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Visscher, Adrie J;Bloemen, P P M
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Evaluation of the Use of Computer-Assisted Management Information Systems in Dutch Schools

Adrie J. Visscher and P. P. M. Bloemen

University of Twente

Abstract

Empirical data on the implementation and effects of computer-assisted school information systems (SISs) is scarce. In the Netherlands SISs have been developed and used since the 1970s. In this research project the extent of SIS use, factors promoting successful SIS implementation, and the effects of SIS use have been studied in Dutch secondary schools. The research findings indicate that SIS use is not of the same intensity for all SIS modules and is not equally distributed across all types of respondents. Although many users in general are satisfied with most aspects of the quality of the SISs, a considerable number complain about their management-supporting capacity. Training and user support has been limited, making it difficult to sort out SIS problems. According to users, SIS use has led to both positive and negative effects. Variance analysis of direct SIS users and nonusers pointed to interesting differences between both groups concerning the perceived SIS quality, features of the implementation process, and of the schools into which the SISs have been introduced. Regression analysis showed three implementation process features that explain considerable variance in the extent to which SISs are being used. (Keywords: computer-assisted school information systems, evaluation, implementation, school management.)

Worldwide, the use of computerised school information systems (SISs) has become very important for the management of educational institutions (Visscher, 1996). Empirical evidence on the implementation process and effects of SISs is scarce, although such information is valuable in preventing mistakes that have been made before and in adopting successful strategies. The overall goal of this investigation is to collect empirical evidence on how schools deal with computerised SISs, how they appreciate SISs, how SISs have been introduced into schools, factors promoting SIS use, and the effects of system use.

The first Dutch computerised SISs for secondary schools were developed by teachers and software houses (the latter often adapted systems that initially had been developed for a business context) in the 1970s. This initially resulted in approximately 10 different SISs that were used in schools. However, schools gradually became more demanding, information technology developed, and SISs became more sophisticated; three SISs (School+ [1987], Scholis [1987–1997], and Schoolfact [1986–1999]) survived. These three systems are now being used in the majority of Dutch secondary schools. Whereas the first generation of SISs was of a highly clerical nature, the current systems also support control activities of school managers to a certain degree. This research project focused on the implementation and effects of the three market-leading SISs in Dutch schools.

RESEARCH QUESTIONS AND THEORETICAL FRAMEWORK

The following questions are answered in this research:

1. How and to what extent are SISs used in Dutch schools?
2. What is the user opinion on the quality of these systems?
3. How were the SISs implemented, and what are the relevant features of the schools into which they were introduced?
4. Which factors prove to have a relationship with the degree of SIS use?
5. What are the positive and negative effects of SIS use?

The body of knowledge regarding the variables that determine the success and effects of implementing computer-assisted SISs is small (Keen, 1981; Kwon & Zmud, 1987). Because an accepted theoretical framework is not available, relevant factors have been identified by means of a literature review in the fields of educational innovation, business administration, and computer science. The following groups of factors are mentioned frequently in the literature (Bjorn-Andersen, Eason, & Robey, 1986; Fullan, 1982; Mayntz, 1984; Rogers, 1983; Stasz, Bikson, & Shapiro, 1986) as influencing the outcomes of educational innovation processes:

1. features of the innovation contents,
2. features of the innovating unit, and
3. the innovation strategy used.

These three variable clusters were considered to be important for studying the introduction, use, and effects of SISs. In the first variable group, the quality of the innovation—in this case, Dutch SISs—is central. The results of the implementation of SISs are also supposed to be dependent on the characteristics of the innovating units, casu quo schools, and of the strategy used for implementing SISs.

Also, a fourth factor can be identified from the work of Bjorn-Andersen et al. (1986), Rogers (1983), and Mayntz (1984), in that the effects of SISs are also influenced by the strategy used for the design of the system. However, this factor has not been included in the research for reasons of feasibility.

Based on the literature, Visscher (1996) developed a model portraying the assumed relationships between the previously mentioned groups of variables and the use and effects of computerised school information systems. The model is presented in Figure 1, in which SIS use is assumed to be influenced by the perceived quality of the system (block B), the features of the implementation process (C), and of school organisations (D). Moreover, the higher the perceived system quality, the more the implementation process promotes system use, and the more the features of the SISs match the nature of schools, the more intense the use of SISs (E) is expected to be. Finally, the magnitude of and the way in which SISs are used are expected to lead to positive and negative effects (F).
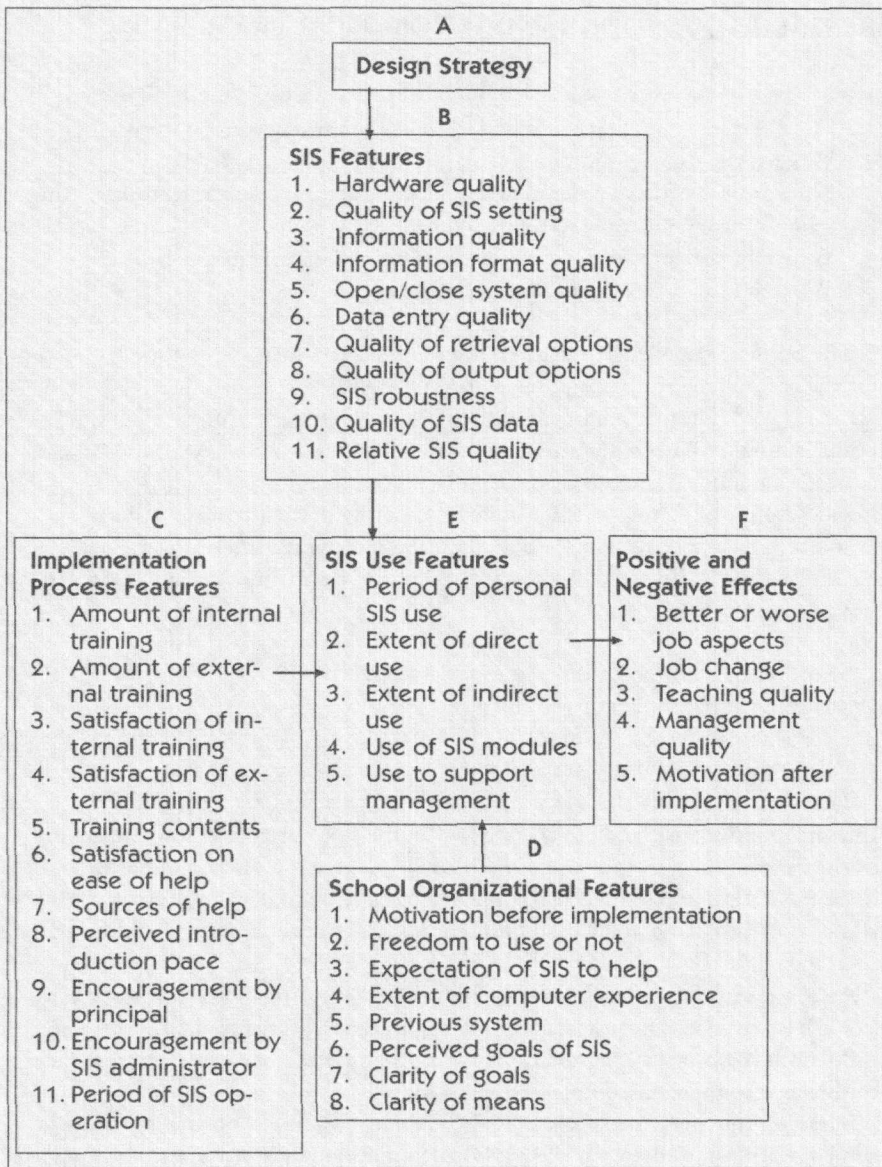
A

Design Strategy

B

SIS Features
1. Hardware quality
2. Quality of SIS setting
3. Information quality
4. Information format quality
5. Open/close system quality
6. Data entry quality
7. Quality of retrieval options
8. Quality of output options
9. SIS robustness
10. Quality of SIS data
11. Relative SIS quality

C

Implementation Process Features
1. Amount of internal training
2. Amount of external training
3. Satisfaction of internal training
4. Satisfaction of external training
5. Training contents
6. Satisfaction on ease of help
7. Sources of help
8. Perceived introduction pace
9. Encouragement by principal
10. Encouragement by SIS administrator
11. Period of SIS operation

E

SIS Use Features
1. Period of personal SIS use
2. Extent of direct use
3. Extent of indirect use
4. Use of SIS modules
5. Use to support management

F

Positive and Negative Effects
1. Better or worse job aspects
2. Job change
3. Teaching quality
4. Management quality
5. Motivation after implementation

D

School Organizational Features
1. Motivation before implementation
2. Freedom to use or not
3. Expectation of SIS to help
4. Extent of computer experience
5. Previous system
6. Perceived goals of SIS
7. Clarity of goals
8. Clarity of means

Figure 1. The variables studied and the assumed relationships between the variable groups.

In addition, the specific variables mentioned in each of the blocks of Figure 1 have been selected on the basis of the literature research. Valuable aspects of the quality of information systems (B) have been derived from Dale and Habib (1991), Fulmer (1995), Honeyman and Honeyman (1988), Visscher (1991), and Visscher and Spuck (1991). Fullan (1991, 1993); Hopkins, Ainscow, and West (1994); Nolan (1995); Visscher (1996); Visscher and Spuck (1991); and Wild, Scivier, and Richardson (1992) point to aspects of the implementation process (C), school organizations (D), and the use and effects of SISs (E and F)

that were considered valuable for inclusion in the research. Each of the blocks in Figure 1 shows the variables that have been studied in this research.

METHOD AND DATA ANALYSIS

A set of four questionnaires was sent to a group of 498 Dutch secondary schools in February 1997: one for the school principal, one for the SIS administrator, one for a teacher who is not the system administrator, and one for a clerk or secretary. Each questionnaire consisted of 43 common questions, and that for the school principal included six additional questions about school features and managerial use of the school's SIS. Schools that had not responded by the end of March received a follow-up request.

Data analysis started with descriptive statistics (frequencies and cross-tabulations) with respect to all variables studied. Thereafter, the groups of SIS users and nonusers have been compared by means of variance analysis to determine differences with respect to the quality of the SIS as perceived by each user group, the implementation process they have gone through, and characteristics of the schools in which users and nonusers work.

Furthermore, to investigate to what extent variance in SIS use is explained by other variables in Figure 1, those variables that from a content point of view were considered to be the most promising predictors of system use were entered into regression analyses. Thirteen potential predictors were identified, but on examining the data, four of these variables were excluded from the analysis because of the high number of missing values. The nine selected variables cover the quality of the SIS (block B in Figure 1), features of the implementation process (C), and characteristics of the schools into which the SIS has been implemented (D). Respondents' scores were transformed into normalized scores, allowing their mutual comparison, and thereafter entered into stepwise regression analyses on SIS use by principals, clerks, SIS administrators, and teachers, respectively. Regression analysis was also carried out on SIS use at the whole-school level (a school SIS-use score was defined as average SIS use of the principal, clerk, administrator, and teacher of that school).

RESULTS

A total of 195 respondents from 63 schools replied to the survey after our follow-up request. The response rate is too limited to consider the research group a representative sample out of the population of approximately 700 schools. However, the data concern an interesting source of information on what happens if schools use SISs. The research schools vary considerably on crucial variables like the extent and length of system use, the implementation process and effects experienced by the staff. This research is a step in filling the empirical research gap and hopefully will inspire future researchers to produce more generalisable findings.

The research schools have the following characteristics. Approximately 61% of them already had their own computer-assisted SIS before installing one of the three mentioned SISs, and the other 39% used manual systems before they started to use the SIS they currently use. The period during which the SISs

have been used varies considerably: between 4 and 144 months! At the time of the survey, approximately 20% of the users had used an SIS for 1–12 months, 15% for 1–2 years, 20% for 2–4 years, and 42% for 5–12 years.

Many of them (38%) are large schools with more than 1,500 students, but approximately 10% are small (less than 500 students). Approximately 20% of the schools have 500–750 students, and approximately 10% is in each of the other school size categories (751–1,000, 1,001–1,250, and 1,251–1,500).

Forty percent of the schools are schools with one or more types of general secondary education. Eleven percent have one type of vocational education, whereas 47% combine various types for general education and vocational education.

In the response group use of the three leading SISs is distributed in the following proportions: Scholis (1987–1997), 10%; School+ (1987), 32%; Schoolfact (1986–1999), 52%; and 6% from a wide range of minor systems such as self-written or those developed by an unknown software vendor. It was decided to include the data of these schools in part of the analysis because they contain interesting information that can be used for answering the research questions. The software vendors estimate that Scholis, School+, and Schoolfact have respectively 20%, 40%, and 40% of the secondary school market for SISs. If their estimation is correct (which is a little doubtful because approximately 6% of our research schools use another SIS), then Schoolfact is slightly overrepresented and the other two SISs are slightly underrepresented in the research group. However, these deviations are far from dramatic.

Degree of System Use

The first research question concerns the degree to which school staff use SISs and has been answered by computing various SIS use indices.

This question concerns the degree to which SIS modules are being used in schools. The percentage of data entry into a module is an indication of which modules are in operation in schools, and as such is a measure of SIS use. According to the responses from the SIS administrators (assuming that information provided by SIS administrators who are in charge of the SIS are more reliable in this respect than those of others), the amount of data input into different modules varies from one school to another. Some modules have been filled completely with the required data, others contain approximately 50% or more of the data, and, in a considerable number of modules, less than 50% of the data have been entered.

The modules most used in the research schools are student test scores, final examination registration, and financial student administration. Less commonly used are absentee registration and timetable administration.

The extent of SIS use is indicated best by the amount of time of direct and indirect use (Table 1). The questionnaire defined the former as using the system oneself and the latter as the use of printouts received from other staff using the system.

SISs are used especially for clerical work, whereas teacher and managerial work are supported relatively little by them. The limited systems use by teachers together with the relatively intensive direct use by clerks and SIS administrators

Table 1. Direct and Indirect Users in Number of Hours per Month

Hours per Month	Principal (n = 37, 49)*		SIS Administrator (n = 54, 50)*		Teacher (n = 37, 37)*		Clerk or Secretary (n = 42, 36)*	
	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
0	30%	6%	11%	18%	60%	38%	5%	28%
< 1	19%	6%	6%	18%	5%	22%	2%	17%
1–4	16%	45%	7%	18%	11%	22%	2%	42%
5–10	22%	27%	9%	24%	8%	14%	10%	6%
11–20	8%	14%	19%	10%	14%	5%	14%	0%
21–30	3%	0%	19%	0%	3%	0%	17%	0%
> 30	3%	2%	30%	12%	0%	0%	50%	8%

The first n concerns the respondents for direct use, and the second concerns the respondents for indirect use.

are consistent with expectations. SIS use among principals in general proves to be limited; approximately 60% of the school leaders use an SISs (in)directly for four or fewer hours a month, although a small group of approximately 15% uses it for 11–30 hours or more. It is striking that approximately one-quarter of the principals and SIS administrators use the computerised school information system *indirectly* for 5–10 hours per month, which means that they receive a considerable number of printouts from other school staff.

Management Use

So far, the analysis of SIS use concerned routine clerical activities. Use for managerial purposes has also been analyzed. The degree of use of SIS printouts to support managerial decision making shows that a considerable number of printouts that are supposed to have a management-supporting capacity are not used for that purpose by principals. The number of nonusers is larger than the number of users for respectively approximately 50% (Scholis, 1987–1997), 42% (School+, 1987), and 65% (Schoolfact, 1986–1999) of the printouts. The printouts used in general concern student results in reports and purely administrative printouts (e.g., student counts) that are used during one school year. Financial and personnel reports, reports in which relationships between data are portrayed (e.g., a report of the scores by student, grade, and subject), or reports in which patterns in the data are analyzed across school years, such as simulations of policy measures, are not used much. Hence, management support is especially of an administrative kind, higher-order forms of managerial support are underused to a high degree.

Perceived Quality of the SISs

The second research question concerns the quality of the SISs as perceived by its users. To get a valid impression of the quality of the SISs, only the opinions of direct users (n = 129) have been analyzed.

In general, the SIS hardware does not cause serious problems.

Whether the SISs provide the information needed is a crucial issue. Sixty-four percent of the users consider (very) much, 42% to some degree, and 13% a

little. Furthermore, 18% of the users are not or are only a little positive about the format of the information the SISs provide. Forty-nine percent are fairly satisfied with it.

With respect to the data entry options of the SISs, most users are (very) positive or neutral. System terms and error handling are appreciated the least; approximately one-quarter of the users are (very) unhappy with those data entry aspects.

Although most users are (very) positive or neutral about the data retrieval options of the SISs, 20%–25% of them are (very) unhappy about the lack of clarity of the menus and system navigation options.

As far as the output options are concerned, 20%–25% of the users are (very) unhappy about the ease of getting data on screen, the clarity of the layout, the ease of printing, and the layout of the printouts. The other users are neutral or positive about these matters.

According to approximately 40% of the users, their SIS does not always work when they want it to. Of those who have problems with the SIS, 80% experience two or fewer problems a month, 10% between two and five problems, and 10% even more than five problems a month.

Approximately two-thirds of the users are (very) positive about various aspects of the quality of SIS data: the degree to which they are accurate, up-to-date, and complete. Striking is that only 40% of the users are (very) happy about the management-supporting nature of the data. Approximately 15% are (very) unhappy about the speed of data retrieval on screen and the speed of printing information.

When asked to compare the SISs they currently use with their previous manual or computer-assisted systems, approximately 1%–10% of the users consider the nine SIS aspects mentioned in Table 2 as a deterioration, approximately 10%–30% evaluate the quality of both systems as equal, and 65%–80% judge the SIS they use as an improvement.

Table 2. Users' Opinions on the Relative Quality of the SISs They Use

Aspects of the Quality of SISs	(Much) Worse	Same	(Much) Better
Data Input and Storage	8%	12%	80%
Accuracy of Information	4%	30%	66%
Relevance of Information	8%	24%	69%
Up-to-Date Information	1%	33%	66%
Completeness of Information	3%	24%	73%
Management Support Capacity	6%	24%	71%
Speed of Retrieval on Screen	10%	18%	72%
Speed of Printing Out	14%	21%	65%
Ease of Information Availability	10%	18%	72%

Implementation Process and School Organizational Characteristics

Research question three refers to the features of the process through which the SISs have been introduced into Dutch schools as well as to the relevant organizational features of those schools.

SIS Implementation

Training was delivered to 70% of respondents by a software vendor; the other users were trained by educational institutions, colleagues, or external bureaus.

All respondents, SIS users and nonusers, indicated how many hours they have been trained by internal school staff and external trainers. Approximately 40% have been trained externally for 11–30 hours or more, 40% have not been trained externally at all, and 20% for 1–10 hours. The data shows that many principals (50%) and teachers (83%) have not been trained at all, which also goes for 25% of the administrators and 17% of clerical staff. Most clerks and administrators (61% and 56%) have been trained for 11–30 hours or more.

According to the users who received external training, training focused on (the missing percentages are the users who did not choose one of the extremes):

+ technical system aspects (50%) versus how to use the SIS (15%),
+ practical system use (37%) versus theoretical aspects (20%),
+ secretarial/clerical work (36%) versus managerial functions (28%),
+ retrieving data (37%) versus entering data (13%),
+ printing out data (37%) versus interpreting and using data (23%),
+ printing self-defined reports (28%) versus printing standard reports (27%),
+ standard data searches (19%) versus self-defined data searches (14%), and
+ system management (26%) versus managing the introduction of the SIS (20%).

Approximately 70% of the respondents have not been trained *internally*, 20% were trained internally for 1–4 hours, and 10% for more hours. Approximately 40% of the direct users are (very) satisfied with the quantity and quality of external training, and approximately 20% are (very) unsatisfied about it. The other respondents (35%–40%) are neutral.

If users experience a problem with their SISs, 44% are (very) satisfied with the ease of getting internal help, approximately 30% are (very) unsatisfied with this matter, and the rest have a neutral opinion. Approximately 30% of the direct users are unsatisfied with the ease of external support, 40% are neutral, and 30% are (very) satisfied.

If users have a problem with the SIS, 77% of them frequently work this out themselves, and 50% often consult the system administrator. A hotline, colleagues within the school, and the system manual are each used frequently by 20%–30% of the direct users. Colleagues outside the school are seldom a source for problem solving. Half of the respondents have a neutral opinion on the pace of SIS introduction, 35% judge the pace as (very) slow, and 15% as (very) fast.

Approximately 40% of respondents do not feel or only a little encouraged by the SIS administrator, another 40% feel encouraged (very) much, and approximately 20% to some degree. Encouragement from the principal is felt only a little or not at all by 30% of the respondents, to some degree by 20%, and (very) much by 50% of the respondents.

Table 3 shows the different stages of the roll-out process in the schools studied. The period the SIS was in operation at the time of the survey varies from 6 to 144 months. At the time of the survey, site preparation had taken place on average four years and seven months ago, whereas the SIS had been in opera-

Table 3. Number of Months Ago that Roll-out Stages Took Place in Schools

	Valid	Missing	M	SD	Range
Site Preparation	40	15	55	39.4	6–144
Hardware Installation	38	17	42.7	34.3	3–120
SIS Software Installation	36	19	48.5	38.4	3–120
Data Conversion	28	27	38.6	39	1–144
SIS in Operation	34	21	49.4	41.3	6–144

tion on average four years and one month. However, the standard deviation for the roll-out activities proves to be high, thus the situations of schools regarding these activities differs strongly.

School Organizational Factors

When the SIS was first introduced into schools, few staff members (10%) were (very) unmotivated to work with it, 69% were (very) motivated, and 21% were neutral. As far as computer experience at home or at work before the introduction of a SIS is concerned, 10%–20% of the respondents had none, approximately 10% a little, 30% some, 30% much, and 15% very much experience.

In the view of almost all respondents, the SIS they use was introduced to improve school administrative efficiency and effectiveness, the information flow with the Ministry of Education, strategic planning by the Ministry of Education, and record transfer between school phases. According to respectively 30% and 35% of the respondents, improvement in the quality of education and increased control by the Ministry of Education have been the reasons for system introduction.

To approximately 70% of the respondents, the goals of introducing an SIS are (very) clear, 20% have a neutral opinion on this, and 10% of the respondents believe the goals are only a little or not at all clear. Approximately 20% have a negative opinion, 30% are neutral, and 50% are positive as far as the clarity of the means and activities to meet these innovation goals are concerned.

Factors Related to the Extent of SIS Use

The fourth research question focuses on the factors that have a relationship with the magnitude of SIS use. Of the 195 respondents, 129 personally use an SIS (they form the user group), 41 indicated that they do not use the SIS (the nonuser group), and 25 did not answer that question. The users and nonusers were compared by means of a one-way variance analysis to identify characteristics of the two groups that may clarify the differences in the extent of SIS use between both groups. The groups have been compared on those features of the implementation process, the information system quality, and the school organization that, from a content point of view, were considered most interesting. Four variables were excluded from the analysis because of the large number of missing values: (a) satisfaction with internal training, (b) satisfaction with external training, (c) encouragement from the principal, and (d) encouragement from the SIS administrator.

The results (Table 4) show that the mean score of the user group is significantly higher than that of the nonuser group for the following variables:

• motivation at the time of the survey,
• extent of internal and external training,
• clarity of the goals of the innovation and of the means to achieve these goals,
• satisfaction with the pace of SIS introduction, and
• perceived quality of SIS information.

The groups of respondents do not differ concerning their start motivation, computer experience, satisfaction with the ease of help, several types of support

Table 4. Analysis of Variance Results for a Comparison of the User and Nonuser Group Schools

Variable	Users		Nonusers		F
	n	M	n	M	
Starting Motivation	116	3.8	20	3.5	1.4
Motivation at Time of Survey	123	3.9	39	3.3	16.3**
Computer Experience—Home	121	3.1	31	3.4	1.0
Computer Experience—Work	128	3.3	30	3.3	0.0
External Training	128	2.5	41	0.4	45.4**
Internal Training	127	0.7	41	0.2	5.6*
Ease of Internal Help	107	3.2	7	3.0	0.1
Ease of External Help	106	2.9	7	2.1	3.7
Goal Clarity	128	4.0	41	3.2	30.1**
Means Clarity	127	3.6	38	2.5	44.2**
Self-Support	120	3.9	8	3.6	0.5
Support from Administrator	105	3.3	6	2.7	1.4
Hotline Support	116	2.5	8	1.9	2.2
Support from Internal Colleague	113	2.2	8	2.4	0.1
Support from External Colleague	113	1.6	8	1.0	3.3
User Manual	117	2.7	8	2.4	0.4
Introduction Pace	110	2.9	22	2.3	8.0**
Information Quality	127	3.4	37	3.0	7.6**
Input and Storage	89	4.0	3	3.3	1.6
Information Accuracy	90	3.9	4	4.0	0.1
Information Relevance	89	3.8	4	3.5	0.4
Up-to-Date Information	89	3.9	4	4.0	0.1
Completeness	91	3.9	4	3.8	0.2
Management Support	85	3.9	3	3.7	0.3
Screen Speed	89	3.9	3	4.3	0.5
Printing Speed	86	3.8	3	3.3	0.5
Ease of Information Availability	90	3.9	4	2.5	7.4

*Significant at .05 level of significance. ** Significant at .01 level of significance. The internal training and external training variables have been measured on the following scale: 0= 0 hours, 1= 1–4 hours, 2= 5–10 hours, 3=11–20 hours, 4= 21–30 hours, and 5= more than 30 hours. All other variables have been measured on a 5-point scale.

in case of SIS problems, and their opinions on many aspects of the SISs and the information they produce.

It is important to note that the data collected concern user perceptions. For example, the degree to which users really have been trained more, or they *think* they have been trained more, or the extent to which the goals of the innovation process really are more clear to them is unsure. It may be that users in general are more positive on these and other matters than nonusers because they manage to use the SIS. Nevertheless, it can be concluded that the use of an SIS goes together with a higher perceived level of motivation, extent of training and innovation clarity, satisfaction with the innovation pace, and perceived quality of the SIS. Therefore, in the further implementation of SISs, it is worthwhile to emphasise the importance of these variables for as many as possible of the staff involved as possible.

It is interesting that for both the users and the nonusers, the means for the following five variables are below the neutral value of 3 on a 5-point scale:

1. extent of external and internal training,
2. ease of getting external help regarding the SIS,
3. extent of hot line support,
4. satisfaction with the innovation pace, and
5. help from internal colleagues, external colleagues, and the user manual.

In other words, users and nonusers tend on average to have negative attitudes concerning these implementation aspects and do not make much use of the forms of support mentioned. This would need further investigation to enhance future implementation processes.

To investigate the extent to which variance in the degree of SIS use is explained by other variables in Figure 1, those variables that were considered the most promising predictors of system use by the principal, SIS administrator, clerk, teacher, and for the whole school (i.e., the mean for the four respondents) have been entered into five regression analyses.

Thirteen variables were initially selected as potential predictors. Four of them were excluded from the analysis because of the high number of missing values. The nine variables entered into the regression analysis are: (a) perceived clarity of the goals of the SIS innovation, (b) perceived clarity of the means to realise the goals of the SIS innovation, (c) respondents' computer experience, (d) ease of external help in case of problems with the SIS, (e) ease of school internal help, (f) users' starting motivation, (g) perceived information quality, (h) amount of internal training, and (i) amount of external training.

Three of the nine variables prove to explain variance in SIS use indices (see Table 5): (a) amount of internal training, (b) perceived clarity of the means to realise the SIS innovation goals, and (c) amount of external training.

- Twenty-three percent of the variance in the degree of direct system use by SIS administrators is explained by the variance in the degree of external training.
- Sixteen percent of the differences in clerks' direct use are explained by variance in the perceived clarity of the means to realise the SIS innovation.

Table 5. Results of Regression Analysis on Direct SIS Use

Variable	Coefficients*	SA	C	T	P	WS
Degree of External Training	β	.88			.48	.57
	βstand	.48			.31	.26
	Significance	.00**			.03	.03
Clarity of Innovation Means	β		.73	.88		.83
	βstand		.40	.58		.36
	Significance		.01	.00**		.00**
Degree of Internal Training	β			.93	.37	
	βstand			.29	.27	
	Significance			.02	.05	
	R^2	.23	.16	.48	.24	.25

* β = Unstandardised Beta. βstand = Standardised Beta. Significance = Level of significance. SA = SIS administrator. C = Clerk. T = Teacher. P = Principal. WS = Whole School. ** $p < .01$.

- Differences in the perceived clarity of the innovation means and in the extent of internal training explain 48% of the differences in the degree of system use by teachers.
- Twenty-four percent of the differences in system use between principals are explained by differences between them with respect to both the amount of internal and external training.
- At a whole-school level, the perceived clarity concerning innovation means and the degree of external training together explain 25% of the variation in direct SIS use.

Overall, the degree of external training and the clarity of innovation means prove to form the most powerful explanations of variance in SIS use (each of them explaining variance in three SIS use indices). The extent of internal training variable explains variance in two system use indices.

The other six variables did not explain any further variance beyond the three variables in Table 5.

Table 5 also provides indications of the strength of the relationship between the implementation process features and direct system use. At the system administrator, principal, and whole-school levels, an increase of one point on the external training variable implies an increase of between .48 and .88 on the system use variable—that is, if the variable "system use" increases with one point, it moves, for example, from the "1–4 hours" of use value to the "5–10 hours" value (or from "5–10 hours" to "11–20 hours," etc.). One may also deduce that system use increases with approximately seven-and-a-half hours (i.e., the mean of the answer categories of the system use variable) a month if the "system use" variable increases with one point.

An increase of one point on the "clarity of innovation means" variable implies an increase in direct system use of approximately .73–.88 at the clerk, teacher, and whole-school levels. An increase of one point on the degree of internal

training variable implies an increase of almost one point (0.93) on teacher use. For system use by the principal, the relationship between both variables is still of importance but less intense (.37).

Effects of SIS use

The last research question concerns the effects of SIS use. Table 6 shows some effects of the introduction of SISs. It can be seen that higher percentages for all listed effects, except for workload and stress, are found on the positive side. In the view of approximately 30%–60% of the direct users, SIS use has led to better insight into school functioning, better evaluation of school performance, improved use of resources, better internal communication, and better information for curriculum planning. According to 20% of the users, workload has improved, whereas 40% think workload has deteriorated. In the view of 12% of the SIS users, stress has been reduced; 32% think it has increased.

Table 6. School-Level Effects of SIS Use in Numbers and Percentages

| Factors | Negative | | | Positive | | |
	Much Worse	Worse	Percentage of Negative Responses	Much Better	Better	Percentage of Positive Responses
Insight into How the School Functions	0	1	1	37	7	46
Evaluation of School Performance	1	1	2	46	7	58
Use of School Resources	1	0	1	29	5	40
Information for Curriculum Planning	1	0	1	20	3	33
Internal Communication	2	2	4	29	5	37
Workload	5*	35#	40	18	2	20
Stress	6@	26**	32	9	3	12

*Note. The table does not contain the percentages for the "same" response category. The difference between 100% and the sum of the percentages for the positive and the negative answers concerns the percentage of respondents who neither observed an improvement nor a deterioration. * all of them are SIS administrators or clerks. # 23 of these are SIS administrators or clerks. @ all of them are SIS administrators or clerks. ** 20 of these are SIS administrators or clerks.*

Table 7 gives insight into the effects of SIS use on various features of school staff jobs.

- A large number of SIS administrators are (very) positive about how the SIS reduced their monotonous clerical work and about the assistance the SIS provides in their work.
- The majority of clerks are (very) positive about the help they get from the SIS in their jobs.

Table 7. The Effects of SIS Use on Various Job Aspects in Percentages

	(Very) Negative				(Very) Positive			
	P	A	T	C	P	A	T	C
Monotony of Clerical Work	5	16	15	18	36	63	15	33
Time Needed for Duties	14	54	50	30	23	28	13	41
Ease of Duties	5	38	25	21	38	33	38	39
Help in Job	13	11	31	9	43	61	31	69
Career Opportunities	–	3	7	–	5	39	14	6

P = Principal. A = Administrator. T = Teacher. C = Clerk.

- A considerable number of SIS administrators, teachers, and clerks are (very) negative about the time they need for duties as a result of the introduction of the SIS.
- One-third of the teachers are (very) negative about the support from the SIS in their jobs.
- About 40% of the principals are (very) positive about the reduction of their clerical work as well as about how their duties have become more easy and the help they get from the SIS in their work.
- Relatively many SIS administrators (40%) think their career opportunities have improved (much) as a result of the introduction of an SIS.
- Approximately one-third of the teachers are (very) positive about the assistance they get from the SIS and say that the SIS has made their duties (much) easier.

In the view of the majority (72%) of respondents, the quality of teaching has not been influenced by the introduction of an SIS, which, given the nature of the SISs, is not surprising. Two-thirds of principals report that the quality of school management has become (much) better as a result of the introduction of a SISs. However, when asked whether their SIS does what they had expected it to do for school management, 5% of the principals who use an SIS denied this, 70% replied a little to a certain degree, and, according to 25% of them, this (very) much is the case.

When asked about their feelings on having the SIS withdrawn from their school the next day and returning to their old system, 84% of the principals replied they would feel (very) unhappy, while 16% would be neutral. As far as the other direct users are concerned, the picture is as follows: 87% of SIS administrators, 43% of teachers, and 70% of clerks would feel (very) unhappy. Striking is that 14% of teachers would feel (very) happy.

User motivation before as well as after the introduction of an SIS has been determined. By the time this survey was done, 76% of the respondents reported that they were (very) motivated (before: 69%), whereas the percentage of (very) unmotivated was 5% (before: 10%).

CONCLUSION AND DISCUSSION

The results of this study show that although some modules of the available SISs are being used by most schools (e.g., student test scores, final examinations, and financial student administration), others are being used much less intensively. Moreover, approximately 75% of the respondents use the SIS directly (most of them are system administrators or clerks), whereas one-quarter do not use the SIS at all. Principals and teachers use SISs relatively little. System use at the management level tends to be administrative, and use for higher-order managerial purposes (e.g., simulations or pattern analysis) is limited.

The majority of users are satisfied with the quality of the information the SISs produce. The same goes for the data entry and retrieval options of the SISs. The number of users experiencing a problem with the system is considerably high: 40% have two or fewer problems a month. Only approximately 40% of the users are satisfied with the management support the SISs provide.

Training for SIS use in general has not been intense. Principals and teachers especially have not been trained much, and the majority of system administrators and clerical staff (approximately 60%) have been trained for 11–30 hours.

Approximately one-third of the users are unsatisfied with the assistance they receive when they experience a problem with the SIS; 77% of them try to solve the problem themselves, and 50% are assisted by the system administrator.

In the opinion of the respondents, the introduction and use of SISs has led to a better evaluation of and insight into school functioning, improved use of resources, and a better basis for curriculum planning and internal communication, whereas workload and stress have been influenced in a negative sense. A considerable number of users (especially system administrators and clerks) are positive about how SISs have led to a decrease in monotonous clerical work and about the degree of help they receive from the SIS in their jobs. Users are more negative about the time needed for duties as a result of SIS use. The negative effects of system use are striking and require more in-depth research.

Users differ significantly from nonusers with respect to seven variables: Users are more motivated, have been trained more both internally and externally, have a clearer picture of the goals of the innovation and of the means to achieve them, and are more satisfied both with the quality of the SIS and the pace of its introduction.

In general, users and nonusers tend to have negative attitudes concerning (a) the amount of training they have received, (b) the ease of help in case of system problems, (c) the innovation pace (too slow), and (d) the level of support they receive from colleagues or from the user manual.

The regression analyses on direct system use showed that variance in SIS use at various school levels is explained by three variables: (a) the degree of external training, (b) the degree of internal training, and (c) the perceived clarity of the means to realise the innovation goals. Differences in SIS use at the levels at which system use is most intense—that is, at the level of the system administrator and clerk—are explained for 23% and 16%, respectively, by the degree of external training and the perceived clarity of the innovation means. In other words, the research findings stress the importance of external training with re-

spect to SIS use and the need for a clear understanding of the means of achieving the innovation. Those variables prove to be critical success factors and need more attention in strategies for implementing SISs. More intensive high-quality training (including the clarification of the innovation goals) are required to increase system use by all school staff. Managerial staff are in need of specific training concerning how SISs can help them in managerial decision making. For example, they need to learn to decide what information they need and how they can get it, interpret it, and use it in school decision making.

If these preconditions are not met, the probability that the goals of SIS initiatives will be met is very small. It is hoped that the findings of this research project will stimulate and help those who are responsible for the design and implementation of computerized school information systems to improve their innovation activities. ∎

Contributors

Adrie J. Visscher received his PhD at the University of Twente in The Netherlands on the basis of his dissertation titled *Design and Evaluation of a Computer-Assisted Management Information System for Secondary Schools*. He has worked at the same university in the Faculty of Educational Science and Technology since 1983. In collaboration with others, he designed an integrated school information system (SIS) for Dutch secondary schools and evaluated its influence over a period of three years. In 1991 he was the editor of *JRCE* 24(1), a special issue on computerised school management systems, and he has published numerous other articles on this topic. He is interested in the conditions for the impact of computer-assisted SISs in educational organizations. Paul Bloemen received his master's diploma in educational science and technology in 1998. His final thesis reports a study on the factors promoting the use of computer-assisted information systems for school management activities. (Address: Dr. Adrie J. Visscher, University of Twente, Faculty of Educational Science and Technology, PO Box 217, 7500 AE Enschede, The Netherlands; visscher@edte.utwente.nl.)

References

Bjorn-Andersen, N. , Eason. K., & Robey, D. (1986). *Managing computer impact: An international study of management and organizations.* Norwood, NJ: Ablex.

Dale, D. M., & Habib, A. G. (1991). Administrative computing in the Australian educational system. *Journal of Research on Computing in Education,* 24(1), 120–145.

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

Fullan, M. (1991). *The new meaning of educational change.* New York: Teachers College Press.

Fullan, M. (1993). *Change forces: Probing the depth of educational reform.* London: Cassell.

Fulmer, C. L. (1995). Maximising the potential of information technology for management: Strategies for interfacing the technical core of education. In B.-Z. Barta, M. Telem, & Y. Gev (Eds.), *Information technology in educational management* (pp. 3–8). London: Chapman & Hall.

Honeyman, J. C., & Honeyman, D. S. (1988). School automation: A paradigm for analysis. In J. H. Collins, N. Estes, & D. Walker (Eds.), *The fifth International Conference on Technology and Education, vol. 1* (pp. 25–31). Edinburgh, Scotland: CEP Consultants.

Hopkins, D., Ainscow, M., & West, M. (1994). *School improvement in an era of change.* New York: Casell.

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

Kwon, T. H., & Zmud, R. W. (1987). Unifying the fragmented models of information system implementation. In R. J. Boland & R. A. Hirscheim (Eds.), *Critical issues in information systems research* (pp. 227–251). Chichester, England: John Wiley.

Mayntz, R. (1984). Information systems and organizational effectiveness: The social perspective. In T. Bemelemans (Ed.), *Beyond productivity: Information systems development for organizational effectiveness* (pp. 151–176). Chichester, England: John Wiley.

Nolan, C. J. P. (1995). The development of computer-assisted school administration in New Zealand. In B.-Z. Barta, M. Telem, & Y. Gev (Eds.), *Information technology in educational management* (pp. 63–78). London: Chapman & Hall.

Rogers, E. M. (1983). *Diffusion of innovations.* New York: Nichols.

Scholis [Computer software]. (1987–1997). Noorburg, The Netherlands: Orias van Biesma Automation.

School+ [Computer software]. (1987). Den Bosch, The Netherlands: Malmberg.

Schoolfact [Computer software]. (1986–1999). Amsterdam: CMG Scholen.

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.

Visscher, A. (1991). School administrative computing: A framework for analysis. *Journal of Research on Computing in Education, 24*(1), 1–19.

Visscher, A. J. (1996). Information technology in educational management as an emerging discipline. *International Journal of Educational Research, 25*(4), 291–296.

Visscher, A., & 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.

Wild, P., Scivier, J. E., & Richardson, S. J. (1992). Evaluating information technology supported local management of schools: The user acceptability audit. *Educational Management and Administration, 20*(1), 41–48.