Principles of Knowledge Building

MS: **[00:00]** You were given the twelve principles there on the far right and they're in blue. They are mapped onto knowledge-creating organizations. We believe the most important things for teachers in professional development, is to actually understand the distinction between the parallels that are very much about schooling, how you get over to that other side, and I'm going to just discuss three of them in a little bit more detail to give you some sense of that, and hopefully tie it a bit more effectively to the examples. So I'm switching to making the impossible possible now in my way of conveying this.

If you take this notion on the far right, community knowledge, collective responsibility, this really says that teams work on a distributed, opportunistic basis. The parallel in schools is collaborative learning, but it tends to settle into small group work, jigsaw classrooms. And what happens there, if you think about that, is the teacher puts the small groups together and then sometimes rotates, but it tends to have to happen on scheduled times because you're working with a complex configuration.

One of your advantages when ideas are in a public space and people can read ideas is you have the chance for a much more distributed, opportunistic, finding ideas a freer—freeing up, literally giving you more time for the work with ideas instead of the procedure. Ann Brown(?), who was masterful at putting this procedure together, finally called the procedures lethal mutations, in that the small groups become fixed, the—the rotations happen at set times, independent of whether the ideas need(?) a rotation at that particular time. But on the other side, working with principles is really hard and abstract and teachers tend to want procedures, so there's a really interesting tension between the way these systems work.

This notion of the knowledge-building pedagogy, what you really need to do is get in the classroom a new norm for the classroom, one that suggests we succeed when we all succeed. So if you happen not to be interested and not contributing, me, as a member of the community, I need to engage you. I need to figure out what your ideas are. I need to get going because we really need each other. The issue is learning by groups, the whole group has to learn and you need for this, as I've stressed, the community space. But also the community spaces, this is—these are our ideas. This is our point of pride. It's like when you go to a conference and identify your answers—answers. It's what's really meaningful to you.

So I'm going to give you an example here. The students start out. They are dealing with what makes a rainbow, and they're having this trouble with—because there are these little raindrops and they act like prisms and they get—kind of get that. And these prisms make a big rainbow—or sorry, these—I'm sorry. These water drops act as a prism. These tiny, little water drops act as a prism and create this big rainbow. But a prism is actually bigger than those water drops and it doesn't create a rainbow.

So now, this is a really interesting notion and it's hard, and it tends to be—the research suggests that if you get a hard question like that, it tends to die. Most contexts, the teacher either doesn't hear it or doesn't quite know what to do with it. You know, it's harder than the other issues, so it tends to die. When it's in a public space and you're collectively responsible for advancing the ideas of the community, then actually we have a responsibility to deal with those ideas.

They went all the way from there in working with this, of our problem, why are the colours of a rainbow always in the specific order? So you see, they're going deeper, deeper, deeper into the curriculum as they go. Traces that tell us they're getting somewhere are you'll see putting our knowledge together. They're gone out for resources. When they need to go out for resources, they tend to find things on the Internet or books in—in **[05:00]** reference sources that are beyond their grade level. That creates a new problem of—of working together because they've got to understand a really hard text. But when you have a community, you bring people together to understand the text. That energy works across these media(?).

Here, you'll also see these are the knowledge advances of this view, and you'll also—oftentimes, students say, "This is what we still don't understand," so they don't have a sense of the finished project. They might come to a natural concluding point, but their ideas are still alive in this space and they'll come back to them. The searches bring them back to them frequently.

You'll also see they all were learning from one another and they were all working in different aspects of the curriculum, and I'll tell you what the teacher did after three years that finally got them the most stunning advances on our assessments. But for now, what's important is they all are trying to talk about their knowledge advances and they have a class portfolio view.

Zoe is the teacher who I keep looking to because this is a social network a—analysis and it looks at her classroom. If you think about what happens in these data spaces, then, or these knowledge spaces, all the children's discourse, their artifacts, their drawings, their video, their audio, whatever is created resides in these spaces, so we have a gold mine of students' discourse. It's—they're just elegant resources for the students' engagement with ideas.

What your—I mean, I—Zoe's story is second to none and she has a video here and you might want to ask her, but this social network analysis says if we look at the notes in her classroom and the connections between them, students are reading all of each other's notes. They are all writing a note. They're all referencing a note. So they are working as a community.

Now the part I want to say is in the analytic tools, you just press a button and 20 seconds later you can get this profile of your classroom. So you can see very quickly whether you have a connected classroom. How you get that connected classroom, of course, is a—is another issue, and I will leave it to Zoe to tell more about that if you're interested.

So this notion of trying to get the—the—the trouble with inquiry on its own without inquiry living in a knowledge-creating context, if it lives in traditional schooling, what tends to happen is it becomes question-answer, and then you start seeing this phenomenon that becomes fairly pa—pervasive. Students ask the questions and then they go hunt for the answer. And the general idea is that the—the—somebody more knowledgeable than them has the answer, and so they have to go find that answer. So this really conveys you're the question asker, the people out there in society are the knowle—are the question answerers. That's not a knowledge-creation energy(?).

This issue about going deeper, diving in deeper and deeper, of course it's still inquiry, but inquiry is set in much, much more complex operation. It is actually not the whole of

what goes on; inquiry is one of the driving forces but the sustained creative work with idea, the whole other constellation of factors that keep you in design thinking, keep you hunting for a different way, all of these forces, which are actually the huge(?) surround for inquiry, is what actually gets you the continual improvement. This notion that it's finally not the technology, because technology always changes, always grows old, but a space where you grow your ideas, a space where ideas live and grow, that actually doesn't grow old and that's why, for us, having a technology that isn't just about scopes(?). This would be as good in a Nobel laureate lab if we build it right—I mean, that's of course the challenge—as it would be in a school because it's not a bou—it's about living a knowledge-creating organization.

When this happens, you can start working across groups. So you—these students happened to be pondering what makes our Earth a sphere. Why is the Earth round? So I—it's actually an interesting question when you think about it. Again, one that would normally just be passed over fairly quickly, so we think. I mean, maybe not, but nonetheless, I just want to give you some sense. Child goes out, finds a thought experiment by Sir Isaac Newton; translates Sir Isaac Newton's thought experiment **[10:00]** into something that's more understandable to the children; actually draws what's Sir Isaac Newton talking about, this cannonball going around the Earth? Wouldn't some forces draw it closer to the Earth? So they're contemplating, put an image of it together. Working together, connect with kids in the Northwest Territories.

A child in the Northwest Territories says, "What would gravity feel like? What's the force that would hold this together?" Actually comes up with an experiment, pretty ingenious. Puts balls in a sock and says, "Is this the force we're talking about?"

The students at both schools work together to try to figure out, "Well, what are the forces here that we are dealing with?" And they move from one representation to a more mature representation, and finally to a pretty abstract representation of what the gravitational field is like and what it is they're working with.

I'm going to—oh, this I just can't resist. But the thing that I'm actually hoping that we in Ontario will do, and this will be a first for us. What we've noticed is these students design experiments. They figure out things. In this case, we happened to read about a Guelph scientist who actually made a discovery about cockroaches and was written up in the newspaper. And we thought, "Wait a second. We think two years ago in Grade 4, the students were working with cockroaches and made not only this discovery but they also learned help—learned helplessness(?)." It turns out this was absolutely true as our records show, but they never get written up in the newspaper, you know? The Guelph scientist made it to the newspaper. And our idea is what if we captured kids' ideas? What if we started doing the publications that actually showed the power of kids' ideas?

Anyhow, I'm giving you my very last piece here. This notion that if you want to make this shift, shifting from what we call belief mode that schools are about getting to true and warranted belief—now, we've got to get to true and warranted belief, but the notion that that's the very highest point at which schools need to be built for is very different from this notion that sustained engagement in designed thinking, that these students will actually be the ones who create ideas, this is really fundamental to this shift.

[12:46] The last thing—I—I said that was the last thing, now this really is the last thing. But it—it's just a quick flash show actually I want to give you.

This notion of when you have students' discourse, you have their points of pride, their exciting inventions, their discoveries, you'll—you'll find in the classroom the talk is not so much about, "Well, we did this paper. We did this," it's that they're talking about their discoveries. What happens in a context where those ideas are literally living in a place where they can analyze? We can see things and I'm really going to go fast because I'm very anxious to get to the conversation part of this.

But you can actually watch the social network structure of your classroom after—over years. This tells you you have a lot of isolated, small group work with the teacher in the middle of the discourse. The teacher redid the unit the next year. You see the teacher actually is still in the centre of the discourse. One child's way out and not very much connected to the discourse, but certainly the students are more connected to each other. It's still not the knowledge-creating organization ideal of opportunistic integration where every child is acting as a node as powerfully as the teacher, and that's represented in this graph here, where the teacher is still there but every child is engaged with every other child.

Of course, these are just social network analyses. The question is is the knowledge advancing. You'll notice as the teacher shifts to this more powerful structure, which is the very powerful structure I mentioned to you before, the knowledge goes up as represented in assessment tests. So we can take either their portfolios, independent assessments of achievement, and determine that the more powerful knowledge-creating structure actually gets more results. On the judged scientific-ness of their work, the complexity of I—their ideas, their portfolios. So those are the patterns we're after. We also want to know that the students are not only operating at **[15:00]** grade level with the concepts they're talking about, but they're actually operating above grade level should—which should be the case because, in fact, we don't have the lid on their ideas. The children are moving where they need.

We're dreaming. We haven't—we have all of these built in rough form. We're dreaming of a really sophisticated dashboard for teachers who we hope will help us co-design these, but I'll give you some sense of what's here now. You can—again, in 20 seconds, you can see the growth of vocabulary for every child. When are they entering new terms into the discourse? Is this true for all students? You can take any expert corpus you want, any curriculum standard, any—any text, anything that you say, "Ah, this is the expertise I'm after," or, "This is the standard I'm after." And then you can put that expert corpus in a view and then you put the student discourse there, and it will tell you what are the concepts the experts are dealing with that the students are not? Or—or what's the gap? What's interesting is if you give this—these results to students, we've monitored their discourse of how, "Oh, we're not saying anything about velocity. Oh!" And then they try to bring velocity into their vocabulary.

So this is what we need by empowering the students. It's not a distant force away from what they're doing, it's an enriching force for allowing them to advance. We're really working hard on trying to get so that students can work with ideas and we would have new metaphors, new rise above metaphors. Students would see ideas moving and growing. So this is just an example where we imagined students can build on, mark up ideas, actually see those ideas grow and became what—the new term that we've recently been in, transliteracy. You're now working with worl—work across the

world. You have to bring coherence to it. So it's another form of literacy and all I want to do is show you this notion that we're envisioning graphical inter(?)—design that actually show ideas rising.

[END OF RECORDING – length, 17:22]