

Changing the school: Experiences from a Dutch “technology-enriched school” project

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Abstract

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Educational change does not occur easily. Intensive and long-standing efforts are necessary. Such efforts are happening in many countries, particularly with reference to technology as a stimulus for the change. But are these efforts resulting in real changes in schools? In this paper we will describe four areas of change: (a) the curriculum, (b) the role of the teacher, (c) the school structure and (d) student learning. The paper reflects on the impact of intensive computer use on each of these areas using observations from a “technology-enriched school” project that is currently underway (1989–1992) in the Netherlands.

Keywords: Educational change; technology-enriched school; computers; teachers; curriculum; learning; computer laboratories; informatics.

1. Change in education

Reform initiatives to improve the educational system are not new. They occur even again, and again, and again, as Cuban [3] has very clearly demonstrated. The major force behind educational reform is society. Cuban states: “Schools perform the social function assigned by the reigning ideologies and élite classes”, where “students, teachers, administrators, superintendents and school boards are mere participants in a process willed by larger forces”. But he also says that “schools and classrooms go largely unchanged, although the noise and motion do give an appearance of fundamental reform” ([3, page 10]).

1.1. Why change?

There is no doubt that our society is changing. As a consequence, the education of future citizens should presumably also change. Crucial aspects of educational reform which seek to stimulate this kind of change, typically include an em-

phasis on self-directed learning, on gaining a broader knowledge of one’s society, of being able to handle information, of improving one’s problem solving skills, and of increasing the capacity for innovative behaviour. This educational change is necessary, but it is easy to realize?

1.2. Change process

There is a considerable amount of literature about educational change. A major reference in this area is the Canadian Michael Fullan [4]. Fullan identifies three broad phases in the educational change process:

(a) the initiation, mobilization, or adoption phase, consisting of the process that leads up to and includes a decision to adopt or proceed with a change;

(b) the implementation or initial use phase, involving the first experiences of attempting to put an idea or program into practice; and

(c) the continuation, incorporation, routinization or institutionalization phase, referring to

whether the change gets built in as an ongoing part of the system or disappears by way of a decision to discard or through attrition", ([4, page 39]).

Fullan further identifies a number of factors affecting the successful working out of these phases. These factors are brought together in four major categories:

(a) characteristics of the change related to need, clarity, complexity, quality of materials and other such factors;

(b) school system characteristics, such as history of change, adoption process, administrative support, staff development approach, timeline and information, and school board/community support;

(c) school characteristics (principal involvement, teacher/teacher relations, teacher characteristics); and

(d) extra-local characteristics (such as the role of government agencies, and of external assistance)" ([4, page 96]).

Summarizing, Fullan selects five factors whose omission will lead to substantial barriers to change:

(a) opportunity (time) for training and interaction during implementation;

(b) good program development or selection;

(c) allowance for redefinition of change;

(d) a (minimal) two- or three-year time perspective; and

(e) supportive principals.

2. Computers and change in school-age education

A next question is how computers can fit into Fullan's model in terms of their capacity to contribute to successful change processes in schools. Tuijnman and Ten Brummelhuis [7] indicate that although many factors have been identified which can contribute to educational change, relatively few attempts have been made to "order these antecedent variables and their relationships with computer implementation in schools in a conceptual sequence" ([7, page 3]). Hypothetical models have been introduced to link explanatory factors with the implementation and impact of computers in schools ([1,7]). Analysis of data to test such models is underway, specifically in the context of the IEA Computers in Education Study [6].

From these analyses, but also from a logical assessment, computers have the potential to create new educational situations in many different ways [2]. Many educators apparently believe in this potential, given the fact that governments all over the world have invested in the introduction of computers in education. What kind of changes are expected as a result of these efforts?

As a school is a very complex organization, with many persons involved, there are many areas of change on which attention can be focused. In this paper four global change areas have been chosen for closer discussion.

Curriculum

A first change area is the curriculum. Curriculum change can occur with respect to new content within existing subject areas, to new subject areas added to the curriculum, and to new resources used in subject areas. Such new resources, specially those closely connected with a computer, can be used to (a) individualize instruction, (b) bring the outside world into the classroom, (c) gain access to vast amounts of information, (d) process complicated data, and (e) provide micro-worlds for exploration.

Role of the teacher

A second change area is the role of the teacher. It is said very often that teachers will have to change from instructors to managers. But there will also be a need for new functions for teachers within the school, functions at the administrative, technical and organizational levels.

Organization of schools

A third change area relates to the physical organization of the school. It is obvious that computer laboratories are being created. But there are many other possibilities for computer presence in the school. How does the teacher deal with computers for demonstration purposes? With single-computer units such as an interactive videodisk or a telecommunication connection? How might or must the school be reorganized so that teachers can use these resources when appropriate?

Learning

Finally, a fourth change area relates to the learner himself. Does using computers have a (positive) impact on learning?

3. Change in a technology-enriched school environment

In the previous sections an approach has been followed in which some general variables and change areas have been described in relation to change in schools. In the next sections, we will apply this approach to a particular situation, a *technology-enriched school environment*.

As was mentioned in Section 1.2, many factors should be taken into account when attempting to stimulate school change. Moreover, those factors should be dealt with in an interrelated way. Therefore, in order to optimize the chances of success, special conditions should be created. A "technology-enriched school" is a context in which such conditions can occur.

3.1. What is a technology-enriched school?

A technology-enriched school (TES) is a school where, through some sort of special project, extensive activity with computer-related resources is taking place. By "extensive" we mean not only more hardware, software, and teacher support than would ordinarily be the case, but also that the project is attempting to involve as much of the school as possible in computer-related experiences. Many such projects are occurring in many different countries. By creating a TES-environment, some of the factors identified by Fullan (see Section 1.2) can be much more easily addressed.

3.2. Factors optimized by a TES-approach

A TES site is selected out of many applicants. This means that the appointment of a school as a TES is the result of a regional or national elimination process. By definition, such a school understands the purpose of such a project: to investigate how computers can change the school system. The first category of the Fullan factors "characteristic of the change" is therefore well understood by those in a TES. When a school applies to be a TES, the school board or governing group has to make sure that support will be given to the project, at all levels and by all the actors participating in that project. The second and third set of the Fullan factors, which relate to district or school-level support, should therefore

also be reasonably fulfilled. In most cases, a TES-project is funded by a governmental or private agency and extra facilities are made available. As a consequence, a mutual dependency will occur, in which both parties (TES and the agency) will try to make the project successful.

From these points of view, a TES is a situation in which the chance for change to occur is strengthened.

3.3. A Dutch technology-enriched school environment

Supporting TES environments has become a central idea in the policy of the Dutch Ministry of Education. In the general education sector, five TES environments have been created: four in secondary education, and one in primary education. The TES in primary education has started very recently (August 1990), so no results are yet available. One of the technology-enriched schools in secondary education is focused on the use of new media (CD-ROM, videodisk, telecommunications) in education, particularly social studies.

The three other technology-enriched schools (collectively called the "Proefstation project") have a more general objective. Their main task is to investigate the impact of using computers in secondary schools on the management, the administration, teaching and learning of and in the school. After some preparation activity, the Dutch Proefstation project started in 1989 and runs till 1993. Each of its TES schools is directly supported by a research team of a nearby university.

3.4. Four perspectives

The results reported in this section are based upon the activities of the TES-projects involving two schools in Enschede, in the east of the Netherlands. The schools are called "Scholengemeenschap Zuid" and "Ichthus College", and are supported by a research group of the Faculty of Education, University of Twente. Specific data about these TES projects is available in a series of reports (15 until now, all in Dutch). As the project is still in execution, results are preliminary. But what change seems to have occurred in the first two years of the projects? We look at this change from the four perspectives outlined in

Section 2: curriculum, teacher role, school organization and learning.

3.4.1. *Effects at the curriculum level*

With respect to the existing subject areas in the schools, there is no clear indication that using computers is changing the content of the curricula. On the contrary, when teachers select courseware, their major criterion is the connection of such a package with the existing learning material, methods and textbooks.

However, handling computers and learning about computers does introduce new topics in the curriculum, but these topics are specifically related to computers. Informatics and computer literacy are obvious examples of such topics, as well as learning to use the keyboard. Thus using computers to support the teaching of informatics is the most popular application of computers in the Proefstation schools. The second most popular application is using computers in the context of learning Dutch, especially to support the writing process, and in particular the planning of essays. In addition, it is expected that in both Proefstation schools the use of computers will become a standard facility in several subject areas, not only Dutch.

Although it is not changing the curriculum of traditional subject areas, the availability of computers in the Proefstation schools adds many new resources to the subject areas. Many kinds of educational software are being used: drill & practice, tutorials, simulations, tools, application packages. The use of tools is most popular, followed by drill & practice and tutorials. The computer is being used twice as much for drill and remediation than it is for the teaching of new content and for demonstration purposes. There has been only a slow start in the Proefstation schools with respect to using computers with telecommunications and to using computers for capturing and processing complicated data.

When selecting educational software teachers in the Proefstation schools prefer the following criteria: (a) will the new resource augment the motivation of the student?, (b) is the new resource easy to handle by students?, and (c) has the new resource a logical straightforward structure which is easy to understand by the student? Again, not an apparent movement toward change.

In summary, computers are not changing curricula, but are changing some instructional strategies within existing subject areas in the Proefstation schools. This is happening as far as a new approach can easily be integrated within an existing curriculum, and as far as teachers and students can see some gain in terms of motivation and new skills. However, the integration of computer use in school practice evolves very slowly, partly because of difficulties finding appropriate courseware, and partly because it takes a long time before teachers are accustomed to the computer, even in technology-enriched schools.

3.4.2. *Effects with respect to the role of the teacher*

Two aspects are of importance in this respect: (a) do teachers become involved in using computers in their school-related activities?, and (b) do teachers change from being instructors toward being managers of information?

There is no indication that the teachers in the Proefstation schools are changing from being instructors towards being managers of information. On the other hand the involvement of teachers in computer-related activities is high. Such involvement can be measured through three kind of activities: (a) are teachers using a computer in lesson-related activities?, (b) do teachers have a computer at home?, and (c) do teachers participate in inservice training? The use of computers in a school-related context in the Proefstation schools did rise from 40% in 1987 to 75% in 1989. While the use of computers for general computer orientation changed from 77% in 1987 to 74% in 1989, the percentages for word processing and for computer grading changed from 60% to 85%, and for instructional purposes from 27% to 53%. Thus in the Proefstation schools, teachers are using computers more, even if their roles are not changing because of this.

The Proefstation schools have stimulated teachers to buy computers for their private use at home. Attractive financial schemes have been developed for this reason (these are called PC-privé projects). The number of teachers from the Proefstation project which have participated in the PC-privé project has grown from 22.4% in 1987 to 70.3% in 1990. Teachers use their computers at home mainly for word processing (92%), to evaluate courseware (54%), and for grade reporting activities (55%).

In-service training can be provided in different ways: (a) directly by colleagues, (b) by self-study, (c) through an external course, and (d) through an internal course. The percentage of teachers in the Proefstation schools participating in in-service training has remained more or less the same throughout the project: 66%. Most of them follow training sessions at their own school (65%) and only 12% have attended a course elsewhere. As reasons not to attend in-service training, "no time and no interest" score the highest. The topic that gets most interest during inservice training is how computers can be used in a subject area; it is followed in interest by word processing.

In the Proefstation schools teachers feel that working with computers creates new challenges for them and raises their motivation. There is a wide acceptance of computers in the school. There is a positive relationship between having a computer at home and having a positive attitude towards using a computer in school. But, there is no evidence that the role of the teacher is changing in the Proefstation schools because of the computer availability.

However, although more teachers are becoming involved in the process of introducing computers in the schools, the main tasks and initiatives in the Proefstation schools are still concentrated within a limited number of teachers. When one of these teachers leaves, great problems arise.

In absolute terms, the use of computers is still rather limited. A minority of teachers in the Proefstation schools (14%) remains negative about using computers. The reason these teachers indicate for not being involved, is shifting from "no time or no interest" toward "not necessary in my subject area".

3.4.3. Effects at the school level

Introducing computers does affect the school in many practical ways: there is a constant need for (a) more facilities (hardware, space, time), (b) extra personnel, and (c) release time for teachers.

Introducing and using the computer laboratory is the main physical change which has occurred in the Proefstation schools, as a result of the introduction of computers. Both schools in Enschede have two computer labs. But the computer labs are mostly used for informatics. In addition to the computer labs, there is a growing need for mobile

computers on carts, which can be used in individual classrooms. Computer facilities (including a laser printer) are also available in the teachers' preparation room.

Scheduling the use of the computer labs is becoming difficult, because of heavy use. This creates a discussion about which subject areas should use the computer lab and which should make use of the mobile computer platforms. The school network is an absolute necessity. If it were not available, the system manager would not be able to cope with his duties.

The computer coordinator, the computer lab manager and the systems manager are irreplaceable in the Proefstation schools. The officially allocated time is insufficient for them to do their tasks. Also, the teachers constantly claim they need more release time. Lack of time is felt as a constant problem. Much "free time" has to be invested in order to cope with computer-related demands.

The automation of the school administration in the Proefstation schools is gradually growing. The administrative support through the computer in relation to the grading of students' work and the automatic construction of report cards is highly appreciated by the teachers.

In both schools the school management is positive about using computers in education, although the rigid school structure in the schools sets its own limitations, especially in the area of individualized education.

A major conclusion from the Proefstation project is that in order to be able to deal with implementation problems, the school management has to be trained. Special attention should therefore also be given to the training of the technical and office staff of the school.

3.4.4. Effects on learning

Despite all the activity in the Proefstation schools, there is no indication that working with computers is having a positive effect on the academic performance of students. However, students work very naturally with computers. It seems that use of computers is improving the students' motivation, although some demotivation can be noticed when computer work takes too much time.

4. Is there change?

The general observation, not only from the Proefstation project, but from computer-related practice in general, is that some changes are happening at different levels: the school, the teachers, the curriculum, and even the students, but only in a very slow fashion.

Two observations are relevant in this respect: (a) a relatively long period of time is needed in order to be able to identify noticeable changes and to make sure that those changes represent some stable picture, (b) some change can be noticed in the first few years of a change situation like the Proefstation environment, after which the change process stabilizes and the situation maybe even returns to its initial stage. In the TES in the Netherlands the involvement of the teachers has been measured using a "Stages of Concern" questionnaire [5]. The results show indeed an increase in involvement during the first two years. Now, in the third year of the project, the increase has stopped.

It seems to be the case that teachers need a constant incentive in order to be stimulated to keep being involved in an innovation. After a few years, they encounter the "implementation dip". The first enthusiasm has faded away, the difficulties involved in really changing education mount up, and the excitement of being in the front line of new developments dries up. The heroes are tired. At that moment in time, something new has to stir them up again. If not, one has to wonder if the little bit of change which has opened up, will survive.

5. Conclusion

Computers will only change education if they are able to change the whole system. However, if change is not introduced gradually, it will not succeed because the effort is too overwhelming. Therefore, how to continue? Again, we would like to refer to Fullan [4]. He says that changes should be carried out in an incremental way, and that significant change can be accomplished by taking a developmental approach, building in more and more components of the change over

time. A change process should resemble the movement of a steam-roller. It takes much effort to get it started. When it rolls, it rolls slowly, nothing can really change that. The important thing however is twofold: (a) keep it rolling, and (b) keep it rolling in the right direction. This is hard when the path seems to be an uphill one.

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