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ICT and Education:  
**INCREMENTAL PROGRESS OR FUNDAMENTAL CHANGE?**

Discussion: **SYMPOSIUM WRAP-UP**

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PROFESSOR SEYMOUR PAPERT

I'm going to take over. I've a one-track mind, I want to make change, I want to extract from listening to this wealth of ideas those that strike me as, "I can use these to land a punch somewhere and make change happen". I hope – we've thought of this before, but I think we have – I think it would be great to transcribe and send you all a transcription of the last – of these reports because it's a wealth of ideas and images that swirl around and I think it would be a great feast for all of you to take them and extract in a way that can't happen in the discussion here. The – well, the punch word – whatever you like to extract, but particularly the punchy points. So my shot at extracting some of these punchy points was first of all, starting with the last remark about crisis as two Germans, Voltan and Vosca, raised it.

We clearly are – I think we clearly are in a state of crisis, but I think that people often don't recognise the crisis, misdiagnose the crisis, don't see the relevance of technology to the crisis. It's the last point that I'd maybe just like to emphasise there, because when I contrast the kind of issues that were raised here with the issues that I heard in the official discourse about technology in school, the disconnect is incredible – but particularly incredible in relation to the crisis. In one of the – in the course of Brendan's presentation he raised the question of how to think about learning, education, nurturing and rearing children, and instruction in schools.

I think that a minor point I'd like to make about that is that this is a very good example for me of where everybody recognises that there are different kinds of aspects of learning. They don't recognise that this technology for the first time can bring those together. And it's not that we can do it – they are bringing that together because nurturing is what happens at home in the nursery, it happens before the kids go to school. But more and more parents are buying software that is infiltrating into the home, and they have to make decisions about it. So there is instruction getting mixed up with the nurturing. And in schools, more and more – if you think of what happens in these Maine schools where the kids can take more control – is more and more, the role of the teacher is nurturing and like, rearing the child rather than instructing. These two things are merging, and that's one of the major roles of this technology: it's bridging opposites that seem always to be separate – they come together. This is missing, I think, from the popular image of what technology is about.

Now, about the crisis though: I hear a lot of parents upset about aspects of computers. They are upset about pornography, they are upset about predators on the Internet. Certainly Americans are, and I presume they must be everywhere. Is that a crisis? Yes, it is, but they are not seeing a relation between that and what we are doing in our schools. And I'd like to just spell out what they were, hints all over the place, connections all over perhaps many of the points raised that bear on that relationship.

You see, I think this business of pornography is a little tip of an iceberg, and the iceberg is about what knowledge children have access to. Traditionally until very recently parents, and later on teachers, really did control to a large extent what knowledge children could have. You could decide you don't want your children to know about this or that or violence or sex or whatever it might be, and that's broken down. It's getting out of your control, it's getting out of the control of the parents. Now we can scream about how to try and fix little bits of this by putting little trips and filters, but isn't this a fundamental change: that this basic function of controlling the relationship between our children and knowledge has deeply changed. And we have to recognise that you can't, Canute-like, hold it back. And I think that that is a really fundamental way in which we have to think about – I don't know what the

answer is, but as a society it is vitally important that we rethink these questions quite deeply about how do we bring up our children.

For example, I know in many families – I see in families two distinct approaches to the pornography issue. There are the ones that – in one extreme case – I know many parents don't even want to talk about it, they try and put filters on, they try and put all sorts of softwares and they don't tell the children what it is that they are trying to protect them against and it doesn't work. On the other hand I know families where they feel driven by this situation to take advantage of it, to discuss with the children what it is that they are worried about, and this opens up the possibility much better than the bees and the birds. And the traditional way of raising these issues, in a deeper way and giving responsibility for the – and that's not perfect either, but on the whole it's a much – it seems to me to be an approach that has worked much better. And there must be many other approaches – but I'm not recommending what anybody should do, I'm saying that this is a deep question, it's not only about pornography, it's about the relation of knowledge and to how we control it. And then jumping from there – that jumps to the question of textbooks, which was raised in the last bit.

Now, what's a textbook – you know, I don't know what was meant there, but for me, Jane Austen – if I read a novel that's not a textbook, and if I read an assignment on physics it's not a textbook. If I read real stuff, it's not a textbook. A textbook is somehow pre-digested, special things for this thing called "education". If I do history by delving into the original sources or, as one school in Maine I know – they tried to write the history of their little towns by collecting letters, interrogating, asking the grandparents and looking into the Internet and finding all sorts of stuff like this, that they could do with their computers. They weren't using textbooks. So this is not automating the textbook, the textbook is a different approach to history, which no historian would ever do – and why can't our kids be more like historians?

So this for me ties up with the same question of how does the flow of knowledge work, where do you go for it, who controls it, how do you manage that – and this is a deep, fundamental, difficult question. So it brings you to cheese! And that is one image that will stick, de Gaulle and his cheeses. I hope people visiting Ireland for the

first time note the fact – I didn't know before I came to the Media Lab for the first time – that Ireland has a huge variety of cheeses so you might pick some up if you have time before you go home.

But that apart – you know, this is the question – it's the same question of, we can't control the knowledge so we can't write the textbooks that are ways of controlling what people know. This diversity of everything is part of this world we are moving into, and we don't have any choice about that. So if we don't recognise that we are being like ostriches who are putting our heads in the sand and we are fiddling while Rome burns, which is as I said before the title of my book that I'm trying to finish, I think this – these are fundamental questions that are not being raised in the official discourse about computers and schools.

The bridging of opposites is an important theme that kept on coming up in these different – you know, formal instruction was it, versus nurturing and parenting – school versus society versus informal instruction. How does school – well, school was our way of – as Jim put it the last time, school was our way of shaping the citizens for society. School as we knew it in the past relied on certain devices. It was part of the control of the citizens, shaping the citizens by feeding out knowledge in the right order and giving them access to things. We can't do that. We need some other way to shape society.

I don't know what it is but we need to worry about it and I'd like – I was very – so struck by the reference that Brendan made to the role of Christianity. I don't know whether I understood him or not, but this is what stood in my mind about that – I look and I see that one of the most immediate crises about school is that people – kids are rejecting it, they are not buying into it, and I think they are not buying into it – you see it in all sorts of ways. If you ask them, the number who say they don't think school is relevant just goes up every year.

There is solid research on that, and I think they are right. It doesn't – you see it, I think, that the epidemic of so-called "learning disabilities: is absolutely a manifestation of the disaffection of the young people who can see that school and

society are so different, and the ways of doing things in school are so different and out of touch with the ways of doing things out there, that they don't buy the idea that school is the thing you have to do, as they once did. So school and the abysmal gap between school and society gets bigger and bigger and bigger, and the bigger it gets the more it breeds disaffection – the more problems, violence, drop-outs, etc., etc. – and that increases the gap even more.

The conservatives make an absolutely far-wrong diagnosis. They think the trouble with school is it has changed too much, when in fact the trouble is it has changed too little. But by trying to push it back they in fact aggravate the – worsen the problem. And right along the line we see systematically the solutions going the wrong direction because they are based on a misdiagnosis and they have pretty well universally – all the stuff about accountability and testing – those are good questions but they have a misdiagnosis of the source of the problem, and so they adopt solutions that in fact aggravate it.

Now, what I want to say about this and Christianity is another problem: it's related to the control of the flow of knowledge. You know, I think once upon a time kids went to school and they sat in their desks and they did what they were told and they didn't question, "Should we be here?" The parents didn't question, "Should we send them to school?" It was the thing to do and you just did it, and you just did it – and you could accept it because we lived in a society in which – the society is built around a big image of the thing to do. And I think that having a single religion or a family of religions that could be seen as sufficiently similar is part of a social perception of society that projects an idea of – as a fundamental part of your thinking, as the thing to do. There are certain things that everybody does and everybody believes in, you just do it without question.

And isn't this the fundamental thing that has broken down, that it's not this particular thing to do or that particular thing. We are living in a world where the idea of the thing to do is dissipating, and we'd better find a way of dealing with that. And we didn't try to hold this meeting to solve the world's problems in a day, but I'd just like to stop on – that's the central thing for me. And I'd like to invite you, when you see

the transcripts, to see in how many places you can pick out this or other issues in the ideas that popped up here, of this as a deeply serious crisis situation. And that the world needs to face – and that the world of educators is refusing to face, and is doing immense harm to the – not simply to the future of children and, more than that, to the future of the world.

I'll just stop there with this one remark that I'd like to make, which seems anti-climactic compared with that: but on this question whether you need change, you need crisis to make change and can change happen. I'd like to mention two things – Jim, I think, mentioned the fact that we sometimes think school can't change, but it has changed very much in certain ways. Corporal punishment was the – corporal punishment, if you read anything about school in the previous centuries, that was an essential part of people's image of what school is – it's gone. Another that I mentioned a while ago, is this thing about special education. It came about in the last 20 or 30 years or so, and quite quickly, from nothing. There was no such idea – to it's an overwhelming thing that is almost strangling our school systems.

*(end of tape 1)*

#### PROFESSOR SEYMOUR PAPERT

We had been talking about computers being in everybody's hands and somebody said, "Do you really believe that there will be a computer in every house?" And Marvin said, "There will be a computer in every hinge of every door". And the computer is – it's not even radical to say there is a computer – everything will have a computer in it, our clothes, our – so this ridiculous debate about whether we should give children computers is totally absurd. But I want to notice not that but one other point: Where do they come from? And something that struck me very much recently is how it always comes from outside, you know, from outside the education world. Now in Maine we've heard from these wonderful educators, our commissioner and the leader of our teacher development in the lap-top initiative. They did a wonderful job but they didn't start it.

It was started because somebody who is not an educator could understand the argument that it is as absurd to have – discuss – whether you should have one or four or six computers in the classroom, as it is to discuss whether there should be one or four or six pencils in the classroom. But Angus King – who is not an educator, I believe – that if he had gone and asked the educators what they thought in advance of making up his own mind, they would have said no, have one or two more computers in every classroom. It came from outside.

This morning I spoke to a person here who is in Les Landes in France. It was the same thing there: it wasn't from inside the system, it was the President de Conseil of the Department. I know the same thing happened in Marseilles, where again the President de Conseil decided to consecrate, I believe, 4 percent of the whole income – of the total budget of his region – to buying these computers to put them in the schools. I believe he didn't even ask the Ministry of Education, because he knew they would be opposed to it. But he had the power to decide to put these things in the school because it so happens, by some freak, that this regional administrator is in charge of the school buildings, and so on. And computers are part of the building! My point is, I do think it comes from outside the educational system. I suppose most people here are inside it, so maybe the moral of the story is we have to make alliances outside and encourage the people inside.

One other example of that, that really impressed me recently and made me think about that as an important strategy – being invited to Quebec, in Canada. In Quebec the Chamber of Commerce has set up an organisation promoting educational change, and they hold a big, wonderful conference every year. They organise delegations that go to visit other places, and they are seriously trying to spread the idea of one-to-one computers, but it's not coming from the education system. The people inside the education system there, as in Marseilles – once it comes they take it and they run with it, because why? Because it resonates with something, it feels like the right thing to do – and of course it's the right thing to do.

And so, I think this is a model that I'd like to throw out there, the seed of that idea, and see what can come back: of ways of making alliances, of reinvoking the powers

outside. We've talked a lot about empowering teachers and empowering kids. What about empowering all the other people in society who could act on the school system or the education system, to make the conditions that could lead to change there? And okay, I will stop there. I think we will try – find a way to get a transcription of this to all of you, and create a website. And I think whatever other time we've got, have ideas about action, what should we do to get the word out, to talk to journalists, talk to your politicians, talk to your school, talk to – yes?

ELISE LECLERC, COMPUTER CLUBHOUSE MANAGER

When you were talking about people outside education, I don't know if I go into that box – but the Computer Clubhouse is after school. I manage the Computer Clubhouse across – the Intel Computer Clubhouse. Can you not hear me?

PROFESSOR SEYMOUR PAPERT

I couldn't hear, I'm sorry.

ELISE LECLERC

I work in the Computer Clubhouse just across and, I think as you were saying, children reject school, and school is in crisis for that. Maybe there are answers in projects that are youth clubs and well, the Clubhouse is a youth club with technology in it. That's why I think maybe technology can bring something new as an incentive, a new form of language that the children who haven't managed to master writing, spelling, maths and things like that through formal education – dyslexic children for whom no higher education is possible really –through technology they can actually have an alternative way of progressing and have access to learning which doesn't have to go through writing and the conventional ways of the learning process, the way it goes in schools. But I think maybe because in youth clubs children go on a voluntary basis, if we want children to come we have to create incentives. And so we

have to go through ways and think about ways of attracting children to come and learn in our projects that schools don't have to do, because school is compulsory.

So I think maybe there are some answers to look at there and see how after-school projects manage to get children, –early school leavers, children who are not interested in school, who have rejected it and who turn up in youth clubs on a voluntary basis – come regularly and are really, really involved in these projects. So maybe there are some answers in these non-formal education projects.

#### PROFESSOR SEYMOUR PAPERT

I think there's one connection there, yes, I think that's great but it would be even greater if you can get these children to – give them an opportunity to learn and enjoy learning, and the greatest proof, you'd recruit them into carrying that back into school and teaching the teachers and helping the teacher bring about change there. I think that kid power is really the answer in the end.

#### QUESTION FROM AUDIENCE

*(inaudible)*

#### PROFESSOR SEYMOUR PAPERT

Yes, it's just an example of that. I see Deirdre Butler is going to say something. I'll give you a minute but can I just say something about your project? Deirdre you might know is doing some wonderful projects in schools here with bringing computer-based – computer-mechanised LEGO to schools so kids can build these LEGO things, programme the computer to make – so this is happening in school time. Now, within the school building these things are an opportunity for inserting all sorts of ideas about physics, mathematics, biology and cybernetics.

Now, the teachers don't necessarily have those ideas. So just imagine that two of the kids in one of the schools that Deirdre is working are in your youth club, and learn

there some engineering concepts that can be taken back into the school – and will enrich by inserting a deeper dimension onto a project that they are doing there with Deirdre’s equipment. And the teacher will, and vice versa – so there’s a way of sort of infecting the school with the virus of ideas. Deirdre?

DEIRDRE BUTLER

I don’t think at the moment – I take on board what you are saying. We have already been implementing these ideas and working in schools for the last five years. So it’s not a question that it doesn’t work, it does work and it’s very powerful. It’s been working in classrooms around the country and now particularly in one of the most disadvantaged areas in the city here. Attendances – we have evidence attendance does go up. These kids, particularly kids in the special classes, are consultants to the rest of the school – which actually throws up ideas of what are our values, what does being smart mean?

So it’s not a question, I believe, of actually sort of bringing the informal and formal learning together, it’s a question of looking at what learning can be and how it can change within the school structure. But I believe that teachers have to be supported, they have to be given an opportunity to engage and experience these types of things for themselves. And I feel if it is more widespread, if we can get this groundswell moving on the ground, I think we will see fundamental change. But our problem is trying to convince the powers that be to allow more funding for this type of activity within the school.

So I don’t feel – and I always feel that it’s not a matter of – that schools by volition or teachers within the school are actually holding up a system that they necessarily believe in. They need to be supported within their beliefs. There are a lot of people out there who know it’s wrong but they don’t have the support to actually engage and actually change themselves. So I feel we do need the funding to be put into schools and we do need to convince. My problem is now trying to convince the powers that be to actually allow or to facilitate more money that we can actually engage in more

projects like this so that learning can fundamentally change. So that is the problem for me, how do we convince people that this is actually a worthwhile way to go.

PROFESSOR SEYMOUR PAPERT

Is Joe here?

COMMENT FROM AUDIENCE

Back in Maine, Seymour, when we were working with the Juvenile Correctional Facilities – Deirdre, your question reminds me that we walk a line in change between being right and being effective. And in a perfect world being right would by default be effective, because everyone would be of one mind or there would be a "right" with a capital R. And it's always in looking – it's in accepting, I think, that there are powers that be, that education and learning is a complex, not pure science, that it's purposed, that it has reason. In Maine, in the one-to-one work that we are doing, one of the pieces that we've got to do is to encourage more input from the business community – that what we are about is economic development, not only education. So we need the powers that be. Economic development in a state like Maine, which has lost – as we heard yesterday – 17,000 manufacturing jobs out of a small economy is a big deal. So how can what we are talking about – you need to know who is holding the strings.

PROFESSOR SEYMOUR PAPERT

Economic development and personal development, that's a kind of job for all of us in this business to make these connections so people see – I thought what was saddest about some of the presentations that we heard from people from ministries of education – their ICT literacy policies. The thing is presented as if it's about a little extra piece of knowledge that the kids might have. It's not connected to how Ireland could change its economy, or for that matter, to the fact that parents are worried about the kids playing these mindless games on their computers at home. Well, why are

they playing mindless games? We have infinite experience that if you show kids how to do better things with the computer, give them a chance to do better things, they take them and run with them. They don't do mindless things. But because our education people don't connect what happens in school to what happens with the computers outside in the lives of the children. The schools have abrogated – they have really thrown away responsibility for giving kids a better insight and a better opportunity to develop powerful ways of using this technology.

So the schools are directly responsible for every kid who does a violent, stupid computer game and becomes violent as a result. The schools are responsible for that because they haven't taken the responsibility of giving kids the opportunity of developing a better relationship with computers.

DEIRDRE BUTLER

It may not be perhaps that they are responsible for it, perhaps they haven't been given the opportunity to be responsible for it.

PROFESSOR SEYMOUR PAPERT

You mean the individual schools?

DEIRDRE BUTLER

Yes.

PROFESSOR SEYMOUR PAPERT

I'm sorry, I mean, I'm not trying to blame the individual teacher, I mean School as a whole, it's our educational authorities. But then it's everybody who doesn't see there is a political issue – and after all we live in a democracy and it's up to us as citizens to exert an influence on the way these decisions are made. Hello, yes?

### QUESTION FROM AUDIENCE

Hello, perhaps making a connection with that, perhaps on the website which is to be constructed we should look at strategies for doing exactly that, taking something which is a good practice but which is ad hoc and seeing how we might invest that into the system somehow. Two further points, and to thank Carol for setting up such a symposium, it really is a meeting of minds, there have been lots of vital conversations today, and I'd like to look at the theme of incremental and fundamental – just two points really. We should look at what we've got and see how we can transpose that and make more of that. What I'm talking about is for example, media studies. There was a comment earlier on about how children bring in bad information, whatever, from television. But rather than saying television is not good, media studies will encourage the students to inquire as to how it works in the way it does and what it is it doing, and whether that is good or bad, making a judgement. And of course that can be applied to the Web as it can to the novel. So I think it's really important to think of the underlying principles that we have in other subject areas, we could maybe transpose into new subject areas. The second point about incremental is that there has been a paper written about the studio system by Hanna, is it, in Boston?

### RESPONSE FROM AUDIENCE

*(inaudible)* from Boston.

### RESPONSE FROM AUDIENCE

Yes, the atelier model of learning is something we also already have. When you do have an adult with 35 young people or even older young people in education we maybe should think about the studio system of education, which is a much more collaborative environment than instructional environment. And it may well sometimes be a matter of 35 or 36 chairs around in a circle rather than in lines. And if I can move on to the final point which is really more about the fundamentals: For the first time in education – indeed in society – everybody can be an author, not a reader, and that is

what literacy is becoming about, about authorship as well as listening and reading. So this self-perception of authors is actually established outside the education system.

We have to credit the BBC. We had Mark – I don't know if he's still here – earlier on talking about the BBC as a public-service broadcaster. It has no commercial interest but it has an educational interest, and it has set up an area of its site about writing and about that sort of authorship, authorship of texts. Channel 4 television in the UK, which is not public service but has that kind of ethos, has established what it calls an ideas factory round the regions and nations of the UK where young people who are interested in actually playing music, recording music and distributing music, for example, can undertake that sort of authorship and go to local workshops and so on. There is a huge amount of extremely important and multi-model related education happening outside the education system and I think to come back to an earlier point, we shouldn't say all television is wrong because it too is changing more fundamentally than perhaps the education system in school. But the connection between those points is that I think we do need a new sort of pedagogy to encompass this new fundamental of what is happening in terms of not just being an audience but being a maker of work as well.

#### PROFESSOR SEYMOUR PAPERT

On that point something that I find is quite a powerful image when you give it to people, sort of hit them with this, that our inner learning revolution – there are more people learning more things in different ways than ever before. And television now – it's amazing that on television there are whole channels devoted to new ways of cooking, for example, as part of a learning revolution. When I was a kid, mothers cooked what their grandmothers cooked and taught their daughters to cook the same thing. Now we are getting in rural Maine, in a tiny village you can buy Thai spices. Television is part of this big learning revolution but the strong image is that school, the institution that is supposed to be charged with learning is the laggard, is behind every other sector of our society in its adaptation – in doing anything about being participant in this learning revolution. It sort of hits people as a bit of a shock.

Yes, I think there are all sorts of things happening and we should use every one, because – for its good results but also to score this point, to raise people’s awareness of the fact that – I mean, look, what we are proposing for schools is already happening everywhere else or many other places. Yes, Sarah?

### SARAH

You said a moment ago it saddens you with some of the presentations that were given over the last number of days there seems to be a disconnect between the policy makers and the needs of society that in, say, speakers talking about ICT literacy, that we weren’t really meeting the needs of society. I disagree with you there, I think that an awful lot of the thinking that is going on currently is very, very conscious of society and that I don’t think that we’re – basically what we are promoting are things like the creative thinker, the collaborative learner, the reflective practitioner. Like, I wouldn’t be so sad because I don’t think that we are so poles apart that – I think you’ve painted a picture that there’s very diverse thinking. I think the thinking is actually nearer. Maybe it’s just the way that it’s expressed, because I wouldn’t be so worried about the presentations that were made in terms of the policies currently.

And just one other point I’d like to make, in terms of do we need a crisis to bring about change? I would hope that we don’t need a crisis because very often if there is a crisis, they tend to be more reactive than proactive. And sometimes when one is reactive you do – there are jurisdictions where we’ve seen reactive curriculum change and then the reaction occurs again very, very soon afterwards. I would hope we are moving into – and I think we are very much moving into, in this country, a continuous reflection on curriculum, curriculum review and reform that is not something that is there for 10 or 20 years and then you look at it and oh my gosh, we need to change it. I think we implement and we constantly review and think how can we make it better. So they are just two points that I’d like to make.

## PROFESSOR SEYMOUR PAPERT

Yes, I'd just like to add one point about that. Yes, we should – maybe the title of this meeting was incremental change or radical – incremental improvement or radical change. Incremental progress or fundamental change. Maybe we should have said incremental creep. Obviously change has to happen by increments. They might come fast. I think the point is when we are revising our curriculum, how do we decide whether to change it this way or change it that way or change it this way? I think the big shift that we need to make is traditionally we change it this way because it's going to lead to better learning results and we must see the better learning results. Now, of course, better learning is the bottom line but there is another way of thinking that maybe this way of changing it will in the long run contribute to a big – moving closer to a big vision far ahead.

You know, I think any business planner knows that if you make your decisions on maximising the profits in the next quarter you are going to be in big trouble, that sometimes you might do something that will in fact lower the profits the next quarter but it's planting – starting a process that will pay off in the future. And I think this is a different way of thinking that we really need to shift the discourse that – and stop asking – for example, I was very struck when in Marseilles, that nobody there was interested in whether the computers they have spent 4 percent of their budget on are producing better test scores. They were a little worried that if they produced a drop in the test scores this might have political bad results, but they weren't directly aimed at immediate results.

They thought that putting the computers there will slowly bring about bigger, deeper changes and eventually change the development of the region. So yes, we should continually be revising with an eye on a long-term vision, where it is going to. Yes?

## JOHN HURLEY, DIGITAL HUB

Hello, Seymour, John Hurley here from the Digital Hub. You referred to some of the work that we are doing here in this area with Deirdre and other people, and we see

ourselves as facilitating a test-bed or a showcase of the possibilities that technology can bring to learning. I'd be interested to know to what extent has the experience of Maine influenced other States within the United States, you know, are there lessons there in terms of influencing national policy that can be learned and transferred to Europe?

#### PROFESSOR SEYMOUR PAPERT

First of all, we have influenced other states dramatically, there is no question. People come to Maine from everywhere. All over the world it's really had a dramatic influence. National policy, that's a whole other story. The national policy of the United States – let's not talk about that. But fortunately, things that happen locally might have a real big impact locally. But I believe that it really – you know, individual schools since the – 1989 – was the first school I know of that gave a laptop computer to every kid and that was a school in Australia. And during the 90s, many more schools than we have in Maine gave many more computers to kids. But it didn't have that impact on making this look really real to the education planners until we had a whole State do it and that had dramatic impact.

Moreover, I think in the long run, it's not only it had impact in making this awareness in the world but in terms of the learning that will take place, that because the State has adopted this there is a deeper – I think it's a deeper appropriation of the idea by the people of the State. There are more people more deeply involved and this is going to produce really exciting results there. The answer to your simple question is, it's had a dramatic effect on other States. I'm told by – his name escapes me – the person who has done the most research on this sort of issue, that more than half the education authorities in the country, meaning a school or a school system or a town – are doing something as a step towards thinking about computers. They've either got a pilot project going or they are studying it or they are doing it in some class of schools.

It's definitely – you can feel it – it's in the air and everywhere and I think there's no question of it being in the next few years, even if we don't get a dramatic drop in the price of computers, which I think we will get, I'm sure we will get, we're going to see

this thing pretty widespread. I believe Maine had an influence on the French decision though it's hard to pin down exactly, but it did get a lot of publicity.

#### QUESTION FROM AUDIENCE

Just to follow up on Helen's theme, our Technology group had a long discussion not only on general BBC representation of students' work, but young students' work has in the past been kept very secret inside the school walls and the Gouda walls, and the thing is local communities now . At the Digital Hub the other day we had an interesting conversation, ways in which the work of the teachers and the students can be brought right out into the community. With tools developed at Media Lab Europe like TexTales where, you know, the community can respond to literally the actual projects that the students do. Not only on the Web, because this can be in poor communities – where, you know, aged people wandering along might not have access to the Web yet, but they can see the work of young children and it's a way of, like kind of enhancing the kid power of this new kind of undertaking, bringing it right into the community on these local screens or hot spots to really showcase the students' work and make young kids' research in a sense visible.

#### PROFESSOR SEYMOUR PAPERT

Yes.

#### QUESTION FROM AUDIENCE

Yes, Michael John Gorman of the Ark. My question is how do we do experiments on fundamentally different models of school?

#### PROFESSOR SEYMOUR PAPERT

Jim Moulton and I were involved for a while – you can see the positive and the negative side of it – we worked for several years inside a juvenile prison where we

were able for a while to have a small alternate learning environment with about a dozen kids working on projects and the results were so dramatic that we could really have a totally different way of learning using the technology. It also was so evident that the whole institution decided to adopt something like this – and when the whole institution decided to adopt it they couldn't for all sorts of reasons. So in a sense the scale of an experiment is a whole other complicated issue, but I think we were able to show a lot of people,, and ourselves what could be done in a fairly short time with a small group of kids. I'm saying that as an example.

Be opportunist, find a chance here and there. A good inroad is that in many places the person who has the greatest freedom to experiment is the special education teacher, because they've written off those kids anyway and you can find places. You can't obviously experimentally start a whole education system.

#### JIM MOULTON

Seymour, it was – these kids – we were allowed freedoms and there was a confinement. The piece that was so dramatic is where kids ranging – everything from wrong place, wrong time to rape and murder – these were serious issues. The ability of one-to-one technical access to free the mind while keeping the body in one place was a radical evidence of genius in these kids. It caused us also to think very carefully about what we mean by education and learning for these kids, many of whom were charismatics, leaders of bad groups of people – and how do you go about informing them, teaching them? The real job was to return them to the civil society. And it wasn't the technology, it was the engagement in real projects, it was doing real stuff that re-connected them to the civil world, for which somebody said thank you to them, was the driving piece.

#### COMMENT FROM AUDIENCE

One of the things that's said all the time, certainly in the States, is, "We have a lot of questions, we don't have any answers, we don't have literature, we don't have research, there's nothing there" – which I think is really totally incorrect. There is a

tremendous amount of knowledge that we have, a tremendous amount of information to be brought to this topic. I, in moments of cynicism – which I try not to fall into too often – I suspect that one reason why people say that is it exonerates them from actually having to look into what is done. There is a tremendous base of knowledge that bears on all of the things that we have been talking about, but very infrequently seems to be used. And people, rather than do that, wring their hands and say, “We don’t have research, we need to do this kind of research”. The problem in the United States is there is still the quest for the fountain of youth, the quest for the study which proves conclusively that technology is good in and of itself, the one study that people can hold up and say, “Here, the technology is good”. That study will never be produced, but apart from that there is a tremendous base of information.

The other point along these lines is I really find that the work that the CEO, the Chairman of the Board of Becta (?) and it was mentioned at some point in the past couple of days – I also mentioned it in my paper – his work on the education epidemic, and then the little paper he’s pulled off – it's called “Working Laterally” – which talks about the ways in which networks of teachers can share information. So that you don’t have necessarily academic – you don’t have research perhaps that’s done in MIT and Harvard, but you have a lot of investigation being done by teachers sharing that in kind of networks has really a lot to recommend it. If you get a chance to look at it, it’s free, it’s on the MOS site and I really think it has a lot to recommend it. It ties directly into that notion of the natural experiments that are happening all over the place, and despite the fact that there isn’t enough of what needs to happen, it is not correct to say that nothing is happening. It is not correct to say we don’t have a heck of a lot more knowledge than we seem to be making use of at the present time.

#### QUESTION FROM AUDIENCE

Thank you very much. If we say okay, we get these technologies to the children, each one shall have PDA or lap-top or whatever is available, and if we change the rules of the school, etc., to have a sort of idealistic scenario, can you describe what do you think the teacher should look like, what should he do?

## PROFESSOR SEYMOUR PAPERT

Jim can give a marvellous description of a teacher.

## JIM MOULTON

To do it we have to go to school, “Kids, we’re in 7<sup>th</sup> grade – 14 years old. You all were listening to the news yesterday – or we’ll go back, last week. Something happened last Thursday – economic, world economics. What happened last Thursday? Oil hit the world record, world high. Okay, oil hit the world high. What we are going to do, I want everybody, we’re going to go to the newseum. I want this group over here to head to Africa, I want this group to go to the Southeast United States – Texas, oil has to do with Texas.” Why am I putting one group in Texas? I pool that information and we head to the web. Now, we would be reading newspapers from around the world. And in American schools, no school receives newspapers for every child every day.

In a world where it truly will be a global economy, if kids think that if it doesn’t happen in Tyler, Texas or in Bangor, Maine, it doesn’t really affect me – so all of a sudden the world has changed. So that we can read the newseum, today’s front pages from around the world, and if somebody says, “Well, when I go to Canada, this paper doesn’t show up, it’s nowhere on the front page”. So we would change – we do current events, go to English Language Arts and be reading text, etc. Then the three words, as I mentioned yesterday, the three most important words that we begin with are the words, “close and focus”. Then when it’s time to bring people back together, we close and focus it. At the same time, if we are doing our work because we are in a wireless environment, that piece of it as well, get up and put yourself in the grouping that you need to be in.

## COMMENT FROM AUDIENCE

You don’t need a computer for every child.

JIM MOULTON

I would suggest you do.

QUESTION FROM AUDIENCE

No, you don't need that, you need access but not necessarily personal access. I'm thinking in terms of – you acted recently, just now, like a teacher that I could see in Chile that has enough access in the community to Internet and so on. So what about – what radical change are we talking about?

JIM MOULTON

The radical change does not involve the teacher then, the radical change is informal. We see kids working on iMovie during recess, during lunch break, during time – informal interaction with information.

PROFESSOR SEYMOUR PAPERT

This kid comes back tomorrow or the next day and says, you know, “I went on with that last night and made an actual model simulating the impact of the oil price in Saudia Arabia, on my family's income and look how it is”. And in order to have that kind of familiarity with the computer he really has to have a lot of time with it, so that it can become part of his way of thinking – as the pencil is for you. And going an hour or two hours. When a teacher says, “This is a lesson, you go do this” – it's qualitatively different.

IDIT HAREL CAPERTON

And I want to add to that because I think you are trying to create this scenario of being relevant, something happening in the world, let's make the kids think globally. So I'm that little girl sitting in the corner, saying “Oil is boring” and I don't really feel

like being in the group that is now going to go and research what is happening in South Texas, okay? And I'm sure knowing you and the context you are working within, one thing that is important to realise about tie-in, is that not all kids like projects like this and that's okay. And they think, do we need to kind of understand – is this idea that we always have to have other ideas in mind.

If you ask about the image of the teacher of the future – which is for these kids who don't really feel like doing this thing that you think is exciting to do with them today – and maybe have a few extra projects in your bag of tricks, “Well, go and write a poem, walk around, see what other kids are doing”. And don't be stressed from these kids that are blocked and stuff, because we have experiences with kids like this and some of them take three weeks to get into a project, just like us adults in a work environment when there is sometimes something that we need to figure out. It doesn't really come right away when our boss told us, “Hey, this is the new product, go think about it”. And as Seymour said before, businesses are willing to invest and maybe lose for – or invest in it for a couple of quarters – there is some sense of the long-term gain. And maybe it's a good place to really emphasise, Seymour – this idea of time, but even bigger than the way it was presented so far.

We are really talking about giving learners a lot of time and allowing them, as teachers, to really get into stuff – not right away, all of them, but maybe weeks later. And we are also talking about maybe not just putting a project in a 40-minute session, but maybe allow them to work for 3 hours in a row, maybe every day, for maybe for 4 or 5 or 6 months. And we are also talking about this principle of more – what we call more is sometimes easier than learning less. So give them a complex project that takes a long time to figure out when a lot of disciplines are actually integrated – may be easier for them eventually because things connect to each other and it all makes sense.

All these principles I think are coming into that image, the teacher of the future, including people talked about noise. I think that we discovered that walking around and being in a noisy environment – a lot of my friends at MIT, their desks are messy, when they programme computers they actually listen to loud music. And you know, in many cases there are a lot of things that are happening around them or they cannot

focus. And so if we – when I did early research at MaMaMedia, to get started I showed a lot of kids what was going on, on the Internet back then – 1994/95, it was very early – and the first thing they said was, “This is just so quiet, it feels like school”. That’s what they said about the Internet! It wasn’t, they looked at a Yahoo page and said, “Well”, you know – and we have to think about that in the digital environments, in the digital designs that we do – and in the physical environment and in the physical designs that we do: that it has to have a combination of all these elements in addition to a wonderful, provocative question or issue and project that we are giving them. And they are probably a long, long, long list.

### JIM MOULTON

The peace and the ownership and the willingness to get involved with the question – if a child or student does choose not to engage with the question, the fact of the matter is that in a wireless, one-to-one environment that is happening here, you are intellectually free to leave the room at your will. That no longer is it – the “sit and get” and you have to take what the teacher is prescribing.

The one issue that you mentioned, that it doesn’t need one-to-one wireless – in the State of Maine, you might be interested, we just finished the second round for this year of state-wide meetings. And Seymour, you’ll be interested in this, and it will be interesting to watch your response, because we’ve had some of the schools who have said to us, “We’re thinking next year that what we’d like to do instead of issuing computers to the kids, we’re going to issue the computers to the classroom so that the kids will come into a classroom and they will be guaranteed there will be enough computers for everybody. And if the teacher wants to use the computers they can just go get one and when they are done, leave it when they leave the room”. That is absolutely not okay.

What we have found is that there is an issue of ownership. Like, we have given every kid an office-space on which they can hang sticky notes on the computer. The idea – because we would go beyond and I would be expecting, if you were visiting the newspaper from Japan, etc., you would have a collection, an archive of those front

pages, etc. The idea of ownership – it's not about having enough computers per room, it's the idea of carrying that device, of having it in your lap, in your hand.

#### QUESTION FROM AUDIENCE

If you think in current development of technology – I wouldn't call it computer – you should need the right device for the right purpose, whether it is a computer or not, so lap-top is something I don't believe will last too much. But anyway, also the image of this teacher of the future, I suppose it should be different in primary teaching, first years, lower secondary and secondary. Perhaps your image in secondary education could engage students – but what do you do with primary students? Shall we continue having one teacher for 30 students or shall we use communication to have, I don't know, teachers in Japan teaching students 8<sup>th</sup> grade in years 8, sharing the same physical space just from Germany and USA, and the one who is in USA in front of the children acts as moderator in a discussion – 18 hours that teachers, students, participate in – which are changes in teaching which have not been discussed. Because in a way we still have the image of the one teacher as you build it up, in front of many students. Okay, you did a group work, you still are the one who is directing the activity, but the social reality is not like that anymore, it has changed. Power has changed, so why don't we bring that change into the classroom, re-think the role of the teacher? I'm not sure I have any answers, I think we need to re-think about that, think what is teaching.

#### PROFESSOR SEYMOUR PAPERT

Absolutely, absolutely. So what has happened in Maine – it's still a tiny microstep towards the transformation of education that will come about in the digital age. It's still a classroom. It's so hard to get the word classroom out of our head. Why should there be such a thing as a classroom, a textbook? Why is it a teacher, an adult, a learning professional who is learning with those children – why should they be segregated by age? You know, all these things will go away, and these are the images we need to at least be questioning – or any of these assumptions we make when we think about school, when we think about learning, when we think about children.

Are any of these assumptions necessarily true for all time? School as we know it was invented, I don't know when, the 19<sup>th</sup> century? Whenever it was invented. Wouldn't it be amazing if those people invented the form that would be the right form for all time? They didn't get it right in anything else, their ideas about transportation or medicine or – everything else in the world has changed out of recognition, but amazingly they got it right about how to bring up children, and schools are going to remain like that – it's not plausible, it's not really likely, is it?

#### QUESTION FROM AUDIENCE

I'm working with a multi-grade school in a remote area of Greece and Europe and the system of class is (*inaudible*) because having in one room to teach few grades, two or three or five or seven or six grades, you have a different perspective of the class. The class doesn't exist anymore as such, it exists of people that operate. You have different teaching skills that they are applied, a larger, a grown-up, a kid of the 6<sup>th</sup> grade together with a kid of the 2<sup>nd</sup> grade, and they doing the same thing. And you have work that is done, that is either cutting across the subject with one exercise – for example of history, counting the troops you can do arithmetic and seeing where the battle took place you do geography. So it's a kind of – this is a remnant of the old times and it tries to ...

*(end of side 1)*

...how the students or the kids, the pupils would work in a more free way. This is done by necessity, but maybe it's a good pedagogical experiment to examine.

#### PROFESSOR SEYMOUR PAPERT

Well I think that's one of these places where there's a total reversal of perspective – that until recently people thought of the one class – one to - one-room class, one-room schoolhouse, as a primitive thing of the past. I agree with you, it's the model for the future, because it has all the advantages one could want. It used to have some

disadvantages, like you couldn't have the big library, but with the technology we – all its disadvantages are disappearing, and there's no doubt in my mind that that's the way we're going to go in the future. Oh, Brendan here.

### BRENDAN TANGNEY

Brendan Tagney here again, I mean the question we're faced with here this afternoon is how to bring about change, and I mean – a couple of observations I'd make. One is I'm very uncomfortable with this model of business being major funders in education. To my mind education - is this on? [*taps microphone*] Yes. To my mind education is something far too important to the well-being of a state or a society to be left to essentially private enterprise to be playing a major part in it. I'm very uncomfortable in conversations which say, well we'll get public-private partnership to invest in the technology, etc., because they're naturally coming from a different agenda.

I think the experience here in Ireland would be that we've heavily engaged in public-private partnership models, some of which have not been wonderfully successful. So if we're talking about change, money is on the agenda, politics are on the agenda. I'm uncomfortable with a model where companies have a major say, or in dictating what's happening, so that's the first point. The second point is, I mean I think we agree that one size doesn't fit all, so I think we as educators and we as people who are trying to convince the public or the powers that be to bring about this change, have to be very careful that we don't over-claim things for computers, right?

I think it was Jerome Morrissey had a slide up yesterday, or on Monday, about the project that's going on in the Digital Hub and various other ones – and he put up a slide that any of us here could have put up, which said, “These are the factors which go into good education experiences using technology: group work, project-based learning” etc., etc., etc. Now anybody here could have put that up five years ago, ten years ago, right? And a lot of the examples that are given of good use of technology are simply just good teaching. I would argue that a lot of the people who are very successful at using technology, if you give them a different technique and apply that

same energy and enthusiasm and different teaching styles and get over assessment and break out of the classroom etc., etc., etc., could also have very positive results.

Now that's not to say that the computer isn't an incredibly powerful tool, of course it is, but I was very struck by the Secretary of State from the UK yesterday making these, you know, outlandish claims about white boards, right? Now white boards are nice, they're cool, but I mean, I wouldn't go building an agenda on them, right? So I think if we are to be serious about bringing about change and influencing people, then I think we have to be careful in the rhetoric we use. And I think we have to be careful about over-claiming what technology is good for. And, you know, it's not a case that one size fits all – sometimes it's a case, we need to sit kids down, teach them their French and Latin verbs, you know, learn off by rote, “Mensa, mensa, mensam” and then, you know, that's not a bad thing to do sometimes.

#### PROFESSOR SEYMOUR PAPERT

Bette Manchester, talking to that point?

#### BETTE MANCHESTER

Yes, Bette Manchester from Maine. I think what we found is, I would agree that one size fits all doesn't work, but I think in our notion of change with our lap-tops it hasn't been one size fits all. It's in fact allowed each child to personalise, and teach her to personalise that child's education or differentiate the instruction in a classroom in a way that we'd never been able to do before, even though many of us have attempted that our entire careers. And I would say, second, that what we have found thus far – and many of the parents were sceptical, most parents were sceptical about even trying this with technology – so we had many people just waiting to pounce at the first sign of this being a dumb idea. And what we found overall is, I can't think of any parents that have complained about the project, which is I think pretty astounding given that we have repeatedly asked for people to come forward.

But the other part of it is that with the teachers, the majority, I would say there are a few people who have talked about changing the model, Jim. And overall the majority of schools that we've heard from, teacher leaders and principals, have said the majority of their teachers would never go back to another way of teaching and are beginning to see how things can change. And it's helping them think differently because the power structures have changed so dramatically in the classrooms.

#### PROFESSOR SEYMOUR PAPERT

Having said that, which I agree with a million percent, I want to add one other point. While I absolutely mean to say I'm uncomfortable about the role of companies in shaping education is putting it mildly, I'm almost speechless whenever I think of the fact that our intellectual establishment – not only the educators – has accepted the fact that a few computer companies can have the amount of influence that they're having on how we use this powerful instrument.

That those computers – that they allow this tremendous flexibility, but that computer was not designed for learning, and a much better computer could be much better for learning. I think that the Microsoft system which Apple is now struggling so hard to imitate is so counter-educational in its complexity and its messiness and unintelligibility, it's really – I don't know, I don't have any words to express. But I think that here again, the educators of the world, if only we got together and used our clout we could take it into our hands to make sure that there's a different kind of computer industry making a different kind of computer, a different kind of software, a different kind of language that goes with it. We ought to be doing it and you provoked me to talk about it, I really should shut up about that because it just seems I get too, it sends my blood pressure too high. But I do think that this idea that choice in computers is Apple, Windows, PDA – well it's ridiculous, we shouldn't be choosing between the offerings of non-educators, we should be generating the ideas of what the things really ought to be that we want to give our kids.

But what Betty says is nevertheless true: that bad as this instrument is, it's infinitely better than anything that existed, anything else that's available, and it does allow a

hugely greater diversity of learning. There is no doubt about that, and that it could do very much more is a separate question.

### DEIRDRE BUTLER

*(inaudible, off-mic at first)* doesn't have to be a lap-top. It brings together what this gentleman had brought up as well, does it have to be a lap-top? My problem in trying to convince even the people at the college – because to get lap-tops, as I say, for every student, we've reached a crisis point in the teacher education college. Because we've colonised so many rooms, we've so many labs, we've now reached the point where we can't reconceptualise what we did, because everybody hasn't got their own technology so that we can actually reconceptualise what we do. It doesn't have to necessarily be an expensive lap-top. You have an expensive device there, but can we not actually make the devices we need to use for our thinking cheaper?

Do we have to have something that costs one and a half thousand euro? And at my college and in the department, they weren't against the idea, which brings in what Mary talked about, the fact that the thinking may be the same. What actually balks people and why they back away is when they multiply it and do the sums, it's the cost that maybe can pull people back. I think we have a responsibility to tackle the industry people. Industry people are sitting back and being very comfortable. We need to tackle them and say, "Sorry, we need these types of devices, something that costs x and needs to do Y, Z, A, B, C."

### PROFESSOR SEYMOUR PAPERT

Yes, again, absolutely, I think we ought to have a device by now that would be as powerful for all the purposes – it could be much more powerful if it was simpler, for that matter, that it ought to cost much less than 100 dollars. On the other hand, the cost of these machines is no excuse for not giving them to the kids. The arguments that it's too expensive shows how little those people benefited from all that expensive math instruction they had when they were at school because in fact, in any of these

rich advanced countries, the cost of giving every kid a computer would add less to the total cost of education than the annual rate of increase that takes place in any case.

If you think of – in Romania there are 34,000 kids; 34,000 computers and all the dollars or euros – it looks like a big mountain because we don't think in the proper mathematical terms. Take the cost of that, take it over the lifetime of the computer: Give up the idea that the computer is going to be obsolete in 4 years – take it's natural, real lifetime. Give up the idea that you have to spend a lot of money on maintaining it, because the kids can learn to do that perfectly well. Average it over time and you will find that the cost is a couple of percent of what we are spending on education. And the fact that that seems like a huge amount is only because we don't know how to think about numbers. And nobody should be allowed to get away with that. They can have all sorts of arguments against having computers – there are some respectable arguments. The argument that it is too expensive is just an obscene reflection of their ignorance and we should shame people into not being able to give that as an answer.

#### QUESTION FROM AUDIENCE

We need to have the figures. It was interesting the figures Gary showed yesterday, about the prison services. The average cost, it costs 100,000 euro to keep one kid (*inaudible*). They wouldn't be in prison in the first place if they had a successful experience in education. So we need access to all these type of figures to make our arguments strongly because (*inaudible*).

#### PROFESSOR SEYMOUR PAPERT

Well, let's get this powerfully up on our website, all the numbers, the figures and the arguments that can be used to knock down this kind of ...

### COMMENT FROM AUDIENCE

I have a comment, let me talk about Europe because it's my home and it's what I know best. I think there's another big disconnect and a very big one that is important on this issue, because as we all know now the information society is a big deal. Everybody talks about the information society and how important it is. Brussels has enormous projects, enormous amounts of money to spend to promote the information society. Except they are talking about the technology of the information society, they are not really talking about promoting people who are actually producing information. And I think this is a political disconnect which is a major one that exists in Europe; it may exist in North America as well but it's something that we're confronted with all the time.

If you go to Brussels and ask for funding, you can get funding to develop advanced software but you can't get funding to build content that would eventually be used in that software network programme. And this is a political problem, and I think the educational community as a whole is probably about the only major lobby that can actually do something about changing that.

### COMMENT FROM AUDIENCE

Just like educators make textbooks and curriculum and things like that, they make the tools that they know according to how the children's minds are shaped. I think maybe clicking on a mouse may be seen as a regression if you only have a mouse, from actually drawing with a pencil, writing, and all these matricity (*sic*) exercises which are I think very important – even when you do math, to be able to draw a straight line. So I think tools need to be invented by people who are in research and who are able to invent these software things like already exist, but just maybe more adapted to children, cheaper as well – pads that would allow them to write as Brendan was doing, but I think it's as important to have a pad and a pen as to have a lap-top, really, because if you only click for all your school time though the mouse I think you are really missing out a lot of development in matricity (*sic*) for the children. So I

think there is a lot to be done in computers for children. I won't be able to do that though.

#### PROFESSOR SEYMOUR PAPERT

Of course in my dream, where children go for learning, there will be workshops and they will be able to make the machine that they need for their purposes and not rely on these people – well, of course they can't invent everything. But this thing, this is the size of computer that kids in Maine have: it's white and it's a G4 but it's too heavy, it's too big. Next year somebody – you will see some prototypes of flexible displays so you can fold your display and put it in your pocket. In 5 years time, I don't know how long it will take – John Gage will probably give a better idea than me – how long will it take before we can have this computer that is as easily transportable as a pocket book and can do much more than this one?

#### JOHN GAGE

There was a recent shipping of computers which are cheap, is a good sign, and what we'd heard from Nicholas Negroponte about the display change, where a projection system could bring the cost down – so if it's true that we can hit the 100 dollar price point that Nicholas claims – let's say he's wrong by a factor of 2 – so we are within a year, I think, or 2 of having that. And then as we have the bandwidth linking to these displays, so that there is no need for the computer to actually be present in the device, that also in a classroom setting can help – so that's your multiple whiteboard, everyone independently having a whiteboard.

#### PROFESSOR SEYMOUR PAPERT

But so that we don't wait for these miracles, there's a lag in education, in getting ideas. We have to move now making the models of what is going to be easier and cheaper just around the corner. Yes?

### QUESTION FROM AUDIENCE

Yes, excuse me for my English, but in the Department of Landes, we have bought computers, lap-top – they are traditional PC because we have no real choice. But we ask the makers how many lap-tops must be ordered to have special series adapted to education and they answered, 100,000. So if we were 100,000 to design the lap-tops for education, they say okay, we construct a special series.

### PROFESSOR SEYMOUR PAPERT

Well, probably to justify that it probably has to be very minorly customised. To make something very different might need more than that. We've got several billion children in the world and that's a big number. But just one point: John mentioned this projection thing, just to give you an idea of how things might look different – some years ago, IBM made a prototype which I've got one of. Instead of having a display it has a little thing that will clip on to your eyeglasses and it has a projector and an optic system so that to actually project the image, you see it here, it weighs nothing and you have your computer in your pocket. That didn't quite work out.

They were actually close to marketing it – they made a few hundred prototypes. It didn't come off but it could be much less expensive and much more comfortable. Another similar idea that John was referring to in a conversation with Nicholas Negroponte, a similar idea – instead of having this display, you have a little projector which will project your image, and you could have it projecting on the cover of your computer or on your wall, your paper – and the point is it could be incredibly much cheaper. The most expensive part of these lap-tops is the display, and there are technological issues which I don't quite understand, which can be pretty insufferable in getting a rapid decrease in the cost of making that kind of display. So if there is going to be a big drop in price, it's going to come through other display technology.

This idea of making a little projecting thing is an example. But I'm only saying this because we've got to get out of our head the way of thinking that starts with: computer equals the thing that we know. You just think about how much they have

changed in the time that you have known computers. In 10 years time, the things will be so unlike our computers that we are now talking about. So again a very silly kind of argument is, “Should we have PDAs or should we have lap-tops or should we have desktops?” That is so beside any point in the long run. It might be a little practical decision for somebody who has got a budget who is going to buy something this year, but if we are thinking of the future of where it is going, of fundamental change, you don’t want to base it on any of those images because they’ll all be wrong, and very quickly. Bette?

#### BETTE MANCHESTER

I was just going to say that one of the issues that’s come up in Maine is about price. And so we have a large number of people who would prefer to see us use, for example, a Citric system – have a terminal and have students go to a terminal. And so I worry when we just talk about price of things, not looking at what you are trying to do with the tools – I bring that up as an issue.

#### QUESTION FROM AUDIENCE

There is a great consensus here I think that change is going to happen and it’s inevitable, we can’t hold it back and that we perhaps are agents of change. I think there are many people in this room who are visionary. I mentioned in the group where I was working, the School group – if you had seen the movie, *Minority Report* – and in that movie there is a vision of the future. And if you think about the vehicles you see in that movie, they do not travel on roads any longer, they travel in the air. If you or I, or the children of today, had to write a script for a school in that movie, what would you visualise? These are steps towards the future that we should be thinking about – what will school be like in the future? I think we should put our vision on paper and it would be very interesting to see. Do we all have the same vision for education or have we all got diverse visions?

#### COMMENT FROM AUDIENCE

I come from the Ministry of Education in Denmark and, as you might know, we have the largest penetration of computers in school in the world – but that’s not my point here. The point is that in some countries you are looking at a new generation who get perhaps computers when they are 3 or 4 years old, so it’s nothing new for them to have a computer. And this is the situation in Denmark: 90 percent of kids in school have their own computer at home and they are networked.

Another thing that we discovered is that of course they like to have a lap-top in school, and they are wireless so they can chat and they can do anything else. But the result is quite clear: the moment we do not change the way of teaching, the moment you are still having teacher in advance and you have all the students sitting there, they develop what they call “poker face” because they are not allowed to laugh when they are sending mails to each other – and it’s just like we did earlier. So why on earth do we need to have one-to-one? Some of our teachers say why? It’s also a question of getting the computers out of the classroom. It’s not good for everything. That’s one point. And then you can talk about, instead of bringing it home – our results from those tests were they didn’t bring it home because they had one at home, so why should they carry it to and fro? It’s not necessary because we had a communications base, they could access it, find a content in the school from home, from their computer, no problem.

The last point I’d like to make is I heard you talk about one teacher, I heard you talk about one class and I do believe the classroom will still to be there. I haven’t heard a word about teacher group. The group of teachers taking care of a specific part of the curriculum, a specific age group, who can combine – and that’s another way to combine every element, history and geography. And this is quite a powerful way of getting the teacher out of the classroom, bringing them into a collaborative group of other teachers and plan for a semester or for whatever so that they have a common responsibility. That is quite a good way to work.

## PROFESSOR SEYMOUR PAPERT

Well, I'd like to say about the argument that – if you are describing a situation where every child has a computer at home and in the school there is access at any time they want it, these computers are all compatible so that they can exchange easily, then maybe you have got an argument that that would be as good or better than having the lap-top. If only 99 percent of the children have the computer at home, it's immediately a whole different situation. 99 percent is not almost, it's nowhere compared – because if one child doesn't have it, you cannot begin to change your curriculum and your ways of doing things that assume the child has the computers.

So the point is they should have access at any time, they should all have equal access, and so then it's the detail – what form of computer they have. My argument is not based on, that's a good thing. I don't think I myself as recommending we do this, but it's going to come – in 2 years, 5 years, 10 years, we are going to have the situation where computers have – so all our thinking about innovations in education, what we are doing is money down the drain if it's not built into the assumption that that is the world we are talking about. Because anything based on any other assumption is going to be totally obsolete and in an amazingly short time. So it just makes for – it seems to me what psychologists would call “denial” to even question whether we should be thinking about the lap-top environment. Jim, and then we're going to have to stop there.

## JIM MOULTON

*(off-mic)* There is no supposition (*inaudible*). There is no simple answer to that question, and the interlinking of the technology and the pedagogy – that absolutely, if you attempt to keep on teaching the way you've always taught the kids will go underground and use the devices to subvert the traditional classroom. It's when you become innovative, take them into the community and I just – Mainelearns.org is the place to get stories of how a variety of educators are making use in very – and we feel – but it's up to you to look through your lens – powerful ways.

CAROL STROHECKER

Well, we'll stop here, I'd like to invite everyone downstairs for some refreshments and thank you very much for coming, for your thoughts, your energy – and Seymour, thank you for your dedication.

*APPLAUSE*

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