy administration and budget control

6 Personnel administration*

61 Recruiting, selecting and appointing

62 Updating statement of lesson distribution, redundancy list and division of departments

63 Administration of personnel data and appointment data

64 Administration of illness, leave and absence

65 Coaching and assessing personnel

66 Salary handling

67 In-service and refresher courses

68 Leave of staff member

69 Producing personnel reports

**Appendix 5: Explanation of terms used**

- The **board of governors** forms the competent authority of a school. Three types of boards are possible: the municipality (for municipal public schools), a private board of governors (e.g. for Roman Catholic, Protestant, Montessori schools), the State (for state schools).
- **cluster (lesson) group**: a set of students in the upper grades who together receive instruction in an optional subject.
- **confidential information form**: this form contains confidential information about an applying student that is important to the teaching-learning process like physical and/or mental problems and the home situation (e.g. the number of parents living at home, their training, divorced or not).
- **DSEPS**: Dutch State Employees' Pension Scheme.
- **Early Retirement**: a possibility for people of about sixty years to stop working completely or partially.
- **educational sector**: the Dutch educational system has two educational levels (sectors), for AVO/VWO schools the levels consist of the following school type grades:

  sector 1:
  - Gymnasium (one of the pre-university forms of education) grade 1 to 6;
  - HAVO/VWO (senior general secondary education/pre-university education) grade 4-5;

  sector 2:
  - MAVO (junior general secondary education) grade 1 to 4;
  - HAVO/VWO grade 1 to 3.

  A teacher is either qualified to teach in sector 2 or can also teach in sector 1.
- **lesson period table**: the school lesson period table indicates how many lesson periods each school type grade receives instruction in various subjects during every school week. The Ministry of Education and Science produces a lesson period table indicating the minimum number of lesson periods that in each school type grade must be given in various subjects. The lesson period table has to be approved by the schools inspectorate.
- The **municipality** forms the higher authority for all schools and oversees the observance of state law. It can provide incidental financial gifts to all schools.
- **periods**: lesson periods and task periods. The number of lesson periods a school receives is dependent on its number of students. The school allocates the received lesson periods to its staff.

The Ministry of Education also allocates task periods to schools which can be used for tasks like library administration and student counselling and guidance. Task periods are allocated to school staff.

- **procès-verbals**: these report on a final examination session: e.g. the subject examined, the students and teachers who attended the session and at what time students entered and left the examination session.
- **profile-improvement**: in some school types (e.g. MAVO) a student can take an examination at various levels. When a student did not take all examinations at the highest level, he/she can decide to take examinations in one or more subjects at an higher level during the second examination period. By doing so he/she can try to improve his/her examination profile.
- The **National Health Service** is of importance for schools of which the Minister of Education is the competent authority.
- **reduction of working hours**: a regulation that determines that people with a full-time job have to work a number of hours less than 40 and for that reason receive a proportional amount of money less. The number of reduced hours depends on the age of personnel.
- **redundancy sequence**: each Dutch school has a list indicating the order in which school staff may have to be dismissed in case there is too little work. This order is determined by the rules of the competent authority. The rules often concern the number of days that somebody has been employed, or staff qualifications. When a teacher is the only qualified teacher for a specific subject she/he will not have to leave the school until this subject is dropped at the school.
- **root class**: a school type grade has a limited number of root classes; the students of a root class follow core subjects in their root classes. A student is always only a member of one root class, while a student in the upper grades can be a member of various cluster (lesson) groups (see cluster (lesson) groups).
- **salary level-12**: this level is the highest salary level for teachers of secondary schools.
- **school direction**: some schools offer a possibility to choose a certain direction within a school type, for instance an A-direction (with subjects like history, geography, languages) or a B-direction (with the science subjects). Sometimes school directions are strict combinations of subjects from which a choice can be made.
- **school work plan**: a document outlining the school structure, its goals (in general and per subject) and principles, the lesson period table, the procedure for student

selection and other procedures, the optional subjects and possible subject combinations, and the school's decision-making bodies.

- **score-improvement**: after a student has taken an examination, he/she can decide to try to improve the score(s) for one or more subjects when the second examination occurs.
- **second correctors**: some of the final examination work has to be corrected by two persons, namely by the teacher of the student and by an outside teacher (the government decides who the so-called second correctors will be).
- **statement of lesson period distribution**: by means of this form the school reports to the government on how the lesson periods and task periods have been allocated to school staff. The form contains among others the following columns for each teacher:
  * name, birth date and qualifications
  * date of appointment at the school
  * degree of appointment (e.g. for 20 or 30 lesson periods a week)
  * subject(s) taught
  * number of lesson periods received (divided in qualified/not qualified per educational sector)
  * number of allocated task periods.
- **student card**: this card includes among others a student's year of entry, sex, name, date and place of birth, address, nationality, previous school, name and profession of the parents/guardian/attendants.
- **student files**: these contain important student data (name, address, place of residence and the like) and confidential information (correspondence with parents, notes of conversations with a student etc.).
- **target management jobs**: the Ministry of Education determines how many lesson periods have to be taken care of by the management of a school. This number is dependent on the school type and the number of students of a school.
- **third period**: the external final examination can be taken at three different moments, the first, second and third period. The first two occasions take place at school. The second period is the re-examination for those students who did not pass the first examination and the first chance for students who did not take part in the first examination. The third period final examination is held centrally in the Netherlands (a sort of state examination) and can be a student's first or second chance.
- **year plan**: this concerns the activities that will take place during a school year and when: e.g. dates for meetings, handing in exercises and test scores, holding examinations, the school sports day, school trips etc.

## Appendix 6: Instruments and respondents for each variable

| variable code* | variable name* | instrument** | respondent*** |
|---|---|---|---|
| A | IS-design method | - | - |
| B | innovation quality | Int. | P, C, O |
| C1.1 | innovation encouragement from principal | Int. | C, O, H Div, H Dep |
| C1.2 | innovation encouragement from coordinator | Int. | P, O, H Div, H Dep |
| C1.3 | degree of intrinsic motivation | Int. | P |
| C1.4 | extra ARS resources | Int. | C |
| C1.5 | degree of ARS problems | Int. | C |
| C1.6 | degree of support | Int. | C |
| C1.7 | degree of support together with other schools | Int. | C |
| C1.8 | degree of oral/written support | Int. | C |
| C1.9 | orientation of the support | Int. | C |
| C1.10 | support contents | Int. | C |
| C1.11 | support satisfaction | Int. | P, C, O |
| C1.12 | period of availability of ARS | Int. | C |
| C1.13 | type of computer | Int. | C |
| C1.14 | degree of introduction first ARS end system | Int. | C, O |
| C2.1 | user attitude concerning ARS | Quest. | P, C, O |
| C2.2 | motivation after first ARS end system | Int. | C, O |
| C2.3 | similarity to ARS procedure | Quest. | C, O |
| C2.4 | truancy reduction efforts before ARS | Int. | P |
| C2.5 | perception of truancy causes | Quest. | P |
| C2.6 | consultation frequency at various school levels | Int. | P |
| C2.7 | degree of influence of various organs/sections regarding 4 policy areas | Quest. | P, T |
| C2.8 | degree of teacher counselling | Int. | P |
| C2.9 | degree of student counselling | Int. | P |
| D1 | degree of registrational ARS use | Int. | P, O |
| D2 | degree of analytical ARS use | Int. | P, C, O |
| D3 | degree of anti-truancy policy | Int. | P, H Div, H Dep, C |
| D4 | degree of a resources anti-truancy policy on basis of ARS | Int. | P, H Div, H Dep, C |
| D5 | degree of general pedagogic-didactic anti-truancy policy | Int. | P, H Div, H Dep, C |
| D6 | degree of subject content anti-truancy policy | Int. | P, H Div, H Dep, C |
| D7 | degree of educational profile anti-truancy policy | Int. | P, H Div, H Dep, C |

| variable code | variable name | instrument | respondent |
|---|---|---|---|
| D8 | degree of anti-truancy policy directed to individual students | Int. | P, H Div, H Dep, C |
| D9 | degree of anti-truancy policy directed to groups of students | Int. | P, H Div, H Dep, C |
| D10 | general anti-truancy policy measures | Int. | P, H Div, H Dep, C |
| E1 | extent of allowed absenteeism | (allowed) Alist | T |
| E2 | extent of disallowed absenteeism | (allowed) Alist | T |
| E3 | percentage 1-2, 3-5, 6-8 lessons truants | (allowed) Alist | T |
| E4 | truancy ratio | (allowed) Alist | T |
| E5 | more truancy combating | Int. | P, C |
| E6 | quicker reaction | Int. | P, C |
| E7 | better insight | Int. | P, C |
| E8 | calculations cost less work | Int. | P, C, O |
| E9 | better registration and handling | Int. | P, C |
| E10 | better pattern detection | Int. | P, C |
| E11 | less time required for absence registration | Int. | P, C, O |
| E12 | less complaints from parents | Int. | P, C |
| E13 | less complaints from police/ neighbourhood | Int. | P, C |
| E14 | more boring data entry work | Int. | P, C, O |
| E15 | ARS-output not used | Int. | P, C |
| E16 | strong analysis of subjects/ teachers concerning truancy | Int. | P, C |
| E17 | uncertainty ARS-quality | Int. | P, C |
| E18 | more work absence registration and handling | Int. | P, C |
| E19 | absence handlers checked more | Int. | P, C |
| F1 | school size | Int. | P |
| F2 | ethnic background of students | Int. | P |
| F3 | percentage of students from 3 socioeconomic classes | Int. | P |
| F4 | 3 school location characteristics | Int. | P |
| F5 | school type(s) | Int. | P |
| F6 | non-ARS measures | Int. | P, H Div, H Dep, C |

* The variable codes and variable names in this Appendix match with the variable names and codes of Figure 9 in section 7.2.2.

** Int. = Interview
Quest. = Questionnaire
(allowed) Alist = (allowed) absence list

*** P = Principal
C = ARS-coordinator
O = ARS-operator
H Div = Head of upper or lower school division
H Dep = Head of Dutch or language department
T = Teacher

## Appendix 7: Reliability of instruments

| variable code* | variable name | | Cronbach α | number of items | number of cases** |
|---|---|---|---|---|---|
| B | innovation | 1990 | .94 | 18 | 90 |
| | quality | 1991 | .90 | 18 | 78 |
| C1.11 | satisfaction | 1990 | .70 | 8 | 90 |
| | with support | 1991 | .90 | 8 | 81 |
| C2.1 | user-attitude | 1990 | .90 | 27 | 90 |
| | concerning ARS | 1991 | .85 | 27 | 81 |
| C2.3 | similarity to | 1988 | .77 | 6 | 54 |
| | ARS procedure | 1991 | .77 | 6 | 54 |
| C2.5 | perception of truancy causes: | | | | |
| | in student | 1988 | .39 | 9 | 29 |
| | + school | 1991 | .40 | 9 | 27 |
| | outside the | 1988 | .56 | 7 | 29 |
| | school | 1991 | .52 | 7 | 27 |

* See Figure 9 in section 7.3.2

** The number of cases between variables differs as a consequence of differences between the number of respondents for different variables (see Appendix 6 for an overview of the respondents per variable)

## Appendix 8: Response percentages

This Appendix shows the response percentages per instrument (interview, questionnaire, and (allowed) absence list). For information on which instrument was used to measure a variable the reader is referred to Appendix 6.

### Interviews

| respondent | year | number of respondents | response percentage |
|---|---|---|---|
| principal | 1988 | 34 | 100% |
| | 1990 | 30 | 100% |
| | 1991 | 27 | 100% |
| internal ARS coordinator | 1988, 1990, 1991 | 34, 30, 27 | 100% |
| head of division | 1988, 1990, 1991 | 34, 30, 27 | 100%, 83%, 70% |
| teachers | 1988 | 332 | 82% |

### Questionnaire

| respondent | year | number of respondents | response percentage |
|---|---|---|---|
| school managers | 1988 | 114* | 85% |
| ARS operator | 1988 | 69** | 77% |
| (clerical staff, | 1990 | 30 | 90% |
| caretaker) | 1991 | 27 | 100% |

### (Allowed) absence lists***

| | year | number of respondents | response percentage |
|---|---|---|---|
| | 1988 | 34 | 82% |
| | 1990 | 25 | 79% |
| | 1991 | 25 | 89% |

* Per school various school managers were interviewed.

** In 1988 ARS operators from Haarlem schools completed the questionnaire.

*** The response percentage for the (Allowed) absence lists was determined by computing the number of lessons from which absenteeism data had been received, in relation to the number of timetable lessons given.



263

## SAMENVATTING

In dit proefschrift wordt verslag gedaan van drie onderling nauw verbonden stud'ɜs:

1. een vooronderzoek (hoofdstuk 2);
2. het SCHOLIS-project gericht op het ontwerp van SCHOLIS, een computerondersteund systeem voor schooladministratie en schoolmanagement (de hoofdstukken 3-6);
3. de evaluatie van de implementatie van een computerondersteund Absentie Registratie Systeem (de hoofdstukken 7-9).

Het vooronderzoek naar de stand van zaken met betrekking tot computerondersteund(e) schooladministratie en schoolmanagement (COSAS) werd uitgevoerd in de periode februari 1985 - februari 1986. Het doel was dit nieuwe terrein te verkennen en daarbij na te gaan welk onderzoeks- en ontwikkelingswerk aandacht verdiende. Het vooronderzoek resulteerde in het SCHOLIS-project, waarvan het doel was een hoogwaardig schoolinformatiesysteem voor scholen voor voortgezet onderwijs te ontwikkelen, waarmee een aantal tijdens het vooronderzoek gesignaleerde problemen zou kunnen worden opgelost. Het derde genoemde onderzoeksproject omvatte een evaluatie van de implementatie van één element van het ontwikkelde schoolinformatiesysteem, namelijk de absentieregistratie-module. Over elk van de drie studies zal nu meer informatie worden gegeven.

*Het vooronderzoek*

Het vooronderzoek omvatte een inventarisatie van de beschikbare schooladministratieve computertoepassingen en hun kenmerken, een verkenning van buitenlandse ervaringen en ontwikkelingen op het terrein van COSAS, evenals de bestudering van automatiseringsprocessen en hun invloed in pionierscholen. Veel scholen bleken belangrijke voordelen van schoolinformatiesystemen te verwachtten en deze vorm van computergebruik bleek snel te groeien. Aangezien COSAS echter ook niet vrij van problemen was, werden aanbevelingen geformuleerd (zie paragraaf 2.3.4) om het computerondersteunde schoolbeheer te optimaliseren. Deze aanbevelingen betroffen het bundelen van krachten voor het ontwikkelen van hoogwaardige schoolinformatiesystemen, een grondige analyse van scholen als basis voor het informatiesysteemontwerp, de ontwikkeling van systemen die op een breed terrein ondersteuning verlenen, overheidssteun voor scholen op dit gebied, de bestudering van automatiseringsprocessen en hun effecten in scholen, evenals de evaluatie van schooladministratieve software.

*Het SCHOLIS-project*

Het SCHOLIS-project vormde, zoals aangegeven, het vervolg op het vooronderzoek. In vergelijking met computergebruik in andere organisaties moest COSAS als achterblijvend worden beschouwd. Een nieuwe generatie van computerondersteunde schoolinformatiesystemen werd noodzakelijk geacht om scholen in staat te stellen door te groeien naar hogere niveaus van COSAS en daarmee hun efficiëntie en effectiviteit te verbeteren. De Faculteiten Informatica en Toegepaste Onderwijskunde van de Universiteit Twente en het toenmalige Centrum voor Onderwijs en Informatietechnologie gingen samenwerken in het SCHOLIS-project dat uitgevoerd werd in de periode oktober 1985 - december 1988. De SCHOLIS-projectdoelen (zie paragraaf 3.2) moeten gezien worden als een poging om de problemen met betrekking tot COSAS in Nederland, zoals deze in het vooronderzoek werden waargenomen, weg te nemen.

In hoofdstuk drie werd de projectstrategie globaal gepresenteerd, die gebruikt werd om het gewenste schoolinformatiesysteem te ontwerpen en om de voorwaarden voor en effecten van systeemgebruik te onderzoeken. Daarna werd in het vierde hoofdstuk meer in detail beschreven hoe het schoolinformatiesysteemraamwerk (SISR) werd ontworpen. Een SISR omvat alle activiteitensubsystemen (bijvoorbeeld leerlingadministratie of financiële administratie) van een school en toont hun input, output en onderlinge relaties, in termen van de informatie- en/of materiaalstromen tussen hen. Bovendien werden binnen elk SISR-subsysteem de samenstellende activiteiten beschreven en werd de rol bepaald die de computer bij hun uitvoering kan spelen. Het SISR vormde de basis voor de ontwikkeling van de SCHOLIS-software. De strategie voor het ontwerpen van het SISR bestond uit de volgende stappen:

- het construeren van hypothetische referentiemodellen van informatie-afhankelijkheden tussen schoolorganisatorische processen, als basis voor de analyse van de informatiehuishouding van scholen;
- het testen van de referentiemodellen door scholen voor algemeen vormend en voorbereidend wetenschappelijk onderwijs te analyseren op hun informatiehuishouding;
- het op basis van de scholenanalyse in concept beschrijven van de elementaire activiteiten waaruit elk activiteitensysteem bestaat;
- het verifiëren van de conceptbeschrijvingen, door deze voor te leggen aan medewerkers van de geanalyseerde scholen en het op basis van de verkregen feedback aanpassen van de beschrijvingen;

- het ontwerpen van een algemeen concept-schoolinformatiesysteemraamwerk voor Nederlandse scholen voor algemeen en/of voorbereidend wetenschappelijk onderwijs, bestaande uit activiteitensubsystemen en elementaire activiteiten;
- het verkrijgen van feedback van medewerkers van scholen op het voorgestelde algemene raamwerk;
- het definiëren van het uiteindelijke schoolinformatiesysteemraamwerk.

De belangrijkste ontwerpresultaten werden gepresenteerd in hoofdstuk vijf, waarin de ondersteuning die de computer in elk van de SISR-subsystemen kan geven werd beschreven. Vervolgens werd op drie manieren bij de ontwerpresultaten stilgestaan:

1. er werd ingegaan op de hoeveelheid specifieke elementaire activiteiten (niet-formaliseerbaar, manueel, machine, mens-machine) waaruit elk ontworpen activiteitensubsysteem bestaat;
2. de wijze waarop het schoolmanagement kan profiteren van beheersmatig computergebruik werd besproken;
3. de mate waarin bepaalde computerfuncties (actualiseren van de database, opvragen van informatie en productie van documenten, besluitvormingsondersteuning, besluitvorming, communicatie) kunnen worden gebruikt binnen verschillende schoolorganisatorische processen, zoals onderscheiden door Mintzberg (1979), werd bediscussieerd.

In paragraaf 5.4 werd uiteengezet hoe het ontworpen schoolinformatiesysteemraamwerk gebruikt is binnen de daaropvolgende fasen van het SCHOLIS-project, i.c. het ontwikkelen van prototypes en eindversies van de informatiesubsystemen, het implementeren daarvan en het onderzoeken van systeemgebruik en haar effecten.

In hoofdstuk zes werd gereflecteerd op de aard van de gebruikte SISR-ontwerpstategie en op andere projectactiviteiten die werden uitgevoerd nadat het SISR beschikbaar was gekomen. Allereerst is de strategie vergeleken met de ontwerp- en de ontwikkelbenadering zoals beschreven door Ganzevoort (1985) en vervolgens met de zogenaamde regulatieve cyclus van Van Strien (1975). De ontwerpers van SCHOLIS hebben gewerkt op een manier die sterk overeenkwam met Ganzevoort's ontwerpbenadering, maar de strategie bleek ook enige kenmerken van de ontwikkelbenadering te bezitten. De SCHOLIS-projectmethode kon goed worden beschreven in termen van Van Strien's regulatieve cyclus.

Tenslotte werden de voordelen en nadelen van de gehanteerde ontwerpstrategie besproken door allereerst stil te staan bij de tijd die ervoor nodig is en bij de inzet die ze van gebruikers vergt. Andere punten die in verband met de gebruikte ontwerpstrategie besproken werden betroffen het eerst analyseren van een complexe en daarna minder complexe scholen, het aantal scholen dat geanalyseerd kon worden, het gebruik van referentiemodellen, het ontwerpen van elementaire activiteiten en de samenwerking tussen wetenschappers uit verschillende disciplines.

*Het ARS-project*

Hoofdstuk 7, 8 en 9 vormen het derde element van de dissertatie, de evaluatie van de implementatie van de Absentie Registratie Systeem (ARS) module van SCHOLIS. De volgende onderzoeksvragen stonden centraal in de evaluatie-studie:

1. Hoe en in welke mate wordt ARS door de projectscholen gebruikt?
2. Welke factoren bevorderen een succesvolle implementatie van ARS?
3. In welke mate veranderde de absentie-omvang in de experimentele en controlescholen tussen 1988 en 1991?
4. In hoeverre kunnen mogelijke veranderingen in de absentie-omvang worden toegeschreven aan ARS-gebruik?
5. Leidde het gebruik van ARS tot andere effecten dan eventuele veranderingen in de absentie-omvang?

De kenmerken van ARS werden getypeerd door middel van een beschrijving van de ondersteuning die het systeem binnen scholen kan geven. Ook werd uiteengezet hoe het onderzoeksraamwerk werd geconstrueerd en welke variabelen als gevolg daarvan werden bestudeerd in het kader van de implementatie van ARS. De in het onderzoeksraamwerk geformuleerde hypothesen werden samengevat in paragraaf 7.3.3, waarna in hoofdstuk 8 de gebruikte onderzoeksmethode gekarakteriseerd werd door een beschrijving te geven van het quasi-experimentele design, de experimentele en controlegroep, de onderzoeksinstrumenten en respondenten en de wijze van datacollectie, -verwerking en -analyse.
Het negende hoofdstuk bevat de resultaten van het evaluatie-onderzoek. Hoewel het gebruik van ARS voor de dagelijkse absentieregistratie en -afhandeling (de eerste vorm van ARS-gebruik, het zogenaamde registratief gebruik) het meest tot ontwikkeling bleek te zijn gekomen, gebruikten niet alle scholen ARS volledig op deze wijze. Scholen waarvoor het laatste gold voerden een aantal voor registratief ARS-gebruik essentiële activiteiten niet uit. Zo gebruikte 15% en 20% (respectievelijk in 1990 en 1991) van de scholen geen absentiecontrolestaten, om op te treden tegen absente leerlingen, ging in beide jaren ongeveer 30% van de scholen niet achter veel van hun absenten-zonder-reden aan en genereerde 50% (1990) en 70% (1991) niet binnen één

à twee dagen een absentiecontrolestaat (ongeveer 25% deed dit niet binnen één tot vijf dagen), waardoor deze scholen niet snel op absenteïsme konden reageren.
De twee andere vormen van ARS-gebruik, analytisch gebruik en de ontwikkeling van anti-spijbelmaatregelen op basis van ARS gegevens zijn onderling nauw verbonden. Als een school geen ARS-statistieken uit het systeem opvraagt om trends in het absenteïsme en relaties tussen absenteïsme en andere variabelen te analyseren (analytisch gebruik), dan kan de school ook geen anti-spijbelmaatregelen ontwikkelen op basis van dergelijke statistieken. Het analytisch gebruik van ARS was niet intensief. Ongeveer 60% (1990) en 67% (1991) van de scholen genereerde statistieken (veelal twee of drie statistieken) die in het ARS-menu zijn opgenomen, terwijl de overige 40% en 33% van de scholen geen enkele ARS-menu-statistiek opvroeg waarop men anti-spijbelmaatregelen kon baseren. Specifieke, zelf-gedefinieerde statistieken die door middel van een zogenaamde vraagtaal gegenereerd kunnen worden bleken nauwelijks opgevraagd te worden. Scholen bleken evenmin sterke ontwikkelaars van op ARS gebaseerde anti-spijbelmaatregelen te zijn. Ongeveer 55% (1990) en 59% (1991) van de scholen ontwikkelde één of meer (in de meeste gevallen één of twee) op ARS-gegevens gefundeerde beleidsmaatregelen om het absenteïsme te reduceren, terwijl 45% en 41% geen enkele maatregel ontwikkelde. Op de vraag waarom analytisch ARS-gebruik en een ARS-gefundeerde ontwikkeling van anti-spijbelbeleid niet sterk ontwikkeld werden werd ingegaan in paragraaf 9.7.1.

Het antwoord op de tweede onderzoeksvraag liet zien dat twee factoren belangrijk waren voor de mate van registratief en analytisch ARS-gebruik in 1990, toen ARS acht maanden werd gebruikt:

1. de mate waarin schoolpersoneel gemotiveerd was en/of gestimuleerd werd om ARS te gebruiken, en
2. de mate waarin een school voldeed aan een aantal condities dat positief voor ARS-gebruik wordt geacht.

Er werd geen factor gevonden die van invloed bleek te zijn op de mate waarin ARS in 1991 (toen ARS ongeveer 20 maanden gebruikt werd) registratief en analytisch gebruikt werd. Noch na 8 (1990), noch na 20 maanden (1991) werd een factor gevonden, die de mate waarin een op ARS-gegevens gebaseerd anti-spijbelbeleid ontwikkeld werd, beïnvloedde.
Verbanden tussen configuraties van schoolorganisatiekenmerken (de zogenaamde Marx-modellen) enerzijds en de mate waarin een anti-spijbelbeleid werd ontwikkeld anderzijds, werden eveneens bestudeerd. De vergelijking van een cluster van colle-

giale scholen en een cluster van segmentale scholen met behulp van variantie-analyse bracht geen verschillen tussen de clusters aan het licht, betreffende de mate waarin een anti-spijbelbeleid ontwikkeld werd, noch aangaande de terreinen waarop anti-spijbelmaatregelen ontwikkeld werden. Paragraaf 9.7.2 bevat een discussie van de redenen waarom de theorie van Marx het gedrag van scholen in deze opzichten niet kon voorspellen.

De derde onderzoeksvraag is het belangrijkst aangezien gehoopt werd dat het gebruik van ARS tot een reductie van de absentie-omvang zou leiden. Vier absentiematen werden gemeten om deze vraag te beantwoorden: het percentage ongeoorloofde absentie van scholen, hun geoorloofde absentie percentage, het percentage spijbelaars dat 1-2, 3-5, 6-8 lessen per dag spijbelde en, tot slot, het percentage leerlingen dat één of meer lessen op één schooldag spijbelde. Er werden voor elke absentiemaat verschilscores (1990-1988, 1991-1990, 1991-1988) berekend en de experimentele scholen en controlescholen werden op basis daarvan vergeleken. De resultaten toonden geen significante daling van de absentie-omvang ten gevolge van het gebruik van ARS. Een aantal mogelijke verklaringen voor de uitgebleven reductie van de absentie-omvang werd in paragraaf 9.7.3 gepresenteerd.

Aangezien de absentie-omvang niet significant gereduceerd werd was de beantwoording van de vierde onderzoeksvraag niet zinvol. Wel werden correlaties berekend tussen enerzijds veranderingen in de absentie-omvang en anderzijds de mate van ARS-gebruik, de gebieden waarbinnen anti-spijbelmaatregelen genomen werden, contextvariabelen en niet op ARS-gegevens gebaseerde beleidsmaatregelen om het absenteïsme te reduceren. De correlaties toonden aan dat een intensiever gebruik van ARS niet samenging met een sterkere reductie van de absentie-omvang en dat het terrein waarop anti-spijbelmaatregelen genomen werden geen verschil maakte voor de mate waarin de absentie-omvang gereduceerd werd. Bovendien bleek het absenteïsme sterker gereduceerd te worden, naarmate scholen groter waren en naarmate de leerlingpopulatie van een school meer leerlingen van minderheden (in algemene zin en, meer specifiek Turkse/Marokkaanse) bevatte. Geen enkele schoollocatie-variabele (bijvoorbeeld een spijbelstimulerende schoolomgeving, een oude buurt) ging samen met een sterkere toename of afname van het absenteïsme. Als de mate van ongeoorloofde absentie van een school hoger was op het moment dat ARS in 1988 werd geïntroduceerd, werd de ongeoorloofde absentie in zo'n school in de periode 1988-1991 meer teruggedrongen.

De laatste onderzoeksvraag betreft mogelijke andere ARS-effecten, dan veranderingen in de absentie-omvang. De resultaten van het evaluatie-onderzoek geven de indruk dat de wijze waarop het informatiesysteem ARS en het automatiseringsproces vorm werden gegeven volgens ARS-gebruikers een positieve invloed had. Een aantal positieve effecten werd door veel respondenten als (zeer) sterk optredend ervaren, zoals een beter inzicht in de spijbelomvang, het feit dat het berekenen van het aantal spijbelaars minder tijd vergt dan voorheen en een verbeterde registratie en afhandeling van absenten. Andere effecten traden naar de mening van de respondenten in minder sterke, maar nog steeds in aanzienlijke, mate op: het sneller reageren op spijbelen, een betere detectie van spijbeltrends en het meer achter spijbelaars aangaan.
Hoewel enkele negatieve effecten optraden werd geen ervan door veel gebruikers als (zeer) sterk optredend ervaren. Het sterkste negatieve effect (het registreren en afhandelen van absenten vereist meer werk) trad volgens 10% (1990) en 18,5% (1991) van de scholen in (zeer) sterke mate op.
De gebruikerspercepties aangaande deze effecten van ARS-gebruik zijn bemoedigend, aangezien bekend is (Ivies et al., 1983) dat dergelijke percepties de mate van systeemgebruik bepalen.