

January 2004

“KATOM” Project

A Computer for Every Class, Student and Teacher

A forward - looking educational experiment:

A portable computer in the schoolbag of every student and every teacher.

Proposed by Professor Haim Harari

Chairman of the Board

**Davidson Institute of Science Education
At the Weizmann Institute of science**

Every journalist, architect, technician or department store salesperson uses computers every day. Most families in Israel own a home computer. Every new car contains several computers. At the Weizmann Institute there are more computers than the total number of scientists, employees and students combined. Computer networks expand at an incredible pace. The use of computers for controlling and monitoring machines is an everyday reality. Almost everyone has access to the internet and the transmission speed of data, sound, pictures and movies through the net is permanently increasing.

Only in one place there is intellectual activity, but almost no computers: The School

After a decade of great efforts, we have not yet reached the ratio of one computer for every ten students, in the Israeli school system – elementary schools, junior high schools and high schools. Most school computers are located in special computer rooms or “labs”, an adequate arrangement for 1990, not for 2004. Many students know and feel that their school is one or two generations behind what is happening in real life.

There is no doubt that, within a few years, be it five, ten or fifteen, every student will come to school with a computer in his school bag. This will happen, whether we like it or not. A decade ago no one dreamed that children would come to school with telephones. This is happening today. It will also happen with the computers.

There is no point in arguing whether computers are good or bad.

The computer is, by far, the most versatile machine ever invented. It allows us to perform many tasks, but most of us just utilize it, not study it. It is the means, not the end. We should use it, not worship it. There is no doubt that some of its applications are beneficial, while others may be harmful. Anything we can do, for better or for worse, with books, letters, films, games, music, tables, pictures, calculations, trade, exhibits, follow-up and more, can be done with the aid of the computer. The computer can also perform additional tasks, some of them amazing. But there are also tasks that every child can perform and the computer is unable to cope with.

There is no point in fighting against the computers. Such a fight is unjustified, and even if it were justified, it would fail. What we need to do is find positive ways of exploiting the computer and avoid as much as possible, harmful uses.

If we accept as given the above two axioms (a computer in every school-bag and the need to maximize the benefits of the computer) the conclusion is obvious. It is urgent and crucial to initiate an experiment, first in a small number of school classes, and then in larger and larger numbers of schools, which will teach us how to live with such a situation.

In the experiment, every student and every teacher will arrive every day to school, with a portable personal computer in their briefcase, schoolbag or backpack

The purpose of the experiment would be to learn what can be done in the school, under such conditions. We want to answer questions such as: What are the difficulties? How the teachers cope with the new situation? Is there a need for substantial changes in the curriculum and in the learning materials? Will the use of the portable personal computer allow for more individual learning and a reduction of the number of formal teaching hours?

However, prior to discussing the experiment itself, we must address a crucial preliminary question. Let us assume that the experiment has been carried out and the result is an absolute remarkable success. Let us assume for a moment that the pedagogic conclusion is that every student and every teacher should carry every day a portable computer.

Can the educational system afford it? The clear answer is: Yes!!!

The calculation is simple, even though it cannot be accurate. Assume that every student and teacher from fourth grade and up will have a computer and will use it in school for three years. This means that the student will receive a new computer in the fourth, seventh and tenth grade. There are approximately 1.2 million students and teachers in Israel between 4th and 12th grade. This means 400,000 new computers every year. Assume that the computer costs \$800 (less than today's price of \$1000, thanks to the huge volume) and that the family of the student will pay for it every month the price of one movie ticket and, at the end of three years, they will own the computer. The net cost of the computer will then be \$500 (after deducting the parent participation). This means an annual expenditure of \$200,000,000 or one Billion Shekels per year, less than 5% of the current budget of the Ministry of Education, and an even smaller fraction of the national expenditure on education (including municipalities, philanthropic foundations and parents). We are talking here about a real revolution, at a cost of a few percent of the total education budget!!!

Our calculation involves numerous uncertainties. They may change the financial conclusions in either direction. We may ask parents to pay more. After all, the computer also serves as a game machine, it will replace many (not all) textbooks, it will replace encyclopedias and many reference books and will eventually also be a telephone and a music player, saving the current cost of cellular phones and other gadgets used by children. Perhaps it will be possible to replace the computer only twice during the school years of the student. Perhaps we should start not at the fourth grade but earlier or later. Perhaps there will be much cheaper laptops. Perhaps there will be suitable handheld (palm) computers, rather than laptop computers. Perhaps there will be cheaper computers, larger than the handheld ones, but smaller than the laptops. There will be some additional costs of training teachers, but most of these costs will replace existing programs, related to computers in the school system. In all cases, the resulting cost will still be less than 5% of the education budget.

We should remember that increasing the national average number of students per class from 30 to 32 or reducing the number of formal study hours per week from 32 to 30, whether it is justified or not, would result in a saving of 5%, more than the cost of a computer for every child and teacher. If the introduction of computers will indeed change the entire system, a re-allocation of 5% or even an increase of 5%, gradually spread over 10 years (the time needed for any change in education) is a perfectly reasonable decision.

All of these calculations indicate that, in the case of a great success, the plan is realistic. But, for the time being, we have no proof, whatsoever, that the use of a portable personal computer for every child and every teacher will indeed improve education and significantly advance the school system. We can reach such a conclusion, if it is at all valid, only by performing a gradual experiment. This is what we suggest in this document.

The idea of supplying a portable computer to every child and to every teacher was proposed by us twelve years ago. Four Ministers of Education accepted the idea, adopted it, but did not execute it, for various reasons, all unjustified. Two Prime Ministers endorsed the program. The Board of Directors of the National Lottery (Mifal Hapais) allocated the funds for the first stage, but no one executed it. A small experiment was performed independently in one school in Migdal Ha'emek and another project was tried, following our recommendation, in two teachers colleges (Yellin and Levinsky). Both experiments were stopped for lack of funds, not as a result of a failure.

Similar experiments were proposed and performed in other countries.

The time has come to implement our original twelve-year old proposal in Israel.

We propose that a team from the Davidson Institute of Science Education at the Weizmann Institute of Science, will lead the experiment and will work in full collaboration with the Ministry of Education and the relevant municipalities. It will start in the fall of 2004 in a few towns. Every municipality will choose a junior high school, and within it, a normal (not outstanding) seventh grade. Every chosen class and all its teachers, in all fields of study, will receive the computers and will use them daily for all reasonable purposes, at home and in the school. In the beginning, we anticipate that most teachers will use existing teaching materials and courseware, as well as standard computer applications. As time progresses, we expect new curricula and learning materials to develop, which will allow an optimal exploitation of the positive features offered by the computer.

In the experiment, every classroom, every student and every teacher, will have a computer.

Every teacher, in every subject and in every class, will determine the spectrum of applications used in the classroom. It is important that the experiment will be open-ended, namely not limited to a specific courseware, specific subject or specific teacher. Using word processors, spreadsheet, and computer-aided presentations is self evident, as is using the internet for obtaining information and reading new material. Beyond that, "the sky is the limit". Among numerous other applications we might mention studying art by viewing the best masterpieces through the internet, simulation of scientific experiments, which cannot be performed in the school (because of cost, safety or technical difficulties), tutoring and personal help of teacher to student and student to student using e-mail, computer-aided projects requiring team work or collaboration of the entire class, special programs for gifted children and for children with learning disabilities, and more. It is actually preferable that some teachers, in some topics, would not use the computers at all, emphasizing that it is only a tool, which should be used only when necessary or advantageous.

Every computer will have an internet connection (probably wireless) and every classroom will have fast network access. It might be helpful to try, in one or two locations, the use of digital display, in addition to the conventional blackboard, displaying to the class websites, individual computer screens of the students or a split screen showing the computers of several or all students.

We do not envisage studying a special topic called “computer literacy”. The child’s ability to use the computer must be acquired gradually, while studying different subjects in different ways. We assume that, with time, new learning materials will be developed, which will enable students to become proficient in numerous computer capabilities, while studying specific subject matter. If we wait until a complete set of teaching materials, in all fields, for all ages, will be developed, the experiment will never start.

The purpose of the experiment is to learn how to use the individual computer in the most beneficial way, in the teaching of all subjects, and to evaluate to what extent it improves various aspects of the learning process. We cannot perform such an evaluation without trying. If we conclude that the computer indeed has a significant potential for improving education, a major expansion of the project will be justified, eventually covering the entire school system.

The proposed Hebrew name of the project is Machshev KATOM, literally meaning an Orange-colored computer, but playing on the Hebrew acronym “KATOM”, which stands for “class, student and teacher”.