

Educational Technology in the 21st Century. Joint Hearing before the Committee on Science and the Committee on Economic and Educational Opportunities. House of Representatives, One Hundred Fourth Congress, First Session. October 12, 1995

STATEMENT OF PROFESSOR SEYMOUR PAPERT, LEGO PROFESSOR OF LEARNING RESEARCH, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASSACHUSETTS

Chairman Walker. I think what we'll do is begin with Professor Papert. We would welcome your testimony.

Professor Papert. Well, thank you. I see in front of me "Where there is no vision..."

Chairman Walker. Would you turn on the mike, I think it might...

Professor Papert. Oh, it needs to be on... I see in front of me "Where there is no vision, the people perish." There is no vision in the education establishment about where education is going.

I think that's the main burden I'd like to make and I'd like to illustrate it by a series of little parables, rather than quote facts, which in the short time.

The first parable is about people in the 19th century who were doing research on how to improve transportation. Somebody stumbled on the idea of a jet engine and had the great idea that if we attached the jet engine to the stagecoach, it would assist the horses by adding to their power. In fact, the opposition to this idea said, "No, don't do that. Let's train the stage coaches better, let's study why the wheels squeak, let's make better grease." Well, they won because they did experiments and they got results, and the other guy, the jet engine caused the stagecoach to disintegrate.

What we're doing with technology in education is exactly analogous. We're putting computers and other technology in a school system that was designed for a totally different epoch where everything about it, the curriculum, its content, the idea of segregating children by ages, all this is the consequence of a system of knowledge-technology called the blackboard or the slate or the pencil and paper that required the dissemination of knowledge through presentation bit by bit by a teacher, so it had to be divided into subjects and the children had to be organized into grades and what could be taught was severely restricted by the conditions under which people, under which knowledge was disseminated.

I think that the problem is not how to stick the educational jet engine onto the educational stagecoach. The problem is to invent the educational jet engine, which is something that will be radically different in all its structure from what we see in schools today.

I object strongly to what you saw being called a classroom of the future. It's a classroom of the very, very, very near future. I doubt if there'll be "classrooms" in the real future. There'll be something else.

Obviously, there'll be places where children learn but they won't resemble what we see today.

I'd like to use one other little parable, and that's about we have a strong opinion in this world that some people can do things like mathematics, and some people can't. And some people can learn languages and some people can't.

Just focus on mathematics. Why do we think some people don't have a head for mathematics? It's because they didn't learn mathematics in the mathematics classroom.

But when we go into the French classroom and see how few children learn French, we do not conclude

that they do not have head for French, because we know that those very same children, if they grew up in France, would speak French perfectly.

So this is a total non sequitur that runs right through the whole thinking about our education, people's abilities, and who can learn what at what age.

The problem for mathematics education is not to find a better way of teaching mathematics in the classroom. The problem is to find the analog of learning French by growing up in France. It's to create a math land, math land being to mathematics what France is to French, and this the great contribution of the computer.

It's not an automated teacher; it's not way of presenting the same old curriculum. It's a mathematics speaking being, a medium, an instrument that would give children and everybody the opportunity to learn subjects like mathematics that we have thought of as too hard, too formal, too abstract, to learn this in the same kind of natural way as children can learn to walk, to talk, to manipulate their parents, to do all the things that children learn to do, without any curriculum and without any of our quizzes or national standards. They just learn these things because they live in a learning environment.

And our job is to convert this new technology into the infrastructure for that environment.

But in order to do that, we have to understand that there's an entire education establishment there, and by that, I mean, the administrations of the schools and the professors and the schools of education and the government agencies, and this whole structure which has been built around supporting and understanding an outmoded system.

And I think one has got to understand that this education establishment has very deep vested interests, not only for their jobs, but more important in their vision. Their vision is how to improve and keep going the old system. The vision is not how to envision and invent and foster the growth of something radically different.

And I think that that is the vision that we have to have. It's very hard to know how to translate that vision into what to do on Monday in the classroom, and we have to face that dilemma, but I think we can.

And I think that the job, the leadership role that our government can give is to recognize that problem, to recognize that when we look into the not very distant future, ten or 20 years, the present system will be totally antiquated in everybody's eyes, and I think we've got to foster the growth of something new in order to make an orderly transition possible.

One last parable, which isn't really a parable. I'm very struck by the analogy between the current state of our school system and the situation of the Soviet Union maybe ten years ago, when, at the time that Gorbachev came into power, it had become apparent that the system is collapsing, that it can't operate.

But it was also, although this was apparent from the outside, to the people inside they tried to fix it by jiggering the details, by making local fixes within its bureaucracy.

I think we are in exactly the same position in our choice of and our approach to trying to fix our education system, which needs a far more radical examination of what it's about, what the problems are, why it is what it is.

And when we do that, I think we might find that one of the reasons is exactly the same as what was wrong in the Soviet Union where they had a command economy where a committee somewhere decided on how many nails would be produced everywhere in the country.

This cannot work in a modern world. But we in our education system are trying to run the closest thing to a command economy in the form of a command curriculum where somehow we think we can dictate, whether it's at a federal or state or local level doesn't matter, we think we can dictate a same curriculum for every child irrespective of who that child is.

I think this is impossible for exactly the same reason. It's going to collapse. We have to recognize that it's going to collapse and see, unless we make and foster very rapid change in the system, it will break down in the same sort of disorderly way that we are beginning to see in some cities now and we saw in the collapse of that Soviet command economy.

I think that's enough. Thank you very much.

Chairman WALKER. Thank you very much, Professor Papert. Dr. Kay.

STATEMENT OF DR. ALAN C. KAY, APPLE FELLOW LEARNING CONCEPTS, APPLE COMPUTER, LOS ANGELES, CALIFORNIA

Dr. Kay. Thank you.

I'd like to submit two documents for the record. One is a Scientific American article I wrote a few years ago, which I think covers a lot of the issues. And another one is a short piece I wrote for this hearing.

Chairman Walker. Without objection, they'll be included in the record.

Dr. Kay. Thank you.

For my short time here, I'd first like to say that I got started working with children in technology because of a visit to Seymour Papert in 1968, 27 years ago or so now. And I was struck immediately by his understanding and vision of how education and this new computer technology is going to play itself out, and I think he was right then, and I think he is right now.

There are some real problems in making it work. If the issue were music, for instance, if America's parents were worried that their children wouldn't make it in life unless they became musicians by the time they left high school, we could imagine Congress or some state legislature coming up with the solution of let's put a piano in every classroom. And they would say, but unfortunately, we don't have enough money to train the existing teachers or hire musicians, so what we'll do is we'll just give the existing teachers two-week refresher courses in the summer on music, and that should solve our problem.

And we know that music, as we know it, is not really going to get into the classroom. Now the children will really enjoy having a piano in the classroom. They'll evolve a kind of chopsticks culture and maybe little bit beyond. But that's basically what we're getting right now.

So part of what Math Land is and part of what any kind of environment for doing rich learning in is one in which the adults are invested in it as well.

I think this the biggest problem that we have to deal with, because obviously American technology can produce as many computers for as low cost as we need. We can saturate the entire world with computers, but to set up a sense of what its special music is, is going to be very, very difficult, and I think that is what we should be aiming our efforts at.

And I'd like to say one other thing, which is a famous Rabbi, famous for his wisdom, in Europe was once asked why the Jews keep the Sabbath holy, and he said because man is not beast of burden. And what he

meant by that was not just that you shouldn't work one day a week, but he meant that being human isn't primarily about working.

So the most important thing here is to try and differentiate between all of the vocational demands that are being placed more and more heavily on society year by year, by parents, by businesses, and what education actually means.

If we take the pragmatic step of simply trying to deal with vocational problems and simply trying to institute training via computers in our schools, we will lose the larger battle and we'll lose it fairly soon.

And it's in part because it is not nearly as difficult for people to learn how to do new jobs as it is for them to have the flexibility to have change be a part of their lives. One of the biggest problems is, in today's business, is not in the intelligence or ability of people to learn; it's in the sense of having a large enough world view to see that there's more things in life than the job that they're doing right now.

So I think that is a very important part.

And the third thing I would like to mention is that even though television is so deeply embedded in our society, it now seems to be the environment that people are exposed to. I think it is one of the worst things in the quantity that it is viewed for helping children understand how large the world is.

People like to say that people find out more from television now than they ever did in the past. But the problem is what they find out is trivial, simple, and has very little to do with the kinds of thinking they're going to have to do when they grow up.

So learning is very entertaining when you do it, but entertainment often isn't particularly good learning.

Maybe television should be the last technology that America produced that doesn't have a Surgeon General's warning on it. It's something to think about.

Now my recommendations are kind of flimsy. And the reason is because, as Seymour points out, we have an enormous situated bureaucracy for running education in this country. And the biggest tragedy is within it are many teachers who are completely dedicated to helping their students' lives.

But within this larger machine, I see very little chance of change in the direction that America needs. I think that is something that Congress and all of the people of this country are going to have to wrestle with for the next quite a few years.

I think setting up goals such as America will be the first in the world in science and math, as President Bush did a few years ago, completely misses all of the points.

One of the points it misses is that this is simply not possible. It will take decades to make changes from what has happened.

And it also misses the point about what the goals should actually be. The goals should be much more like this famous Rabbi, which is that schools should not be just for learning how to make living, but learning how to live.

Thank you.

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Chairman Walker. Professor Papert, you said something to the effect that in the future, that there's going to be a place where children learn but it won't look like today's classroom. Would you give us an idea

what you think it will look like?

Professor Papert. Maybe it'll look like a research lab. Maybe it'll look like an active, creative architect's office. I think it'll look like a place where people are engaged, young people of mixed ages, because it's absurd that we should deprive eight-year-olds of contact with anyone except people at their own level of incompetence.

[Laughter.]

Professor Papert. Where people of mixed ages will be engaged in projects that are rich in knowledge and using the technology to research, get knowledge that they need in order to conduct long-term projects.

Chairman Walker. Doesn't that begin to look a little like the old one-room school?

Professor Papert. I think the one-room school is a better model than the big, massive high school building, yes.

Chairman Walker. That's interesting.

And would you agree with the point that Dr. Shaw made, that the teacher in that kind of setting becomes a kind of a coach, an information manager type of individual, rather than somebody who is imparting information as their primary function?

Professor Papert. I agree with those words, but I'm afraid Dr. Shaw doesn't get it. I think his phrase that the teacher, I quote, "will be a coach walking around the classroom, seeing what the students are doing," is a typical translation of a new concept into the old framework.

There won't be a classroom, the teacher won't be walking around seeing what the kids are doing, the teacher might be part of this constructive project.

Dr. Shaw. To be fair, most researchers now to whom I've spoken do not agree with Professor Papert on this point.

Professor Papert. I did preface my remarks, I think there's an education establishment that has its head wedged in a culture that grew up over a century during which there was the most lethargic progress in education of all fields of human activity, and they continue to suffer from being part of that culture.

I think Congress ought to find some ways of planting seeds where there can be real radical change, real radical experiments, which are not subject to the consensus of the researchers and other members of the education establishment.

In my written testimony, I suggest that you could use the Job Corps, for example, which belongs to the federal government, as a place where real innovation could be made without many of the difficulties that attend trying to introduce it into the classrooms. It wouldn't even cost anything. All you'd have to do is to free the bidders for Job Corps Centers from the micromanagement of a sclerotic bureaucracy, and let people who want to innovate there, innovate.

Chairman Walker. I promised you a lively discussion.

[Laughter.]

Chairman Walker. Let me go to the point that Dr. Shaw raised in terms of the specific terminology, but I think I heard it throughout all of your testimony, and I just want to make certain I did.

Do I hear each of you saying in some form that what technology promises to be able to give us is the

ability to individualize instructional programs, and that it will be based then on the students' talents, the students' abilities, the students' intelligence, what the student brings?

And I assume that this would be in consultation with parents and so on as that instructional program would be designed?

Professor Papert. No, no, no. We've got to give up the idea that learning is instruction. Instruction is a small part of learning. The important part of learning is doing. And I think the big change is that we will move from an emphasis in instructionist thinking to constructionist thinking.

Chairman Walker. But is it an individualized curriculum?

Professor Papert. I think there'll be individualized activities, which will be of such a nature that each individual will be able to draw on personal strengths and personal—

Chairman Walker. And each student will not be learning the same thing as every other student?

Professor Papert. Absolutely, that's right.

Chairman Walker. Okay, so that's individualized. Dr. Kay, would you agree that that's a—

Dr. Kay. Yes. I think if you look at six-year-olds, they are the greatest mathematicians they'll probably ever be in their life. They're the greatest scientists they'll probably ever be in their life. They're really great in general.

And if math and science and so forth were easy, we could just let them invent it, but we know that it took thousands and thousands of years to actually make real progress there.

So the balance I think is that the students are inventive and creative, and when an adult is involved, what an adult can do is to have some sense of where things might be going. So the adults have some sense that the math might wind up in calculus some years down the road, and that could have something to do with the kinds of things that the kids are encouraged to look at.

But the kids have to invent it for themselves and the computer there can be a tremendous factor.

I think nobody has been able to show yet a computer curriculum of any kind, all by itself, that when coupled with children, will have the same effects as children in an atmosphere where adults really understand them and understand how to set up an environment in which all of their energies can be directed at learning, but where the outcomes are likely to be fruitful.

....

Chairman Goodling. ...is there anything going to happen as far as preparing the teacher or the observer or whatever we're going to call the person in the future to handle the situation, beyond all the other responsibilities they've had put upon them?

Professor Dede. There are some changes taking place in teacher education, not as rapid as they need to be. And some of the answer for that is that the faculty of schools of education need to catch up to the 20th century.

And some of the answer for that is that our mechanisms of accreditation, and what parents and communities expect of teachers, often force teachers back into older models of teaching.

In a sense, we say, yes, we want a teacher that's innovative but I also kind of want a teacher that was like

the one that I learned so much from, that helped me to be successful in life.

And I think that until we evolve in the minds of parents and tax payers and community members, a broader sense of what it means to do teaching and learning and a shared responsibility for that, so that it's not a matter of dry-cleaning, where you drop off your student on the step in the morning, and they come back brainwashed in the afternoon.

When we get to a different and a more powerful model of that, then I think we'll see the pressures for changes in teacher education increase.

Dr. Kay. One of the things I mentioned was the piano as a metaphor, but I could also say, 150 years ago, the response was let's put books in every classroom, and they are in every classroom, but in fact most teaching is done from textbooks and is in accord with textbooks.

Books are all about diversity of opinion, and about learning at your own rate, and about learning as deeply as you want. They're all about individualized learning. But textbooks are about lock-step learning.

So this is a perfect example of a great educational technology starting some 400 and 500 years ago, that has actually been co-opted into much more of a party line from what it could be.

And I believe that's exactly what's going to happen to computers, is what's happening to computers in classrooms right now.

....

Mr. Brown. This strikes me as being somewhat close to the message that may be coming from you, that it's not the technology so much but how we can change the society and involve the students as a part of that society.

I'd just ask you to comment on that and see if I'm anywhere close to being right?

Professor Papert. Yes. Well, I think it's both sides of that. The technocentric people who think that technology will solve it are totally wrong.

But a little parable for the other side: Leonardo da Vinci invented the helicopter but there was no way in which you could actually make one because you would have needed a whole lot of other infrastructure; materials science and all sorts of stuff that wasn't there.

I think that there've been generations of really deep thinkers about education including Illich, including my own Professor Piaget, who really saw dead on. They knew what to do but there wasn't the infrastructure to be able to carry it out on a mass scale.

...the technology gives us today the infrastructure to put into practice ideas like learning by doing, learning by experience, coaching. All these are old ideas, but I think that for the same reason that da Vinci simply couldn't have made a helicopter, however smart he was, these people could not put into practice.

Our own American John Dewey, almost 100 years ago, said almost everything about education that we can say today, but it couldn't take effect because we didn't have the technological infrastructure.

....

I think that the problem is to create some very compelling models that can set an example and change people's thinking. Unless you can change the whole public's thinking about what constitutes learning and what constitutes school, you are not going to get real change.

So I think the point is to make models and I don't know where.