Transcript - Strategies for Success: Tina Grotzer

2/2/2024

NORMA HOLLEBEKE: Welcome to the Every Learner Everywhere strategies for success webinar series for 2024. It's a pleasure to have you with us today. My name is Norma Hollebeke. And I'm the senior manager for network programs and services with Every Learner Everywhere.

Before I introduce our speaker, I'd like to take just a few minutes out to tell you about Every Learner Everywhere and the mission of our network.

Every Learner Everywhere is a collaboration of higher education organizations with the expertise in evaluating, implementing, scaling, and measuring the efficacy of digital learning and its integration into pedagogical practice.

Every Learner Everywhere is sponsored by the Bill and Melinda Gates Foundation. Here at Every Learner, we work with colleges and universities to build capacity among faculty and instructional support staff to improve student outcomes with digital learning.

Our mission is to help institutions use new technology to innovate teaching and learning with the ultimate goal of increasing student success, especially for first generation college students, poverty impacted students, and racially minoritized students.

A quick housekeeping note-- throughout this presentation, we welcome your questions in the Q&A section. If participants raise their hand, we will not be able to unmute you. However, we will be monitoring the Q&A section as well as the chat.

And now to our esteemed guest. Dr. Tina Grotzer is a member of the faculty of education and a principal research scientist at Harvard University.

She is a cognitive and learning scientist, who studies learning and education as it relates to the complexity of our world and specifically to the sustainability and climate education.

She is passionate about making approaches to climate education more inclusive, as well as shifting mindsets from short term to long term thinking towards more global collective perspectives.

This work includes developing earth resonant design moves that accompany a shift in mindset from human centered design to earth centered or Earth X design.

Dr. Grotzer is also a faculty director of the Next Level Lab with a focus on the future. So her work with NLL has the focus on future work in a volatile, uncertain, complex, and ambiguous world.
Her work with NLL seeks to redefine the visions of optimal learning and work performance with project strands focused on what it means to be an expert learner and on preparing for green jobs for the future.
She is also the principal investigator of the cognition in a complex world lab focused on challenges of reasoning about complexity and developing instructional supports for developing sustainability minded citizens.
And a PI on the Eco Learn Team, which develops virtual worlds and other immersive technology based experiences to support understanding of ecosystem dynamics.
Tina's courses focus on leveraging research findings to develop expert learners, instructional design and pedagogy, and climate and sustainability. Dr. Grotzer's publications include many articles, book chapters, and a book on Learning Complex Causality.
Her awards include an NSF Career Award, a Presidential Early Career Award for scientists and engineers from the United States, and the Morningside Teaching Award from Harvard Graduate School of Education.
Links to Tina's publications can be found in the link that we are adding into the chat.
Please help me welcome Dr. Tina Grotzer.
TINA GROTZER: Thank you, Norma. What a pleasure to be here today and to be able to speak to all of you. I am, especially, appreciative when teachers take time out of their day to talk about climate and how to teach and engage learners in thinking about our changing climate.
And the one thing that I'll add about my background is that I spent the first 15 years of my career in the classroom. And so I have deep appreciation for the work that you do and how challenging it can be.
So when I think about the climate and our changing climate, there are a number of things that I keep in mind in terms of the science, just from a broad perspective.
And this includes the really important understanding that we are becoming-- human beings are becoming a large enough force in planetary dynamics that we are shifting our climate. And that is why it's called the Anthropocene, constituted of both human and recent.

I also try to keep in mind with humility that humans need the Earth, but the Earth does not need us. So that's just really important to be keeping front and center in our minds.

And the fact that we're living on a planet that is habitable in the way that our planet is, is a rare confluence of events. We have enough free oxygen in the atmosphere and enough carbon, so that our climate is stable and moderate.

It's warm enough so that we can survive, but not too cold either. So some carbon in the atmosphere is very important. It's not that we don't need carbon, we need the right amount.

The other idea is that it's a complex, dynamic, and interacting system. And I'd love to think that we were really, really good at thinking about those things. But as the research will bear out and I will share with you, we're not so good at thinking about those things.

And finally, we really need more than just the ability to think in certain ways. We need sensitivity to occasions to think and reason in particular ways. We need the understandings and the ability. We also need inclination, I would add to that sentence, to be able to live together on a small blue planet.

So the other big puzzle for us is that the responsibility for this crisis-- and it truly is a crisis, isn't shared across the world's populations or generations. And so as we look at what's happening and we see the consequences disproportionately impacting the most vulnerable, it's really, really troubling.

This is a picture of people in Bhutan, who are literally changing the pathway of the melt, the glacial melt, so that they don't have what they call a lake burst that comes down at a certain time and floods their village, but still supplies them with the water they need.

And then we look at classrooms around the world and in the US being interrupted by changing climate and more extremes in terms of our climate. So teachers are a really important resource for us. You are on the front lines of this changing world. And often as teachers, we adopt the long view.

And even though this is an imminent crisis, it's also one that requires us to adopt a long view because we need to raise a generation of citizens, thinkers, and learners who actually know how to live in a changed climate in a different kind of world.

And we need to do that despite the fact that they may not feel so positively towards the generations that have come before them who haven't done enough to address this climate, this crisis.

So when we talk about educating all learners and thinking across the curriculum, climate change is a really, really important topic to come at from different perspectives.

When we look at climate, the crisis involves issues of social justice and equity, medical and mental health issues. There are legal issues, economic issues. There's issues around innovation, science, design, and technology.

So it isn't just a science issue. There are many, many places across the curriculum where we can engage learners and need to be helping them figure out how to live in a new and different world.

So I'm going to talk about 10 points today that come out of the work that I've done and the work that others have done and just give you a sense of how each interacts with creating curriculum that really addresses the needs of all learners.

The first is that you should teach the science, but recognize that it is not enough. Don't take away the complexity. And I'll talk about what that means. Focus on authentic problems because they're rich and they will-- there are ways for kids to come into them. And I'll show some examples.

Create curriculum with a low floor and a high ceiling. We want everyone to find a place in the curriculum, a way to come into it. Use every opportunity across the curriculum. Design for interdisciplinary curriculum. Hold space for mental health. So we'll talk a little bit about that.

Shift learner mindsets towards a collectivity of beings on planet Earth. We're not always so very good at that. Embrace multiple ways of knowing and learn with humility from cultures that embody sustainable ways of living in relation to the Earth. And then finally, rethink the fundamentals of how we design, innovate, and help learners to do so, too.

So starting with the first one, teaching the science but recognizing that it's not enough. If they don't understand the science, they won't have a way to know what's going on or what information to trust.

And of course, teachers need to make decisions about what level they need to understand the science, but deciding-- sometimes I hear people say, well, they don't really need to know the science.

Well, I think they need to understand it well enough to be able to analyze and think about the information they're receiving. And more than specific facts, they need to understand the nature of science.

So science is based on claims, evidence, and reasoning. And there's really nice work on CER for classrooms. It's not about right answers. It's about coming up with the best explanation for the evidence at the time.

And as we're gaining more evidence, our best explanation may change. We're trading up for better explanations. So that means that uncertainty and changing ideas are necessarily a part of science. And many people do not understand that. And it frustrates them because they think that scientists are changing their minds.

So helping people understand the nature of science and how it works is really essential to helping them think about climate change and think about the actions that we need to take, rather than denying that we need to do anything.

If you think about it, predictions are really, really hard. We were very good at predicting, many things would look different in the world. And I think that if you ask learners to look back on the last couple times they made some predictions, what information they had and what information they didn't have, they'd realized that what they do is they base their-- they base predictions on the best available information.

And then we move forward with that. And sometimes you find out more information later. And sometimes you find out that you needed more information to really come down in the right place.

So when we look at the facts of the science, one of the puzzles about climate change is that there are scientific explanations that are important to learn, but there are real challenges to learning them.

And the educational research has looked at many of these and has helped us think about ways into them. So one of the puzzles for kids is the idea of carbon. You can't see it.

And so the idea that trees play a role in sequestering carbon and that trees actually create their mass from carbon from the atmosphere has been well studied.

There are videos-- how to help kids understand that have been well studied. And there are videos out there in the world to help you think about it with kids, but it's a counterintuitive idea. It's not an easy idea.

The other thing is it involves reasoning about deep time. And when you're only in second grade, or fourth grade, or sixth grade, deep time is not even within your conceptual framework.

So thinking about the Earth longitudinally, thinking about our planet as an n of 1, all of these things are challenging aspects of thinking about the science. Albedo effect has a feedback loop as an essential part of it.

So Albedo is when you're talking about the melting ice, which would reflect more of the sun's rays out of the-- away from the planet out of the atmosphere. But instead, what you get is a more cyclic pattern and more heating as darker surfaces-- as the ice melts and you have darker surfaces.

And then the idea that some greenhouse gases actually are needed to keep our planet warm enough to be habitable, but that too much leads to overheating. So there's no simple it's this or that. It's really about balance. And then there's a lot of complex concepts that feed into the larger construct of climate change.

So teaching the science is not easy, but there is good information out there to help you think about it. One of the puzzles with teaching the science is this. And this is where I have spent most of my research career focused on.

Human beings have trouble reasoning about complex causality. It's very difficult within the cognitive architecture that we have to pay attention to things that extend beyond our immediate attention. So things like indirect effects, feedback loops, issues of scale, balance and flux.

So tipping points, the idea that you can have an-- not see an effect until a certain point and then see massive effects. That's very hard to grasp because it's not sequential and it doesn't add up in a systematic way as far as learners see.

So this is a problem. It's particularly a problem for climate change because climate change involves all of them. So let me just go into a little more depth on what some of this means.

Some of us are old enough to remember some of the pollution from the '70s and the '80s. And you could look up and you could see it. You could see that there was smog in the sky.

And before the Clean Air Act, and the Clean Water Act, and some of those early forms of legislation in the '60s, '70s, and '80s, you had these obvious impacts.

The puzzle with climate change is that you don't see carbon. You don't know that it's there. It's very hard to keep in the front of your mind, so hard for kids to really focus on, hard for adults to focus on too. Now we're starting to see effects, but we're closer and

closer to points where the system is so out of balance that you start to get tipping points.

Another big concept that we've studied, we call action at an attentional distance. It's really hard to pay attention to causes and effects that are in different attentional frames.

So if you see something happen and you see an outcome, you can easily use the covariation to put them together and to infer that this made this happen based on whatever mechanism. So sometimes we jump to conclusions about correlation, but often, we can see the mechanism.

When something happens in one attentional frame-- you're driving your car to work and the Marshall Islands are disappearing. And polar bears-- the ice is melting. It's really hard to connect those. So we need to help people realize that you can have global impacts based on actions that are local and close.

So I'm going to ask you to not take away the complexity. One of the things that we know is that learners can understand these forms. And we've been studying kids in kindergarten, second grade, sixth grade, fourth grade, sixth grade and up, seeing that they actually have intuitive understandings of many of these swarms of complexity.

So as educators, we can build upon those. And that these forms of reasoning are learnable. If you're interested in thinking about curriculum that has a more systems approach to the science, The Habitable Planet came out of Annenberg Learner. It actually came out of the Harvard Center for the Environment. And then it has been published by Annenberg Learner is a really nice resource.

Out of our own research, we have curriculum modules focused on teaching complexity, some specifically on climate and complexity and others focused on complexity across the curriculum.

So places where you can teach kids to think about cyclic forms of causality, domino forms, balance and tipping points, processes and steady states, some of the many concepts that are inherent to climate change.

And sometimes, as educators, we find ourselves in places where it's difficult politically to teach about climate change. And if that is the case, we can absolutely teach about some of the underlying causal patterns that will help learners discern what's going on, as they start to think about climate in other contexts.

And those apply across the curriculum as well. These forms of causality apply in teaching about batteries and bulbs. They apply to teaching about density, buoyancy, concepts like that, in addition to understanding ecosystems, climate change, et cetera.

The other thing that's really important when thinking about climate and thinking about it from an interdisciplinary perspective, is that if you engage in authentic problems, they are often inherently interdisciplinary. There are ways to come into them that you can chart a path from all different disciplines.

So I'm going to share an example from some work of a colleague, Dr. Lauren Birney. And this is actually work happening in New York City. And it was funded by the NSF, this project of hers.

But she's been doing work with The Billion Oyster Project. And The Billion Oyster Project is a project where city kids have been studying the history of where they live.

And they've been learning that, at one point, there were lots and lots of oysters in the river. And that those oysters filtered the water and extends, makes an extensive difference in the quality, water quality in New York City.

But they were also used in the restaurants in the city and in the oyster market. So they were part of the economic structure of the city.

So the kids have been growing oysters. And they've been growing little tiny baby oysters. They've been graphing them, charting out how big they get. They're pretty excited when they see that their oysters are getting bigger and bigger.

And look how much bigger and I grew this. And I'm contributing to this large effect. So all of these individual actions of growing oysters has an emergent outcome because, together, their oysters are being put back into the river, and they're filtering the river, and are becoming part of the economic engine for the restaurants. And they are changing the water quality in the river.

So here's an opportunity to do many of the things you see in the science standards-- the graphing, the observing, the documenting drawing, the math involved. And it's a real authentic project. And there is a video at that link for people who are interested.

Another project I want to tell you about is some work that we've been doing as part of our EcoLearn projects. So there's actually four of them. I'm going to tell you a little bit about EcoXPT. It grew out of EcoMUVE.

So this is a virtual world that we created that learners come into.
And unlike some problem based learning, we don't start with a problem. We just have the kids explore. And they start moving around in the world.
The kids using this are usually anywhere from fourth grade to about 10th grade, but I've seen adults use it and enjoy it, so it's flexible in that way. And they move about in this space.
And while they're moving about, they start finding different animals, collecting information in a field guide. Then they start learning about some of the organisms. They start learning about some of the tools at the bottom of the screen that you see there.
So there's an opportunity to go down underwater and look at things. You can take the camera and you can capture different organisms. But essentially, as they're wandering around, they notice a problem. They notice that there are many fish that have died. And they start trying to solve this problem.
And there's an explanation here as to what's happened. But for the kids, they've got to find it. So you've got this complex eutrophication scenario in the background. But to them, they've got to use various tools and graphs to start to see the problem and to see what's going on.
So they collect data using the various tools. They can see correlational patterns. They can graph data. They also have a lot of supporting structure to see things that we often miss. So we might miss changes that are very subtle, but in EcoXPT, they can actually time travel back and forth.
They learn a lot about how their minds work and how we miss things if they're not big and they don't our attention. They can take measurements of water quality and monitor the health of the environment.
They also have access to various experimental tools, both in the virtual world and out in a little lab building that's in the world, so ones that take place right in the world itself.
So kids engage with this. They explore. They collect data. They start to construct explanations. They have a concept map where they collect and try to make sense of the information that they see.
And they engage in claims, evidence, and reasoning. So they're putting their explanation together in terms of making a claim, finding evidence for it, and coming up with the best explanation.

And EcoXPT encourages kids not to jump to conclusions. It encourages kids not to look for a right answer, but instead to really think about-- what are the possible answers and what's the best explanation based on the evidence that you have?

It also creates a window into some of these forms of causality that are otherwise hard to grasp. So there are spatial gaps between causes and effects and EcoXPT. And they get to experience that and then talk about it.

There are non-obvious causes. There's a little microscope tool that's in a submarine that goes down in the pond. And they can see things at different levels of Zoom. And they start to notice that there's something going on with the bacteria.

They learn about phosphates and nitrates. They learn how variables that they cannot see impact the ecosystem. I do see a raised hand, but I'm not sure that I can answer that right now. But perhaps someone on the back end can answer that.

Because they can time travel, they can see these changes over time that they otherwise might not see because it's not a big event. Instead, it's something that's slowly happened over time, but it's the time traveling that lets them do that.

So EcoXPT has a number of supporting thinking moves-- deep seeing, evidence seeking, pattern seeking, analyzing causality, constructing explanations, and building a body of evidence. And while this work is very much focused on understanding an ecosystem, it's completely relevant to learning about climate change.

Each of these thinking moves relates to the kinds of things that we need to be thinking about as we think about the changes happening to our planet and how to help kids build understandings of them and be able to explain those to others.

EcoXPT is actually a free download for teachers. It was NSF supported. It was built with early funding from the Institute for Education Sciences at the federal government, at the DOE for EcoMUVE and then later the National Science Foundation. So it's available. It can be downloaded. And everything you need to do it is there.

So the next thing I'm going to encourage you to think about as teachers is creating curriculum with a low floor and a high ceiling. So why is this so important?

Well, I'm sure you all have a range of learners in your classroom. And you want to find places for all of those kids to engage and to be challenged at a level that's appropriate for them.

So a lot of authentic curriculum has a space for all learners because you can answer these questions at different levels. So EcoXPT is an example of that. You come into it and you can create an explanation about what's going on in the ecosystem at one level.

And then other kids might get lots of other details that you may or may not have found, but everyone does come up with an explanation. And then they compare their explanations to see what they can learn from each other.

These kinds of problems work very well at the center of interdisciplinary units because you have an authentic problem and lots of ways into it. And some of them have this unfolding feature to them, like peeling back the layers of an onion. Let's say a bit more about that.

The other thing I really want to encourage you to do is to use every opportunity to teach about climate across the curriculum. So these are examples from the arts and literature that can lead to really interesting conversations, can be quite powerful.

The "Follow the leaders" piece by Isaac Cordal was part of an exhibit that a colleague did on slow violence. And it's one of those things that makes you stop and say, wait a minute, what's happening here? Why are they standing there? Why is this group of people standing there as they literally are covered by the water?

But these kinds of things invoke creative thinking. They also invoke the kinds of analogical reasoning that kids are capable of. So that was work that Rob Nixon had done.

So climate, if you teach it across the curriculum, you can invite both critical and creative thinking. So the power of narrative, very, very powerful. People start to connect to the experiences of the people in the narrative.

These can be some of our most compelling ways to pull people into thinking about climate change. And I think, as you see, increasingly, the effects of climate change, more and more people are starting to tell their stories to the news.

More people are starting to understand why it matters so much that-- these people, there are people like them and people who are different from them. And they get to know stories over stats. We are human beings.

And as much as the statistical information is important, narratives are what drive our emotional-- we're embodied beings, embodied minds. And so having those emotional

ways in to thinking about concepts-- you can always go to the statistics and look at those, too. But the stories are what draw many people in.

So the other thing, as you're thinking about the arts, often, there are action oriented projects that are interdisciplinary. There are ways that people can become activists in sharing arts, and actions, and ways of communicating to others through their arts, through public works of art, et cetera, like the one on the first slide.

I think the other thing, too, is that it's really important to realize that there's often embedded assumptions in the curriculum. And often, they relate to unsustainable progress, development, and economic systems.

I don't have a piece on gaming for the planet in this talk, but I will say that it connects to the concept of gaming for the planet because so often, games have embedded assumptions.

In Minecraft, you're building, building, building, building. I love Minecraft for many of the things that you can learn from it. There's a lot of math skills that transfer really beautifully there.

But at the same time, is that sustainable progress? Is that a conception that we want kids to identify as good? There's also things like, years ago, the Simcity series, those same thing. It's all about progress is building, knocking things down.

So when you design for interdisciplinary curriculum, think about, what can be at the center of that? One is this idea of scientific issues. They're everywhere. So this is an example that was on NPR's reveal program recently.

Copake residents, Copake, New York, are resisting the development of a wind farm on old farm land. And so this is a really interesting case because the people proposing the solar farm thought it was a great idea.

The farmers pushed back and said we don't want all those-- we don't want a wind farm here. And then, eventually, certain citizens got together and started a small group who could really talk to each other. And they started to bring the whole community along. So it's a really nice case study.

But a socio-scientific issue often has that peeling back of the onion approach. Essential questions, something like, who owns the water? What is owning water? As a cultural concept, there are cultures that don't accept that you can own the water.

So as Indigenous peoples in our areas might say, well, we can't own the water. Who can own the water? But a really interesting concept-- I homeschooled my son for a little bit.

And when he asked me one day, how come the reservoir by our house says "City of Cambridge," but the water is from here in our town. Why does it say "City of Cambridge"? And he was very curious about it.

So we had a lot of good conversations about who owns the water. But this can become an essential question for an entire unit. And then you can have problem based learning like EcoXPT, like The Billion Oyster Project at the center of interdisciplinary curriculum.

So when we think about interdisciplinary curriculum and design, one of the really important things is to think about the disciplines as lenses in on the problem space instead of fences that divide the content. So think about how they can add ways of perceiving it. This is a quote from my colleagues, Howard Gardner and Veronica Boix-Mansilla.

And one of the things I do often with my students is I have them start with an essential question in the middle, like, who owns the water? And then think about different lenses. So it doesn't have to be those lenses that I have there. It might be other roles or lenses-- an activist, maybe a politician, maybe a journalist. So what other roles might you fill in? What roles are a good choice for looking at this particular issue?

So socio-scientific cases-- there's a lot of information out there on them. I don't know if I should say a lot, but increasingly there's research on using socio-scientific cases. Troy Sadler is a researcher who's done quite a bit on using these cases at the center of reasoning about climate change.

And the idea here is that you're not only teaching what's going on with the problem, you're actually integrating information on ethical competence and perspective taking, thinking about others' perspectives and emotions, et cetera.

So it also lets you really look at some of the diving in deeper and deeper, so you can get to root causes of issues and problems. And sometimes that invites us to talk about disinformation. And that's really important because kids need to have a way of discerning whether information is trustworthy or not. And if not, what to do about it.

So mental health, holding space for mental health. So we want action because we know that engaging in action around climate helps support resilience in learners and young people.

However, we also need to realize that despair and inaction and hope and action, they have a complex relationship with each other. And hope is a fairly complicated concept.

There's different types of hope. There's hope that ignores that anything's happening. So being like an ostrich, pretend it isn't going on or there's hope that's maybe more pessimistic than it needs to be.

But the next generation really has to be able to live in a way that's healthy on the planet, but when you're holding this existential threat, that's hard.

So whatever you do around climate, make sure that you have a space for kids to talk about how they're feeling, to have a safe space that they can reach out to you at any time, that they can help each other with hope.

When I saw that the piece on Elmo reaching out this week and all the responses Elmo got, sometimes you don't know what's going to come back until you create the space for it to happen.

One of the concepts that our lab is working on is a concept of regenerative hope. So regenerative hope is when hope renews upon itself. And we have two pieces. One about critical hope, which is more focused on a constructive hope that's bounded in the climate crisis realities. And the other one is this idea of regenerative hope. And those are on our website.

And it's there because we-- you're educators, so this is-- who else would understand this better? Educators come to work every day with a sense of regenerative hope.

When things don't go well, one day you hope, again the next day. And you keep hoping and hoping to make things better for your students. And you see people in positions where hope has to be regenerative. And I think that's what we need for the climate crisis.

So the eighth big idea I want to share with you is the importance of shifting learner mindsets towards the collectivity of beings on planet Earth. And this is hard when you're in your own little corner of the planet thinking about the things that happen there.

I was fortunate enough to hear Dr. Jill Tarter speak a number of years ago. And she was the chair of the Search for Extraterrestrial Intelligence, group that was doing-- the center that was doing research on this.

And one of the things she talked about was the importance of thinking like an earthling. We think a lot about the things that divide us, but if we compare ourselves to what's out there on other worlds, we're more alike than we're different. We are one species. And she talked about that. And she talked about the need to think like you're an earthling.

So we have a paper that we wrote about that, looking at some of the research on understanding collectivity. But thinking like an earthling is a really important aspect of what I hope the next generation will be able to do.

And some cultures come to this more easily. They have-- I won't say easily, but it's embedded in their culture to think about collectivity. So Ubuntu is a concept from the African nation on I am because we are, the importance of the group or community to others.

And there are a number of concepts in various parts of the African continent related to the importance of interdependence and relationships. And you also see that in Indigenous populations elsewhere.

So I want to mention-- I'm looking at time here. And I want to mention three climate activities related to thinking like an earthling that you can engage learners in that invite critical and creative thinking, active and deep processing across the curriculum.

And the first one is about analogical reasoning about global collectivity. I'm going to talk a little bit about designing for moral musical chairs. And I'm going to share something on Earth resonant design moves.

And so sometimes we think the only way into thinking about climate change is talking about climate change or talking about the science. So there's a film that I show students. And let me just show you some of it, but it's available online. And it's a silent film. It has a little bit of music.

But I'm going to share just a teeny bit, and then I'm going to skip to a condensed version of it, given time. But it's a film that I asked them to reason about analogically in relation to climate. The film is called Balance. And I think you'll just be able to hear it.

[VIDEO PLAYBACK]

[NOISE]

[NOISE]

[NOISE]

[END PLAYBACK]

All right, so in this film-- that's just to give you a sense of the feel of it. It goes on for about eight minutes. But they begin to put out fishing lines. And at some point, one of them-- so you see in this one on their platform with fishing lines. One of them pulls up a box and it plays music. And as the film goes on, you observe them having an interest in this. But the box will move to whoever is manipulating the balance of the planet the most. And so they're moving back and forth. And they're trying to get the box to come to them.

And students have an interesting time thinking about that in terms of resources and who has resources. And you see some of them cooperating and working together to maintain the balance of the platform, but also they have to step away from the box in order to not have the platform tip.

But as the video goes on, eventually, they start fighting about it. And they literally push each other off the platform. And the last scene that you see looks like that. So at some point-- makes you take a deep breath and makes you should think about our collective on this planet.

But I ask students to consider it analogically in relation to climate, the fate of Earth's peoples and other organisms, and just the interactions in terms of the dynamics related to climate change.

And kids at different levels, from probably middle school up, are able to think about cooperation, competition, the common good. They also think a lot about power and who has it as they get older.

And so we ask kids to process the parallels in the film and really think about the tensions or forces in play. And this is a way that the arts can invite conversations that you probably aren't going to have in the science classroom.

And it really gets kids actively processing it and arguing about it. And then, of course, looking for other video and films that have similar kinds of messages because that's when you get good transfer, when they start to extract those deep tensions, and principles, and look forward.

So the other game-- that's not a game. I shouldn't call it a game. The other activity that we engage kids in is something called moral musical chairs. And this goes back to my earliest days at Harvard, when I worked with Professor Lawrence Kohlberg, who used this to-- he would offer moral dilemmas and then see how people reasoned about it.

But we've actually modified it a little bit for climate. So this is how it works. So in moral musical chairs, learners are considering what perspectives might relate to a certain situation. We would be specifically focused on climate.

They gather information about each. And they try to be mindful of their own perspectives and lenses, which can be hard to set aside. And then they play moral musical chairs. It's different than musical chairs in that you don't take a chair away. Everybody has a chair. They just don't know which chair they're going to inhabit. And that's important. It's called the veil of ignorance. And it basically says, you could be anybody in this situation. So how are you going to reason? How are you going to think about the situation?

And what typically happens is that you have to reason in favor of the least empowered voices in the conversation because the idea is you could be them.

Now, that's taking empathy and turning it on its head because you have to imagine that you could be that person. It's creating empathy, but it's also saying, through our own selfishness, we develop empathy. Maybe that's true.

But it does give them a chance to really embody and become part of and explore different perspectives. And often, they find they need more information. And as part of it, they go back and they do more research.

So they might be asking questions like, what is my lens in contrast to others? What are some dominant and silenced voices? What other perspectives should we be bringing? Can we adopt other lenses to view particular situations?

And what if I step out of my own stance? What might I do if I didn't know which role in the complex situation I would inhabit? So the picture-- there is a picture from COP 2018. And that's the government of Maldives basically saying, get on it, guys. We're going to be underwater. One could see doing a moral musical chairs activity around this.

And we have done this around all different kinds of issues connected to climate. And often what I do is I actually engage the kids in planning the conversation. Sometimes teachers want to plan the conversation with them, but I think there's a value to having them think about whose voices are not at the table.

So the ninth big idea here is embracing multiple ways of knowing and learning with humility from cultures that embody sustainable ways of living in relation to Earth. And there are cultures that do much more of that than others.

And so bringing these forms of wisdom to bear can be a really important way to both understand other cultures but also learn from them with humility. There are nice resources out there, so there's a nice set of resources from the North Dakota Native American Essential Understandings program, the teachings of our elders. And they talk about the sacred relationships related to Earth.

There's also a really nice body of research around-- work around Two-Eyed seeing from the Mi'kmaq people. And their Elder Albert Marshall talks about looking through the eyes of science and looking through the eyes that they bring in their Indigenous perspectives.

So the last big idea that I want to share-- and I'm actually going to cut this one a little short only because I want to be able to share the big ideas with you and then have time for questions.

But we are working right now on something called EarthXDesign. And the reason we're doing this is because when people usually think about design thinking, they think about these things. And they think about human centered design and putting humans in the middle.

And good things have come out of this work, really good things. We have things that are better designed for people. We have things that-- people who are differently abled or have physical impairments have been able to live better in the world because of the wonderful work coming out of IDEO and the Stanford Design School.

However, in an age of climate change, we really need EarthXDesign. We need to remember that we are here on the planet and that everything we do hinges upon the health of the planet.

So if we start with Earth-centric approaches to design, we will have-- humans will be addressed. Their needs will be addressed. Because if we don't address the needs of the planet, humans are on it. I mean, you can't forget about the fact that we're on it.

And we really do need-- we need innovation. We need new ways of thinking about innovation and design. What we don't need-- maybe I won't mention television shows that focus on designs and inventions.

But sometimes those shows promote a consumer approach. It's like, we need more stuff. We need stuff for our stuff. We need stuff to make every minor thing in life easier. In the meanwhile, we're burying ourselves. Anyway.

So we're developing a set of instructional moves and materials to support these EarthXDesign moves. This is an explanation of it that's on our website. We have various ways of what is it, what would it look like, what would you do. We are working, actually, on a book for teachers about EarthXDesign moves. So there's 10 of them.

Very briefly, some of the things in the EarthXDesign work are not brand new. People have mimicked nature and engaged in biomimicry for a long time. We see it in some building design, learning from the termites. We see it in solar cells inspired by leaf design. We see it even in the wings of airplanes, things like that.

Another big idea-- I'm just sharing a couple of examples with you here, is empathizing with the voiceless and the invisible and really getting people to think about who's not represented at the design table. This fits with moral musical chairs.

So you see people starting to think about creating wildlife bridges over highways. You see bee friendly urban landscaping. I was bringing in-- we had tadpoles in the kindergarten that were-- they turned out to be bullfrog tadpoles. They take a very long time to turn into frogs.

And so they went to the first grade with the kids. And at some point, the kids wanted to know, how come they don't have to eat? And I realized that they didn't know why I was bringing all this water into the classroom from the pond once or twice a week.

We were feeding them. So we showed them with the microscope. And they suddenly realized that there was a whole microscopic world that they were not aware of. And then the kids started talking about Horton Hears a Who because they know that there was a whole world on a flower. But that's about what's not necessarily visible to them.

So we ask kids to think and teachers to ask a set of questions about how Earth resonant the features of designs are. Do they really have consideration for the planet? Can they be sustained over time? Are we turning some of our assumptions inside out? And I'm seeing the comment here about ancient inhabitants, really thinking differently about the Earth and working with the Earth and in relation to the Earth.

One of the examples that I sometimes share related to Earth resonant moves is an example that came from a bunch of college kids who designed what they called a resurfacing oceanic locator.

And basically, it's a way to locate your lobster trap without having the entanglement risk with ropes to protect the right whale. But they went and took into account local

knowledge. They talked to people in the lobstering industry before they designed it. They really thought about the long term. Whales are really important in sequestering carbon.

And they also thought about-- they could have made it cheaper, but they realized that if they made it so you couldn't reliably always find the trap and lobsters died in the trap, that lobsters would come to-- because they are scavengers, they'll come to where the dead lobsters are.

And you have a repeating cycle that would very quickly devastate the lobster population because they would get stuck and you wouldn't be able to take them out.

So as we think about the 10 points-- those are my 10 points. And I'm seeing your note, Patty, about the whale on the Coast of Cape Cod. Very sad, that kind of entanglement. There's laws about it now.

I'll also tell you that Woods Hole had a device. It was much more expensive. The kids actually came up with something for $200 a device. And Woods Hole was well over 1,000. So they were pretty excited about it. And they actually had a patent for it now supported by their university.

So 10 points for teaching. Those are my 10 points again. I'm going to stop because I want to leave the last five minutes for conversation. That's our website. I'm sure that you guys are putting that up. And there's also a part there on sustainability and green jobs. But anyway, I'm going to come back to that slide. All right.

NORMA HOLLEBEKE: Thank you so much, Tina. We do have a few questions from our audience. And I'm going to try to pull a couple of them together. They have a common theme here.

You, and Patty, and I were talking before the session started about how UC San Diego looks like they're going to start requiring climate change for a graduation requirement. And there's been questions in the Q&A about, how can we keep that momentum going from the K-12 world? We can really get to those kids when they're in pre-K, and kindergarten, and fourth grade, and 10th or 11th grade.

But how do we keep that going into the college realm and really help to educate our citizens as they're getting ready to go out and start voting and understanding how it's going to impact their neighborhoods and stuff?

So what would you suggest-- I know that's a really complicated question, but what would you suggest on how we keep it going through, not just K through 12 but into higher ed?

TINA GROTZER: Well, you see in K through 12, some of the focus on making curriculum available to teachers, making it available across the curriculum.

We see what New Jersey did with-- across the curriculum, there's a group called Subject to Climate at Harvard. And I'm part of their advisory board. And they make curriculum available for teachers. That's great. And that's really important. But I think as you get into college, you're honing your skills for certain kinds of jobs.

So one of the reasons I really like this example from the WPI senior project is that these kids are going off to be innovators and inventors. So EarthXDesign is a really good fit for them.

If I were working with students who were going off to work in the justice department, for example, issues of truth, issues of evidence, issues of how you bring information to bear.

There was a professor working at the law school, who was doing work with her students on, how do you navigate the changing landscape of laws around climate? What do you protect through incentive? What do you protect through legal means?

So I think that, as you get into the college level, there's the specific focus if it's a professional school or it's a school with a certain focus.

For the other schools across the liberal arts, I think helping them to be aware that they can make a difference. And the very kinds of things I shared that are interdisciplinary, I think, can be helpful to them.

But I appreciate the push towards making sure that they continue to care. And letting them know how much they own-- the future is theirs. It's theirs. It's not ours. It's theirs. And they can shape it. And there are really great solutions out there.

If I can put a plug in for a film, there's a film called 2040. And it takes all different inventions and innovation that is already in existence and looks at what would happen if we used it. So there's great reasons for hope. And I think if we mix that hope with specific possibilities-- yeah. Well, I don't know.

NORMA HOLLEBEKE: Wonderful. So we are running out of time. So I'd really like to thank Dr. Grotzer for such a wonderful and insightful presentation, especially to me as a biologist, I really got a lot into that.

For our audience, we ask that you take just a few minutes out to complete our survey for today's presentation using the link that we're putting into the chat for you.

And if you've got something else going on immediately after, don't worry, we will send you the link to the survey in the follow up email that you'll receive tomorrow.

We would also like you to take a quick look at our strategies for success schedule for the rest of this and encourage you to register for the remaining three sessions if you have not already done so.

And we would also encourage you to submit a proposal for our upcoming project-- The Impact of Digital Learning on Minoritized Students. That information is also going to be posted in the chat for you to ponder and consider that effort that we're doing.

Lastly, besides thanking Dr. Grotzer and thanking our audience, we welcome anybody from this event to reach out to your colleagues as well and encourage people to visit the Every Learner Everywhere website and our resources page. All of our resources are free to read online or to download.

So I would like to thank our guest speaker, Dr. Grotzer. I would like to thank our audience for taking time out to join us for today's webinar.

We look forward to seeing you next week for our third webinar in the series, in which Dr. Carrie Diaz Eaton will discuss her research on what students might need the most out of their math and science education. Have a wonderful day. And thank you very much.

TINA GROTZER: Thank you.