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COMBATING TRUANCY: CAN THE COMPUTER HELP SCHOOLS?

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Introduction

ARS is an acronym for Absence Registration System, a computer-assisted system that supports the registration of absent students as well as the analysis of absence data. The design and development of the system resulted from an initiative by the Dutch government, which was looking for a means to reduce absenteeism and therefore started a project in 1988 with thirty secondary schools in large cities in western Holland. Project schools received ARS hardware and software, as well as support when implementing the system in their school. In exchange for these facilities schools had to collaborate in a research project intended to evaluate the introduction and effects of ARS. The aim of the project was to investigate whether the computer could help schools to reduce absenteeism. It was hoped that this would be possible for several reasons. Firstly, the ARS procedure for registering and handling absent students is systematic and, if carried out correctly, enables the detection of absent students. ARS produces so-called absence control lists that contain all students who have been absent without a reason regarded as valid by the school. Absence control lists are used to determine reasons for absence of one or more *individual* truants (valid reasons or not). When the reason for a student's absence is known, an absence handler (e.g. a tutor) can decide if measures against that student (punishment, counselling etc.) should be taken. Measures against individual truants will hopefully reduce absenteeism by discouraging them to play truant.

A second reason for the expected reduction of truancy concerns the statistical reports ARS can produce, which can assist schools to discover absenteeism patterns, such as relations between absenteeism rates and other variables (e.g. subjects, teachers and timetable characteristics). On the basis of this information schools can develop an anti-truancy policy; that is, apply *general* measures for the whole school, which are meant to reduce the extent of truancy.

Research Questions and Research Framework

The central research questions of this project are:

1. To what degree is ARS used by project schools?
2. To what extent did absenteeism rates change in experimental and in control schools between 1988 and 1991?
3. What factors stimulate a successful implementation of ARS?
4. Did the use of ARS bring about effects other than changes in absenteeism rates?

To answer these questions a theoretical framework, presented below, was constructed. Very little systematic knowledge exists regarding the role that various variables play in implementing computer-assisted school information systems (Kwon & Zmud, 1987; Keen, 1981). Because no accepted theoretical framework is available, relevant variables have been identified by means of literature research. Research literature from the fields of educational innovation, business administration and computer science was analysed concerning the development and use of information systems (IS), and the implementation of *school* information systems. Although some variation exists between the clusters of variables that various authors (Fullan, 1982; Rogers, 1983; Mayntz, 1984; Stasz, Bikson & Shapiro, 1986, Björn-Andersen, Eason & Robey,1986) distinguish with regard to educational innovation, the following groups of variables are mentioned most frequently:

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

These three clusters of variables are also considered to be important for studying the introduction and use of ARS. As far as the first group of variables is concerned, the quality of the innovation (in our case ARS) seems to be especially valuable. The results of the implementation process are probably also dependent on the characteristics of the innovating units (in our case schools) and of the type of strategy used to implement the innovation. Following Björn-Andersen et al. (1986), Rogers (1983) and Mayntz (1984), it is assumed in this project that the impact of introducing computer-assisted school information systems is determined by how the IS has been designed (block A in Figure 1) and how it is used (block D).

Figure 1 shows the groups of variables that are studied in this research project and their mutual relations. As explained in the introduction it is hoped that the use of ARS will lead to a reduction in the number of truants. Therefore block E contains the main effect variables and the absenteeism rates (E1 to E4 in Figure 1).

Two forms of absenteeism are distinguished in this paper. The first is disallowed absence, which is the same as truancy, and the other is allowed absence. Disallowed absence (variable E2) is defined as being absent without a reason considered valid by the school, while allowed absence (variable E1) is defined as being absent during a lesson with a reason regarded as valid by the school. Variable E3 shows the percentage of truants that play truant for 1-2, 3-5, or 6-8 lessons respectively on a specific school day.

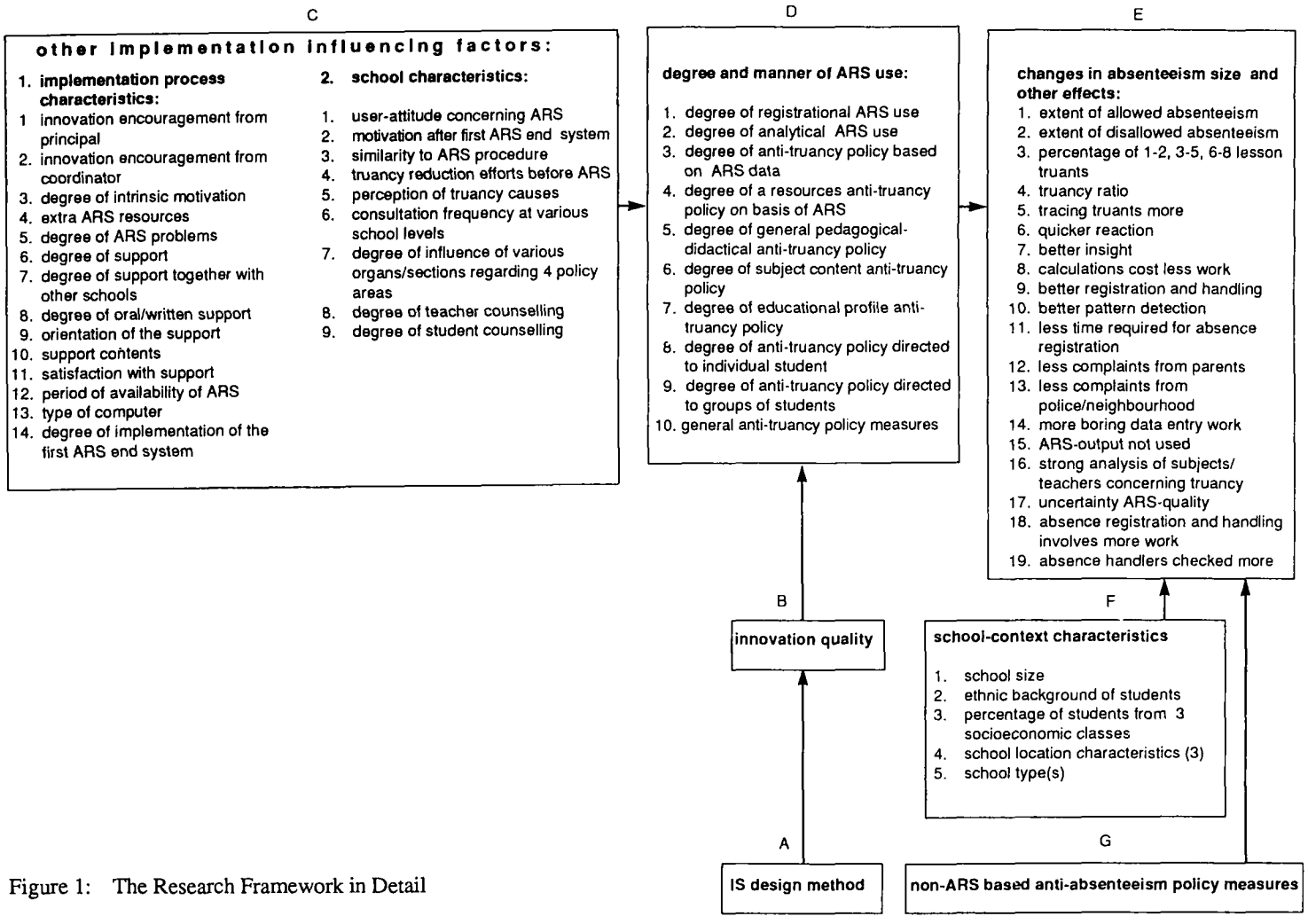

Figure 1: The Research Framework in Detail

The truancy ratio (E4) expresses the percentage of students of a school truanting for one or more lessons on the monitored day. Since installing and using computers often goes hand-in-hand with unplanned positive and/or negative effects, the degree to which such effects occur is also determined (see E5 to E19 in Figure 1).

Figure 1 assumes that block E is influenced by the use of ARS (see block D), that is, the frequency with which ARS is used in certain ways. Three forms of ARS use are distinguished:

* *registrational*: registering daily absence, that is, entry of absence data and retrieval of absence control reports containing daily absences (D1);
* *analytical*: retrieval of statistics over long periods to find absence patterns and relations between absenteeism rates and other variables like subjects, teachers etc.

Moreover, a school can *develop an anti-truancy policy on the basis of ARS data* (D3 in Figure 1) and as such try to reduce absenteeism.

ARS use is assumed to be influenced by the quality of the innovation (block B), by characteristics of the implementation process and school characteristics (block C1 and C2). It is assumed that the higher the innovation quality perception of a school (block B), and the more the implementation process characteristics promote ARS (block C1), the more intense will the use of ARS probably be in that school. Moreover, it is expected that certain school characteristics (block C2) will promote ARS use. For instance the attitude of staff towards ARS (variable C2.1 in Figure 1) or the similarity between ARS and the procedure of absence registration already used by the school (C2.3).

Blocks F and G represent two variable blocks that might influence the primary effect variables, the absenteeism rates. In case of a reduction of absenteeism rates, context variables like school size (F1), the socio-economic (F3) and ethnic background (F2) of students are expected to be related to truancy, and their influence must be controlled for (Bos, Ruijters & Visscher, 1990). The same goes for variable G: truancy reducing measures that have been taken by schools since 1988 but which are *not* based on the use of ARS. The relation between these 'other measures' and trends in absenteeism should be studied.

Block A represents the method used to design and develop ARS. Since ARS has been designed in one way only, the design method is not a variable studied in this investigation.

Method

Experimental Group, Control Group and Research Design

In order to answer the research questions, data were collected in thirty secondary schools that voluntarily participated in the ARS project. The Dutch government wanted four large cities (Amsterdam, Rotterdam, Utrecht and Haarlem) to participate since it assumed that truancy was a big problem there. The four cities were asked to select schools that were willing to participate in the project. Project schools were probably motivated to participate because of a hoped for reduction in truancy and/or for the resources they received (hardware, software, support etc.). Therefore the research group is select and the findings of this investigation cannot be generalized statistically.

The study has a quasi-experimental design with a pre-test and two post-tests. The degree of absenteeism was initially determined before ARS was introduced in April 1988. The second measurement of absenteeism was carried out in April 1990, when ARS had been used for 8 months. In April 1991 (schools had been using ARS for 20 months) absenteeism was measured for the last time. Data regarding the other variable blocks in Figure 1 were also collected at these same moments in time.

Besides the project schools a group of 19 control schools was involved in the study. At each of the above-mentioned stages of data collection, absenteeism rates and some organization and context characteristics of the control schools were determined. This enabled an analysis of developments in absenteeism rates when ARS was *not* used (i.e., in control schools) and might prevent changes in truancy rates being attributed mistakenly to the use of ARS. The control schools were selected on the basis of four criteria: location (Rotterdam, Utrecht, The Hague), school size (0-300, 301-500, 501-750 and 751 or more students), school type (six school types were distinguished). Moreover, only schools that did not use a computer-assisted absence registration system could function as control schools.

Clearly there is no perfect match between control and project schools. Some combinations of school types that exist in the project group do not exist in the control group and vice versa. Moreover, the number of control schools (19) is smaller than the number of project schools and none of the control schools is located in Amsterdam. So, comparisons between the results of project and control schools should be drawn carefully.

Procedure and Instruments

Absenteeism data were gathered in the experimental and control schools during one day in April 1988, 1990 and 1991, during all lessons (e.g., about 6000 lessons per year), except those devoted to examination (highest grade) classes. The degree of absenteeism was computed *at school level.*

Data on the other variables in block B to G were collected by means of structured interviews and questionnaires with principals, administrative staff, teachers and the internal ARS coordinator of each school.

Data Processing and Analysis

Data processing resulted at first in descriptive statistics (cross tabs, frequencies) and association measures such as Pearsons Product Moment correlations. To be able to determine to what degree changes in school absence rates (between 1988, 1990 and 1991) differ between project and control schools, Mann-Whitney tests were carried out concerning these changes. This was only carried out on the data of those schools of which all required data were available. This meant that data of 22 ARS-schools and of 17 control schools could be used. Moreover, regression analysis was used to determine predictors for ARS use. Data of 30 (1990) and 27 (1991) project schools could be used to answer the fourth research question (other effects of ARS use).

Results

The four research questions will be answered subsequently.

The Use of ARS

The first research question concerns the degree to which ARS is used. The study of registrational ARS use, analytical use of ARS and the use of ARS-output for the development of an anti-truancy policy during the school years 1989-1990 and 1990-1991 produced the following picture. Registrational ARS use (registering absence daily, retrieving absence control lists and handling absence on the basis of these lists) developed mainly in the project schools. A relatively small number of schools use this ARS for analytical and policy-making purposes and where they do, this is not done very intensely. In both school years quite a number of schools did not use ARS for developing anti-truancy measures (13 in 1990 and 11 in 1991, or respectively 45% and 41% of the schools). If a school developed measures to combat truancy on the basis of ARS these measures concerned the resources of the school (e.g. changing absence registration procedures) or general pedagogical-didactical measures (e.g. arranging support from external specialists). Schools did not take measures concerning the subject contents or the educational profile of the school (the structure of the school as depicted for instance by the various possible educational streams and student career options). Registrational use proved to be the only ARS use that was significantly stronger in 1990-1991 than in 1989-1990. Thus, concerning other forms of ARS use no systematic development was observed between these two school years.

The Reduction of Absenteeism

To answer the second research question four absence rates have been studied (see variable E1 upto E4 in figure 1). These rates have been measured for 1988 (the pretest), 1990 and 1991 for both experimental and control schools. For each rate the differences *between* control group and experimental group concerning the *difference scores* (e.g. the percentage of disallowed absence in 1991 minus the same percentage in 1990, or in 1988) have been computed.

Disallowed absence and allowed absence

The disallowed absence difference score 1990-1988 expresses how the disallowed absence rate has developed between these two years. Table 1 shows the results of the Mann-Whitney test of the difference scores of the experimental and of the control group.

Table 1 shows that if 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 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.

Table 1: Results of Mann-Whitney Test of Disallowed and 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.)

difference scores	control group (N=17) M	experimental group (N=22) M	U	one-tailed significance of U	Prob.
disallowed absence					
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
allowed absence					
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

For the T2-T1 and T2-T0 difference scores this probability is .48, which means that the probability is greater (.52) that a difference score from the control group is higher than the probability that a difference score from the experimental group is higher than a score from the control group.

The disallowed absence difference scores do not differ significantly ($p<.05$) between both research groups. In other words, neither in the period 1990-1988, nor in the periods 1991-1990 and 1991-1988, did there prove to be a significant difference between these groups concerning the development of the degree of disallowed absence. This means that experimental schools, when compared with control schools (the latter register absenteeism manually) could not reduce truancy systematically between 1988 and 1991, despite the use of ARS.

Table 1 also 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. The comparison of the allowed absence difference scores of the experimental and of the control group shows that experimental schools and control schools do not differ significantly ($p<.05$) concerning the way in which allowed absence rates have changed between 1988 and 1991. So, ARS usage did not produce a reduction of allowed absence beyond that achieved by non-ARS using schools.

The percentage of students that plays truant 1-2, 3-5 or 6-8 lessons

A third absence rate that was determined to analyse trends in absenteeism as a consequence of introducing ARS concerned the average percentage of students who on a specific day played truant during 1-2, 3-5 or 6-8 lessons. The probability that a randomly chosen observation from the experimental group would exceed a randomly chosen observation from the control group was more often (for five of nine difference scores) smaller than the probability that a random difference score from the control group would exceed a random experimental group difference score. None of the difference scores showed a significant ($p<.05$) decrease or increase in this absence rate. In other words, if ARS schools and control schools are compared with each other, the former did not succeed in reducing significantly the number of students that did not attend 1-2, 3-5, or 6 or more lessons between 1988 and 1991.

The truants ratio

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

Factors that Stimulate ARS Implementation

To determine to what extent the quality of ARS, characteristics of the implementation process (the C1-variables in figure 1) and of participating schools (the C2-variables) influence the degree to which ARS is used (the third research question), two stepwise regression analyses were carried out. Since the relation between the number of variables and the number of cases (27) was unfavourable, the number of independent variables was reduced. This was done by combining variables in compound variables on the basis of their content. This 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 differs as a result of which they are not comparable. Therefore compound variables were standardized (z-scores). The compound variables comprise the following variables:

- compound variable 1, the degree to which school staff is motivated to use ARS (variables C1.1, C1.2, C1.3, C2.1 and C2.2 in figure 1);
- compound variable 2, the degree of support (satisfaction), (variables C1.11, C1.4 and C1.6);
- 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 ARS was implemented (variables C2.5, C2.4, C2.7 and C2.3).

These four compound variables were used as possible predictors in two regression analyses for both 1990 as well as 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 block B (innovation quality). The four compound variables were also involved as predictors in the second regression analysis. The dependent variable of the second regression analysis concerns the degree of anti-truancy policy on the basis of ARS output (D3 in figure 1). 'Innovation quality', which is the fifth predictor in the first regression analysis was replaced by the variable 'school staff meeting frequency', because it was expected that 'school staff meeting frequency' would correlate much stronger with the extent to which ARS is used for the development of an anti-truancy policy, than did 'innovation quality' (the latter probably correlates stronger with registrational and analytical ARS use).

For the 1990 data two strong predictors for 'the degree of registrational and analytical ARS use' were found: the degree to which school staff is motivated to use ARS and the extent to which a school meets positive conditions for ARS use before it is implemented. 'Motivation' accounts for 31% of the variance in the degree of registrational and analytical ARS use and 'positive ARS-conditions' adds 17% to the explained variance (the standard error is .15 for both variables). The accompanying β-values are high, .66 for 'motivation' and .42 for 'ARS-conditions' respectively. Thus, during the first stage of the implementation process (in 1990 ARS schools used ARS for about eight months) the degree to which schools were motivated to use ARS (variable C2.2) and the extent to which they were encouraged by their principal (variable C1.1) to do so proves to be very important. The importance of innovation motivation corresponds with educational innovation literature and literature on introducing computer-assisted information systems (see e.g. Bennet & Lancaster (1986), Piercy (1987)). The fact that the compound variable 'positive conditions for ARS use' proved to be a second predictor in 1990 implies that schools in that year also differed concerning this.

The results of the 1990 analysis imply that the other three compound variables did not explain any variance in ARS use. This is remarkable since it means that in this project neither the quality of ARS, nor the support (satisfaction) of schools, nor the degree to which schools have had to cope with hardware and software problems proved to make any difference to the extent of registrational and analytical ARS use. However, from this finding it should not be concluded that these variables are of no importance for successfully implementing ARS. In a number of cases relations probably could not be found due to there being little variation between schools in the scores on these variables. The latter may be because some variables hardly varied between schools, like the degree of support that schools received and the perception of the innovation quality.

The regression analysis with the dependent variable 'degree of anti-truancy policy' for the 1990-data did not produce any significant results, which is probably linked to the fact that ARS schools hardly developed anti-truancy measures (13 of 29 schools did not develop any policy measure and no school developed more than three 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 results. None of the five predictors can be regarded as either promoting registrational and analytical ARS use, or policy-making on the basis of ARS data. Two factors that predicted registrational and analytical ARS use to a

high degree in 1990 do no longer predict registrational and analytical ARS use in 1991. As mentioned above a possible explanation for this finding might be that these factors are especially important during the first phase of the innovation process.

Another possible explanation may be the fact 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 is 356.7 (mean = 1177, maximum score = 1545), in 1991 it is 270.3 (mean = 1245.7, maximum score = 1570).

The 1991 results concerning ARS use for the development of anti-truancy measures are in keeping with the results of the same analysis for the 1990 data. Just as in 1990 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 was very limited (11 of 27 schools took no policy measures, nine schools one, six schools 2 and one school took 9). Variance between schools on this variable therefore is probably not large enough to detect a predictor. The fact that schools did not use ARS intensively for the development of anti-truancy measures probably means that it must be very difficult for them to develop such a policy.

Other Effects of ARS

The principal, the school employee responsible for coordinating the implementation of ARS, and the ARS operator were asked by means of a 5-point scale to what extent ('not at all' or to a 'small', 'fair', 'strong' or 'very strong' degree) introducing ARS had led to other (positive and/or negative) effects than changes in absenteeism rates (the last research question).

Positive Effects

Having a better insight into truancy figures proved to be the strongest positive effect in 1990, according to 80% of the schools this effect occurred (very) strongly. In 1991 this effect is also very strong (82%). Another effect that seems to occur strongly in 1990 is that computing the number of absences per student for student reports takes less time: on average 70% of schools perceives this effect as occurring strongly or very strongly and in the opinion of 26% of schools it occurs to a fair degree. In 1991 this effect is even stronger: about 90% of the schools perceive it as (very) strong.

According to more than 76% of the schools absence registration and handling have improved in 1990 to a (very) strong degree as a result of using ARS. This is approximately the same as for 1991.

In 1990 43% of schools think to a (very) strong degree that, as a result of ARS use, they can react more quickly to truancy, among 47% of schools this effect appears to a fair degree. In 1991 the picture is somewhat different: according to 63% of schools this effect occurs (very) strongly, whereas 26% think it appears to a fair degree.

The last effect that in 1990 in the opinion of a considerable percentage of schools appears to a (very) strong degree is the improved ability to discover truancy trends. According to 47% of schools this effect occurs (very) strongly; in the opinion of 37% it appears to a fair degree. In 1991 this effect is the strongest since it ranks as a (very) strong effect in the opinion of *all* schools for that year.

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

Negative Effects

The general picture is that none of the negative effects is experienced by many schools as occurring to a high degree. The sum of 'strong' and 'very strong' in 1990 varies between 0% and 10%, for 1991 it varies between 4% and 19%. The percentages for to 'a fair degree' are low too. In both years 'more work in registration and handling' is the strongest negative effect: 37% and 48% of the schools respectively think that this negative effect occurs to a fair degree in 1990 and 1991, while in the opinion of 10% and 19% respectively this effect appears (very) strongly. This finding is remarkable since it means that ARS use in the perception of a group of 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'. Possibly this is due to the fact that more attention is paid to absence registration, which requires more time. Another explanation might be that ARS use requires more time than when absence registration is done manually.

It is satisfying that other possible, undesired effects of ARS use do not appear in most schools to a (very) strong or fair degree.

Discussion

First the select character of the research group and the imperfect match of experimental and control schools has to be pointed out again. This means that generalizations of the findings would be unjustified and that the results of the comparison of experimental and control schools should be used carefully. The findings should be considered as assumptions that have to be tested in a larger group of schools. Of course, an evaluator should always strive for random assignment of schools to experimental and control groups. However, this study proves this is not always possible. The Dutch government selected experimental schools and it was impossible to create a perfectly matching control group because schools were not eager to participate as controls in such a study (time consuming but no pay off). In future studies evaluators may better attract potential control schools by rewarding them financially for their effort, but this will require extra project funding. However, schools might also be willing to participate more intensively in a research project (e.g. more frequent monitoring of absenteeism). Measuring absenteeism at various moments in time is actually necessary to evaluate the effectiveness of an information system like ARS in a more valid way.

The most important question is of course why this study did not show that using ARS results in a significant reduction in absenteeism. A number of possible reasons can be mentioned here. Firstly, ARS may not be powerful enough to reduce absenteeism. Petzko (1990) in her study of American high schools also found that technological innovations did not produce lower absenteeism rates. Secondly the failed reduction in absenteeism might be linked to the selectivity of the research group. Many project schools proved to be schools for (individual) lower vocational education and were small. It might be that in these schools it is especially difficult to reduce absenteeism, both with and

without ARS. Moreover, these schools have many students from ethnic minorities (30% of students for 56% of ARS schools) who play truant because of external factors (e.g. home characteristics). Petzko (1990) has shown that the extent of truancy in a school is determined to a high degree by its percentage of students from ethnic minorities. In connection with this, school-external factors like the family situation prove to influence the degree of truancy (Petzko, 1990) strongly. It is very difficult for schools to change the influence of these factors. This may imply that the degree to which schools can influence absenteeism is limited.

Thirdly the study showed that the use of ARS for anti-truancy policy-making was underdeveloped. Maybe this results from the fact that absenteeism is not regarded as a problem that requires policy measures. In other words, combating absenteeism could be mainly considered by schools as a matter of registering and handling individual truants. Had schools used ARS more intensively in this way too, absenteeism may have been reduced. Possibly the period of time during which ARS was used by schools (20 months) was too short to enable schools to evolve towards higher levels of analytical and policy-supporting ARS use. Therefore future evaluators of the use of decision support systems should try to determine the use for policy-making over a long period (e.g. five years).

Moreover, the way in which project schools use ARS for registration may be questioned here. Does registrational ARS use mean that truancy reasons and causes are detected and tackled, or is it just a matter of treatment of symptoms? It might be that registering absenteeism by means of ARS and the former manual absence registration hardly differ, so that ARS use did not produce the desired reduction in absenteeism. When a project like the ARS evaluation study is carried out again, evaluators should try to find out what schools do when they track down truants. Do they try to detect and combat truancy causes or just punish students?

Notes

Because of the limited space available here not all details concerning the research framework, method and results can be given. Readers can contact the authors for more details at the Department of Education, University of Twente, P O Box 217, 7500 AE Enschede, The Netherlands.

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