Video: **https://vimeo.com/102001380**

Dr. Seymour Papert: I must say, though, that I don't really know, exactly what I want to say. I think it was Bertrand Russell who said, "How do I know what I think until I hear myself say it?" There's something in that. You've got to let it come out and try it.

On the other hand, I usually start off knowing more exactly what I want to say. This morning, though, I woke up feeling what I thought about saying, which was like going to any other audience in the world, maybe didn't feel right. I came in here and walked around and spoke to people, it felt even more not right to sort of give a formal talk here, explaining some themes. I was going to talk about the history of Logo. I decided instead to be more intimate and more informal and try to share with you, who have all been involved in Logo, and I presume, in one way or another, one aspect or another, love Logo.

I'm going to share with you my feelings about aspects that I think have worked out wonderfully in the vision that I thought I had, where Logo would go in the early days. There are ways in which it's gone differently and excitingly, and ways that I wouldn't, I couldn't, anticipate and feel wonderfully happy about. Then there are ways where I thought it would go and I'm glad it didn't. Then there are ways where I thought it would go and I still hanker to stir them up. I will focus somewhat on those.

The general direction is the subtitle of "Mind Storms," which was "Children, Computers and Powerful Ideas." I do think that in certain ways, what I imagined in my fantasy, megalomaniac, maybe, fantasy about what powerful ideas could mean in the lives of children. I think this is still, at best, a scratch on the surface and I'd like to convey a stronger image of that direction.

So to put that in a context, a little while ago, last week in fact, I made a quick trip to Singapore. Twenty-four hours and that's from the time I stepped on an airplane in Boston, to the time I stepped off the airplane in Singapore, I had 24 hours of relaxation. I slept. There was no telephone. I wrote for about four or five hours. I wrote a program for another hour. I thought about a mathematical problem and I did my stretching exercises and push-ups on the floor of the airplane, to the astonishment of other people. So I didn't mind that at all. When I got to Singapore, I arranged my time schedule so I didn't have to make any time adjustment and I just came back, so I didn't notice.

I was giving the opening keynote address of a conference. It was entitled "Rethinking the Role of Technology in Education." Everybody has titles like that. I made what's getting to be my standard response to that sort of title, but made it a little bit more emphatically than usual. That is, you've got it the wrong away around. The point isn't to rethink the role of technology, it's not to rethink technology in education, but to rethink education, in the context of technology. How can education be different in the context of technology?

This is what I think it's about and I don't want to retread on ground that I've written about, but again in "Children's Machine," I do emphasize the sense that when, in the early days, in the 70s and even the early 80s, microcomputers, anyway, in the hands of children was a revolutionary and forward-looking kind of concept. Behind every computer I ever saw in the classroom was a visionary teacher, who saw in the computer, maybe she or he didn't exactly know how this was going to happen, but somehow that computer was built to be something you could try to use to break out of the constraints and restrictions of school with a capital S, that whole system that was set up then.

There, of course, are many such visionary teachers, still, even more now than there were. But compared with the total use of computers in schools, that's become less dominant and probably a minority use of the number of computers. Most of the computers in the school are being used, not as instruments to change what we mean by education and learning, but to reinforce and improve what has always been there. So what started as a revolutionary instrument shifts to something whose main role is to support and solidify the existing structure.

Well, that's a process to be expected and we even have chatter about that. Actually, in Singapore, was one I've often heard and that is, I'm paraphrasing, because they're more polite and there's sheer arrogance, why should you guys, you technologists, why should technology make us rethink education? We've decided, it's been decided, society has decided what children should learn and how they should learn and how technologists are not the people who should come along and tell them, just because you've invented some new machines, they should learn something different.

Well, I think that argument needs to be addressed, maybe more directly than it has been in the past. I think I've already approached it obliquely. I think we should approach it head-on. I think the key to approaching it head-on is to say they wrote the sign wrong. It's what goes on in school that is dictated by technology.

What we're talking about is liberating the learning process from the confines of that primitive technology of the printing press and the pencil and paper, which that's also a technology. We don't call it a technology because we've lived with it for a long time. We only call it a technology when it looks like this and it's been invented in the second half of the 20th century. But, in fact, the other thing is a technology and let's look a little bit at how the sense in which technology does depend.

I have an example in “Mindstorms,” that I can't help with just repeating it, of the sense of my original structure. But my example in “Mindstorms,” I think, was not the most fundamental one. But it's still a good one, and so repeated, and that's in the standard mathematics curriculum, all over the world, children learn that a thing that looks like this is called a parabola. They learn that the equation is Y equals X squared or A squared plus B, or something like that.

The question I'd like to ask is why do we pick out that little piece of mathematical knowledge, which in my calculation is about one-billionth of all the mathematical knowledge that exists. Why do we pick out that one and say this one is very important for children to know?

I think there's only one answer, or that a big part of the answer is that it's easy to teach with pencil and paper. You get out your graph paper and you draw X axis, Y axis, and then you plot a point here and there, and you draw it up with a line and there's your parabolas, it stares you in the face, and the kids did an exercise. You can say, you got it right or you didn't get it right. or even if you don't judge it, as right or wrong, it was something that lent itself to pencil and paper as a technological context.

The absurdity is that now we have fancy computer programs for drawing the same graphs, and not that there is anything bad about these graphs, or that there is anything about these computer programs, but if you don't question why on earth the parabola should have been selected, as the best of all the mathematical gems to give to children, certainly maybe a tool for doing that whole thing better, is only consolidating a basically anti-intellectual, basically socially unpredictable end to children's learning. They've always learned it, go on, we'll keep on learning it. So there's an early example.

My currently favorite example, I think, goes a little bit deeper, and that's, and maybe it’s so obvious, but I think it's true, it does go deeper. It’s shown by the preoccupation in the days of the code for this new math in the 1960s and 70s with the idea of number bases. This is always tricky ground to talk about because it's like apple pie and motherhood to say number bases are a bad thing or parabolas are a bad thing. Well, they're not. They're wonderful things.

Nevertheless, the question is there are lots of other wonderful things, why those? And the other thing, that in this case, it's also about technology and for the following reason. That in the days of paper and pencil, what children could do when they worked with numbers, was write the numbers on square paper and then you manipulate them, add them and multiply and all the rest.

Now, you are working not with numbers as some sort of general idea, you're working with numbers as they're written on paper. And so, there is a clear occupation with the writing of numbers, but how you write them, how you formalize them to put them down on paper. So when people said, what are the concepts behind underlying, say, arithmetic? Or numerical mathematics?

The focus was on the concepts underlying the writing of numbers and the manipulation of the written form of numbers, rather than, I'll take some examples in a moment of what else it could be. But this is one particular direction in which you could look for the conceptual underpinning. The point here is that there isn't only one conceptual underpinning. There are many conceptual directions which you can go from there. And that that one was determined by those special conditions that prevailed for a very long time when the only way to handle calculations and deal with numbers was in this very physical way of largely writing them down, through abacuses and so on. They then get very similar dynamics and not get too carried away by going into details.

But my point is that I'd claim that that whole, not only the particular arithmetic, the particular mathematics done in the school, but the very idea of which directions you would go if you wanted to deepen it, was dictated by a technological environment of the time.

Well, I think that technological environment has changed in a number of ways. First of all, there is much less, if any, practical concern these days with the mechanics of manipulating multi-digit numbers and maybe you've got to do them in an emergency, in simple cases, but you don't have to do very much of it, and possibly none at all. Certainly, in the days of the calculator, you can afford to wait a few years before you learn to do that, because previously, if you couldn't do those things, you couldn't use numbers at all. Now you can. You can use these calculators and computers and you get a long way without bothering with all that stuff.

So, from a practical point of view, but I'm not really interested so much in the practical point of view, which is obvious, but in another aspect, what really perturbs me, and that's the theoretical, conceptual point of view of that. What are the powerful ideas here behind mathematics. Or is there such a thing? Talking about a powerful idea anyway, but I don't think number bases is a terribly powerful idea and I'd like to bring that out by contrasting it with a couple of other directions you can go looking for powerful ideas that are related to understanding mathematical thinking and what they're used for, and even manipulating numerical problems.

One of them that has been a theme of much of the work we've been doing here for a few years is the idea of feedback. And I won't say what I think about an idea of feedback, let's leave numbers on the side for the moment.

This was already there way back in "Mind Storm," obviously, an example of if you wanted to program a turtle with 10 sensors to walk around a table, how do you program it? In those days, I'm sure this would be true now, and I've not tried to do this experiment recently, but the obvious way to do it, if you're brought up in the school of math, is measure the table and then say forward so much. Then say, left 90, and then forward so much, left 90 and forward so much. That's a way to program this turtle to go around the table.

A bad way, were it to even work, because if the turtle bumps on the table, it will jam; if it wanders off a little from the edge, it won't feel, it will be able go there, but run into this. It's going to be a mess. And besides, it will only work with this table.

So, for a hundred reasons, it's much better to use this wonderful idea, which combines the concept of feedback and the concept of differential determination and the concept of local algorithms where you forget about the table and you just say, feel forward, if you're touching it, you're too close, turn away. If you're not touching it, you're too far, turns towards it a little bit and take a step forward. Like that, you'll get around the table. And not only this table, you'll get around any table, you'll get around this sofa, and that's a powerful idea.

But the actual shape of the path that it moved was not determined. Lady Lovelace said ”Computers only do what they're programmed to do, neither more nor less,” and this is an often cited principle of A.I. and so on. But I think it’s a deep sense in which, there’s a deep kind of ambiguity in that, that's worth our pondering. What does is this computer program worth if we walk around this table? Now, in the first way it was, the second way it wasn’t. It was programmed in a way that walking around the table would emerge.

All interesting programming, and all the interesting thinking, and all the interesting action in the world is of that nature. That is, you don’t act in the world by, say, there’s my goal, this is where I'm going to get, there’s the first step, next step, next step, next step, we get there. Very few things work like that.

Interesting things and important things, work in a different way that require a different kind of mindset where you're interacting with a system and you make something happen and you see what happens when you train it and you modify it. There are powerful ideas that help you imagine. Feedback is one of them.

So come back to, well, that's turtles. Come back to arithmetic and there is sort of the obvious way in which feedback comes into, relates to, doing of arithmetic for me is using the idea of success of approximations. Which when Newton, may be just as important as finding out about the moon and gravity and the apple falling on his head. He formulated this method and basically, if you want to find out what the square root of 10 is, start by taking a guess, it doesn't matter, guess something.

Two. Is two squares 10? Well, no, it’s too small so try a bigger number. And four, four squared is 16, is too big, it’s somewhere between two and four. Try three and by this homing in, which is exactly like the feedback when walking on the table, you will find the square root of 10 and moreover, there isn't a single problem I've been able to find in the usual high school algebra and in the SATs, all those problems you can solve much more easily if you're a master of using feedback and approximation and taking a guess, rather than doing this precise manipulation.

That difference between finding the square root by having a precise algorithm versus really getting a feel for finding it in this sort of way of success of approximations, that's really mathematics. It's not concerned with how the number is written. We don't care where that when we say that three squared is too small, it didn't matter whether it was written in the base 10 or base 2, or no base at all, or Roman numerals, as long as you know how to multiply it and probably got a computer for that anyway, the point is it's the behavior of the numbers.

Feedback, I see then, as capturing. It's a concept that underlies arithmetic, like a lot of other things and because it underlies a lot of other things as well, like a lot of engineering, like a lot of physics, like thinking about equilibrium in all situations and why the planets go around in orbits and why the moth turns around the candle, it helps you think about all those things and so it's powerful.

Well, so what do we do about that? I think, first of all, we recognize that behind any concept of curriculum or learning environment, there is an assumption about what aspects are most powerful, there's assumption about what ideas are powerful. These assumptions are based or determined by all sorts of factors, but way back in history, whereas most of it was decided long ago, when there was a different technology, there was a different form of society and there's a different model of production on production lines versus lean production and service and information industries.

All these things have to be called in question. Then we have to see, can we make new ones? When we make new ones, we're going to realize that these new ones aren't going to correspond to the particular classifications of the curriculum either. Feedback doesn't belong to arithmetic, it doesn't even belong to mathematics, or rather, it doesn't only belong to mathematics. So where the mathematics specialist said, oh, but that's not mathematics, well, we begin to see how the change emanates out and sends out waves that upset all sorts of things, like whether there should be a mathematics curriculum specialist, and etc., etc.

Who is the person who's going to break down these barriers, and it's you. I think that it's you because I do think that these new instruments, these instruments now like having computers and programs and Logo and Play-Doh and the new directions we're going in and putting in a little program or a brick inside the Lego thing, and etc., etc., that these are all putting you in the position where you have, not only the technology, but theoretical framework for being able to think about a different organization of knowledge.

Let’s talk about that, coming back to my theme. I think if one casts around, roughly speaking, we see an education world and its traditions, a number of ways of organizing the knowledge that somebody is going to learn for a learner. I mean, you can’t just say go out and learn. It’s got to be organized, very structured somehow.

In many circles, structure means a particular kind of structure. There is hierarchical structure of the curriculum, there’s top level, there’s knowledge, the curriculum, and there’s math and science and language and history. Inside of math, there’s algebra and geometry and arithmetic. Inside of arithmetic, there’s fractions and so on. Inside of fractions, there’s adding and subtracting. Inside of adding, there’s etc., etc. Then right down at the bottom, there’s grade levels and within that there are tracking levels of advanced.

Until, eventually, there is only a sum where somebody is actually working on one little tiny little piece. For many people, that means structure. For me, that means chaos, because it’s structured only in the point, in the mind of the person who set up that hierarchy. For the poor kid, it’d been floating around there, nothing is connected. Everything is this one piece. I'd call that chaos.

A second way of structuring, and this is the direction where I think Logo has been most successful and most wonderfully rewarding and [inaudible 00:24:04] is structuring in terms of projects. Here we're going to make a project and the first good example I saw, like there’s Marian, who didn't want to say it in pictures, to introduce me, but she did. The first example I saw of a kind of project that's spread, I think, I don't know how much in, I think it’s grown up spontaneously, in other places, too, she made another writer program, what was that other writer? Was it [inaudible 00:24:38]? Life cycle of a fly, it was the fruit fly. [Crosstalk 00:24:45].

She made this life cycle of a fly. This is the kind of project the kids had to investigate, understand the fly, worry about how to represent it, make this presentation, and that got to be a very important kind of project, where kids take up a theme of interest and led to investigator, to researcher, to think about it, and was computer context, in many ways makes it more exciting and easier to do that in a rich way than doing the same thing just with pencil and paper and doing reference books. I think that's been a wonderful, rich direction and I think there have either been many insights that have come from different directions about how to enrich that aspect of the development of the use of Logo.

I don't really want to say much about it, but there in my first version of what I was going to talk about, was mainly about that, but you'll find out about that. I will say if you look in the latest Logo Foundation youth letter, there's a little piece I wrote there which points out certain limitations of the way that this project-oriented kind of approach has developed in many places, but it's often a particular concept of a project gets established.

But people break out of them and I think that's an extremely healthy view. By the way, I noticed here some people and some children from way across on the other side of continent, from Washington State, from the Bellevue School is it? It's the Bellevue School, where I saw one of the best examples of this sort of project that I've seen anywhere. I'll just give a little piece of an example where they've picked up on a theme that had the myth about [inaudible 00:27:02] on having children write software projects.

So I picked that up and it hadn't been on the [inaudible 00:27:15] where they could write about any project they liked. Just to take one example, that stuck with me and I find very moving, where it was the only one that was moving, that four kids working as a team, as a company that wrote a software project on the anatomy of the slug.

Now, that was brilliant. It was brilliant, I think, of the kids and I think brilliant of the teachers to encourage that, because what they had to do as part of their project was not only produce bits of software and software consists of Logo programming where you saw the slug and pointed to various pieces of it, where you have no information. It will continue that in many directions and make it more interactive and using MicroWorld's bees at a click here and then get, etc., and get along. That's a healthy direction to go.

What I liked best about that particular thing was that these children also had to produce, not only the software, but like in these [Hemingen 00:28:21] projects, which Jasmine [Kaffoy 00:28:24] has been continuing in having kids make games, they're going to make all the literature that goes with it. How to use it and the justification. This one included a piece written by these students, 5th grade, I think, on why should you study the anatomy of a slug.

This I thought is where it was very brilliant, because the kids had a chance to think about … well, usually in school, in biology, we study the frog.

Why is a slug better than a frog? Well, as soon as I ask the question, then the battle is won, but it more than wins easily because they pointed out that the frog, all the parts are very obvious. But the slug is much harder to know which part is which. In fact, I've thought a lot about slugs since then. It’s hard even to know what's a part of a slug, or the log.

The point about this project was that kids, they were thinking not only about why you should learn something, but what kind of thing you should learn. They were focused on another very common idea, and that's the idea of structure. That if you really want to understand the structure, as human beings, we have a structure of nervous system, skeleton, vascular system, same as a frog, and so does the slug. But it’s surprising that the slug has this same structure and so it’s more interesting to study the slug, because the more you're surprised by problems and distant paradoxes.

But what is being directed, then, this is where we come back onto my theme of where there’s a weakness. That weakness in this particular case, was you can see the weakness wasn’t all together so pronounced, but still it’s there, and that's the powerful idea, there was the idea of structure. Studying structure and asking why are we structured like that, what is common between this structure and that structure? And these kids were edging that way, they had a sense, intuitively, that they were grabbing a hold of an important powerful idea, that we have structure in this case. But they didn't have the language for articulating it. They didn't have information sources for finding out more about structure, where would they go search.

This is really where I think what the big task for this commentary is going to be, to figure out ways for kids to get more involved with a set of powerful ideas. Particularly with the idea of powerful ideas, which is the most powerful of all. I think of putting out, picking up, particularly as we mentioned, too, feedback, structures one. Putting these out for kids, and teachers, and seeing this as a different way of organizing knowledge, is the curriculum is one way, the project is another way. Powerful ideas is another way. And powerful ideas and projects cut across one another, so that the powerful idea and the project, the project is richer because it can draw on these powerful ideas. The powerful idea already gets meaning because you can invent a project.

Then as for the curriculum, I won’t even say you should throw that out, but that I think that for students who have been through, had experiential, living with projects and are ready for the conditions, ready to be immersed in them. They've been in contact and identified important, powerful ideas, through this, they've built a foundation in which, I guess you can give them the curriculum as a kind of organizing.

Now, in they're already structured, what they already know and they already know this terrain, so now organizing it in a hierarchical way and pacifying kinds of knowledge and going over them formally, becomes something of a different meaning, because you're giving structure now to something that they already know. I believe and I think the intuitive evidence is obvious and I don't know how to prove this in a formal way, but I think it’s obvious that the amount of time that you'd have to spend on the formal curriculum would be minute, compared with the enormous waste of time that you spend at the moment.

I've noticed, and I'm going to show you examples. I noticed that they've been carried away. I told you, I didn't know, certainly know it was instructive at the time, but I do think that, so I'm going to, it’s about time for me to stop?

[Crosstalk 00:34:00]

Well, where I was sort of come to, and now thinking back on what had worked great and what had worked, but less great, was the project side of Logo, has worked wonderfully and some very wonderful stuff. The powerful idea side is not that it hasn’t worked, I think it hasn’t been articulated. I think my idea of the slug is not such a rare thing. Because I think in many, many projects, the project is really being directed by a sense of being in touch with an idea that is powerful and exciting. But I think we've been weakened making explicit, this aspect.

What I'd like to see, thinking about how to correct this, I've gone through a couple of phases. One of them is in the last year, with the group of researchers, care of the media lab, we've been thinking along following sort of lines of how to bring children into contact with these ideas. One direction has been let’s invent them in kinds of project.

For example, Jasmine Kaffoy, whose book about this is going to appear soon, I hope, has been having kids in the Boston area, with teachers here on kids working at making their video games. Channeling the enthusiasm that kids have for video games into making them as well as playing them. Games to be made rather than games to be played. There’s no doubt that there is lot of excitement about this.

You can make a game without there being a lot of powerful ideas in it or they're being explicit. So for instance, how to make it easy for them to introduce these. What can we do to introduce into the game more powerful ideas? The obvious way, which the kids think of themselves immediately and which has to be worked through is the way then education community has seen it, that is you build into the game questions and answers. So this game is about the planets and unless you answer the question correctly, you can't get over this barrier or whatever, something of this sort. The ki*d*s make it instructional in that sense.

Now that's a first step and since most of the education community hasn't gotten beyond that, it can't be such a bad step for a 4th grade. But I should like go further. One idea for going further was illustrated by a concept using a word that [inaudible 00:37:32] proposed, I'm not sure that I read it right or not, and that's the word "contructopedia." The idea of constructopedia, let me just give you an example of the kind of game, a game situation that's easy for kids to make. I'm going to set this up, but it doesn't matter.

You see this guy, he's also long, now that's very easy Logo programming and in MicroWorld, it's easier than ever because you can have this parallel processing. When he hits the barrier, and guess the other one was already there, this slide, are next to the other one, but they lay on top of him, so. Now, we can try again and this is the idea about trying again, is well, what he can do? We'd like to introduce the idea of there are these trees over there, for this focus, that I know that if he jumps in between the two trees, his machine doesn't run at the same speed as the [inaudible 00:38:54].

Anyway, the point about it is, this point about constructopedia is jumping is a kind of situation you run into in, if you're trying to make it. It's a natural thing to run into in a vast [inaudible 00:39:14]. Suppose you want to make something jump and it's clear, it's not so obvious how to make something jump. In Logo, there's an obvious way and that is you make it go forward by, in MicroWorld, you'd say forever forward once, and it goes creeping along. Now how do you do the jump? One way to do the jump is where you say set Y, set the Y coordinate up, then it goes around and then down there.

That's a kind of a jump, but it's not a very good jump. Kids will say it doesn't look like a real jump. It's a funny jump. Now they might want a funny jump, but supposing they don’t. It also makes it too easy, because in this case, what was interesting that the game was judging when to make the leap, and it just went up and down.

What the constructopedia idea was, was to have [inaudible 00:40:11] out into, to have available for these kids, not to get built, but we're collecting stuff like that, in the form of probably hypertext stuff in the computer, but it could be printed and it could just be ideas circulating in the community, that there’s a lot of information about jumping. Getting into constructopedia ideas about jumping will tell you a lot of things. Like you might get video stuff of animals jumping, so you can see how they jump. We might get information about jump records, all sorts of stuff about jumping.

Amongst other things, though, how to represent a jump. Something really interesting about fundamental underlying concepts here is that the following way of representing a jump is exceedingly powerful and exceedingly easy and I've just been doing it recently with a few kids at seven or eight. Nobody finds this difficult. This is the way you make a jump.

Instead of going forever forward one, you go forever and one to the next [inaudible 00:41:26]. Do that by having a special parameter that says increase by. So it moves forward by increasing the X forward. Now if you wanted to go up, what you increase is the X velocity. If you wanted to go up, what you increase is going to be the Y velocity.

When it’s something running along, Y velocity is zero. So the procedure for making a jump is make the Y velocity 10, or whatever. Now it’s going to go up like that in the diagram. This is an idea that nobody can not immediately see. It’s simple, transparent, and yet, it’s something if you try to identify it in the sort of standard curriculum, this is decomposition of velocities and it prolongs maybe in advanced placement of precalculus, or physics, or somewhere up there. But it’s a simple, concrete and mathematical idea and an extremely powerful one that you're going to have and then that you can really access through this sort of entryway at a very young age.

Now, of course, the jump as I discovered, has a bug because it will jump up to the moon, it keeps getting up now. So how do you correct that bug and this is where we stand on Newton’s shoulders and his feet and he stood on the other giants and with now gravity. What's gravity? Well, there's an easy way to think about gravity. Gravity is something that eats vertical velocity. So it may have a procedure that eats vertical, whenever there is vertical velocity, it takes away, it just eats it at a standard, fixed rate. It just nibbles away at it. Again, that's easy in MicroWorld, because you set up another process, it just eats away.

Now, when it goes up, to jump you go over to vertical velocity 10, and as it's going up, the gravity is eating away at it and it's getting to be 10, 9, 8, 7, and it's getting flatter and flatter. Zero and then minus one and it's beginning to come down, it's beginning to come down to the ground. And then we're putting one more bug, that when it's on the ground and it's ordered, gravity switches off.

So here's a structure of a program which is very accessible at a very early age and which brings you into direct contact with a mathematical idea that's considered very advanced, which is actually very direct and completely accessible at an early age. It means breaking from strict total coordinates, but there you go. The fact that you have to break from that is itself maybe an aspect of what makes the idea powerful.

There's an example of how inside the context, we can imagine doing projects inside the context of having this accumulating and constructopedia, which I see is something that is going to accumulate not by one person making it, but by large numbers of people all over the Logo community being able to make contributions and put them in some central place or somewhere where we can get at them through information highway or whatever we come to call those electronic mediums. Then kids can get at them, so that whatever project you're doing is a rich realm of powerful ideas couched in a constructionist, poor man's contructopedia of a realm, so encyclopedia, with a little twist.

Well, that's the direction we're going and doing some work and making the elements of this, but I do want to stop with the direction that's on top of my head right now, and I don't know why I didn't think of this before as maybe the way to do it. And that's to run with Marian Rosen's idea with her, with this [inaudible 00:45:49] project, that the great thing that's happened with projects in Logo is that kids pick out their own project and make up a little piece, teaching about the anatomy of a slug, including teaching why you should learn about the anatomy of a slug, or the life cycle of a fly, or the planets and how they rotate, or the presidents of Costa Rica, which is what I saw when I was in Costa Rica, a couple of months ago.

Now, why shouldn't it be projects of this sort, which are about ideas? So we might start with some ideas that are already named, like the fly or the slug were feedback. The project is to go and look for examples and situations. You can find exemplifications or a striking exemplification of this idea and a way of using it and present it to people, or showing connections or identifying it, or finding one that hasn’t been recognized with a name. There isn't a fixed set of powerful ideas, you can cut knowledge in many different ways.

My model of the way in which these things then come together, or the one that's preoccupying me right now, thinking about how to do it, is that kids collectively or individually or working alone or in classes or through virtual groups across electronic communications, will be working on projects which are explicitly directed towards identifying and expounding your powerful ideas. Or taking something like jumping. Now jumping doesn't seem like much of an idea, it’s just something you do. You don’t think about it.

But let’s take it and to your task, this is we're going to say that this is not an assignment, but it’s building a culture around putting a value on, or examples of, taking something as ordinary as jumping and turning it into an idea. What's the idea? What's the essence of jumping? What's behind it? How can you think about it?

Putting the focus on the kids as generators of making explicit, of powerful ideas, and through this, of course, talking a lot about that idea, of powerful ideas and I don't know how you do that, what I've just been doing in the last hour is one shot at how you might talk about this idea in a way that it might trigger and catch on. And I have enough confidence in you to believe that in a few years’ time, I'll be amazed at all the other wonderful ways that I encounter at the next few logosiums, if that name is going to stick, to do this. We'll stop there.