ICT for people

40 YEARS OF ACADEMIC DEVELOPMENT IN STOCKHOLM

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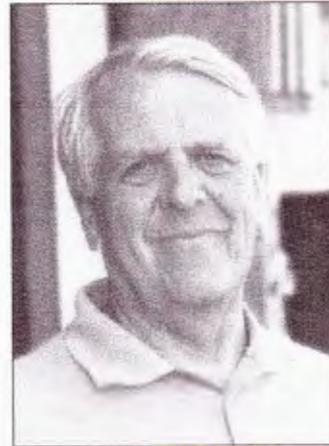
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IT FÖR MÄNNISKOR

40 år

COMPUTER SUPPORTED EXAMINATION

Abstract

Early computerized university examination (late 1960s) is described.
Examinations used prepepared punched cards for multiple choice
questioning. The system was successfully expanded to broadened
examination administration. User experiences were positive.

Educational background

The early Stockholm University/Royal Technical University
curricula concerning Information Systems were innovative.
We teachers were a number of educational newcomers. Surely,
we were fairly experienced with own personal university results,
and most of us had already at least some teaching experience.
But the creation of a new educational curriculum in a field that
was quite unripe certainly demanded innovative thinking.

We created courses based on knowledge and intuition. The
increasing student demand in the 1960s pushed us to work fast.
Some courses were defined as late as at the immediately previous
semester. We were aiming at content creativity. We wanted to
be part of something new, something that was neither computer
science nor applied mathematics or conventional business data
processing. Many of us early teachers had natural science as our
educational origin, but we shared the desire to create something
scientifically broad. We were inspired by our creative new profes-
sor, Börje Langefors, who developed new thinking in information
systems design.

The desire to avoid the conventional did not prevent us from
defining and providing courses in programming languages. In the
late 60s, this was natural. In the beginning, the courses in pro-
gramming were often related quite strongly to computer language
grammar. A move towards characteristics of different types of
programming models and structures took place successively.

Also, at the time some knowledge about the inside of comput-
ers was natural. Secondary storage (hard disk) data organization
turned increasingly important. The concept of data bases started
to be used more and more often, as sequential access was comple-
mented by random access that was made possible by adequate

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hardware development.

As the number of students rapidly increased, administrative work related to the delivering of these courses came to be more and more teacher resource consuming. In 1968, we had 600 students. We divided each semester in short packages, and arranged separate student examinations at the end of each package. For some of the first year courses it turned out to be natural to use multiple choice questioning. The large amount of students demanded some type of rationalization, for lecturing but also concerning examination. The question was close at hand – could computing technology be used also for the examination? Surely, computerized records of student personalia were kept, as well as examination results. But the examination itself – could it be to some extent automatized?

Multiple choice, supported by hand punched cards

The type of questioning that was named Multiple choice was pedagogically considered somewhat stereotypish. However, this form was inviting for rationalization. For this use, optical reading was considered. But this turned out to be technologically sensitive, and the readers were expensive. We switched to punched cards. At the time, punched cards was a quantitatively dominating data and program storage medium, especially for US related computer systems.

There was a type of technology available that had not been tried very much practically – the use of "marking cards" or "needle cards". Each card, of ordinary punched card size, here was prepared so that it was easy for a user with a thin stick (needle) to punch out predefined small rectangular holes in the hard paper card, to make it machine readable for input. To find the right manual marking force from the beginning, the card would preferably need to be placed in a hand-size cardholder. For a question with

"Needle card"

The card was prepared so that a user with a thin stick could punch out predifined holes in the card.
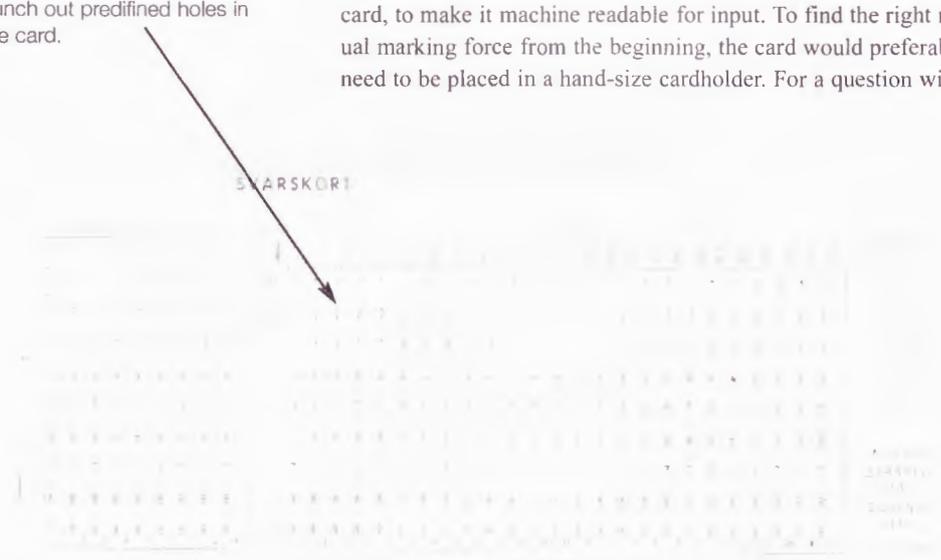
up to 9 suggested choices, it would be easy to mark one as the choice chosen.

A card layout was chosen where the student on each card identified herself or himself by birth date plus a three-digit number, a type of identification that was socially common at the time. After that, it was necessary to mark the sequential card number, plus the answers, the desired choices concerning up to 25 different multiple choice questions. The cards could then be read and processed by ordinary computer equipment.

For security, we invited each student to give her or his initials in handwriting in the upper right corner of each card that was used. This was done to make cheating difficult.

At this time, there was no specific personal integrity problem for an application like this where student examination results were stored centrally. This was so although Sweden was the first country in the world to create and adopt a fairly complete integrity legislation, a law that was taken as early as 1963. This university examination application was in this respect considered quite harmless in terms of integrity.

Each student first filled in a paper based complete question form, and then as a separate activity transferred the full list of choices to the (usually two) punched cards. The paper version was kept by the teacher for later security checking. We found that the students in average needed 10 minutes for the transfer from paper form to punched cards.

The computer system used was a Control Data 3200, an at the time medium-sized system, and the software was written in Algol, incorporating input/output features according to the so called "Knuth's proposal".

" At this time, there was no specific personal integrity problem for an application like this where student examination results were stored centrally."

Systems features

First, the technology was used as input only to checking of examination results. We developed practical ways to handle the punched card technology, and tried it out in practical tests. The examinations naturally had to be administratively integrated with other parts of the university administration.

It turned out that a certain amount of contact between the formulation of the examination alternatives and the practical technology was needed. Questions had to be

- distinct
- not overlapping
- with an adequate number of choices
- with only one single answer
- with the same degree of complexity between exams
- chosen from a list of questions that would be publically available before the exams

Usually, the number of separate questions in each examination was quite high, around 50.

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The first sharp tests showed some practical punched card problems, but these soon were taken care of. We became dependent of access to card readers in the then "computer room", access to which at times demanded some waiting. Anyhow, once there, the examination results naturally were produced, for the time, quite fast.

At the exams, we invited the students to "guess" if they did not know the correct answer. In this way, we thought, guessing would be spread as evenly as possible among the student groups.

We found it natural to complement the examination software with a number of administrative routines. We developed additional software for:

- provison of a full list of all for a certain exam possible questions
- production of a sampled complete question form for an exam
- checking of the names of all students that were present at an exam
- checking of groups that were entitled to participate at a certain exam
- updating of student files with examination results.

All pieces of software were thoroughly documented.

Usage impressions

" ... the teachers seemed happy, because examinations were formalized, and that the teacher examination workload could be reduced."

As the system was introduced, the teachers seemed happy, because examinations were formalized, and that the teacher examination workload could be reduced. The students also seemed happy mostly, they found it fun to use new technology, especially in a field of education like this.

The time saved by having the chance to produce examination results extremely fast, was appreciated by all. As an example, for the computing system it took 8 minutes to calculate the results from an exam with 50 questions, answered by 200 students out of a total student amount of 600.

The cost for using the computer at the time was 100 US dollars per hour, indicating 5 cents per student for this exam, a reasonable amount.

In the ideal situation, student punched card information was transferred to the computing system without problems. In practice, however, certain cards at times were mechanically damaged, which led to certain duplication problems.

Perspective

The system was used practically for a number of years at the end of the 1960s. After certain practical initial problems, the system ran smoothly, and provided cost efficiency to the Institution at the University. At the beginning of the 1970s, however, use of the system successively decreased. The reason for this was not technological. It was found to be too pedagogically simplified, and awk-

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ward, to use multiple choice technology for examinations related to an education that turned out to be increasingly complicated in structure and contents. Also, the number of courses that stressed group work increased.

However, the parts of the system that were used primarily to rationalize the student administration turned out to be useful for a longer time.

It was suggested that the system should be used also for commercial questioning environments, political polls etc. However, unfortunately there were no resources available to inform about and market the system for that.

This complete system was an early attempt to rationalize university examination. Seen in perspective, it was successful. It was probably one of the earliest systems in the field of computerized education support.

" It was found to be too pedagogically simplified ... to use multiple choice technology for examinations related to an education that turned out to be increasingly complicated in structure and contents."

Reference

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by Mats Lundeberg and Tomas Ohlin, 1968