

Rethinking How Kids Learn Science

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How important are museums, TV shows and after school clubs to teaching kids science? Ira Flatow and guests look at "informal science education" and what researchers are learning about learning science. Plus, what's the best way to keep undergraduate science majors in science?

Linda Kekelis, executive

director, Techbridge, Oakland, Calif.

Susan Singer, Laurence

McKinley Gould professor of the natural sciences, department of biology, Carleton College, Northfield, Minn.

Transcript

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IRA FLATOW, host: This is SCIENCE FRIDAY. I'm Ira Flatow. We're going to be hearing President Obama talking about the need to help kids learn science in places other than the classroom.

PRESIDENT BARACK OBAMA: I want us all to think about new and creative ways to engage young people in science and engineering, whether it's science festivals, robotic competitions, fairs that encourage young people to create and build and invent, to be makers of things, not just consumers of things.

FLATOW: And we keep hearing about how American students are falling behind the rest of the world when it comes to math and science, but new studies are showing that the places to teach science, places where kids will soak up science, are not in the classrooms, but museum trips, TV shows, afterschool clubs, even radio shows about science. Has that been your experience, too? What do you think? How much of what you know about science comes from your experience outside of a classroom?

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me introduce my guests. Lynn Dierking is the Sea Grant professor in free-choice learning in the College of Science at Oregon State University in Corvallis, Oregon. She's also the interim associate dean for research at the College of Education at Oregon State University and she's also an advisor to SCIENCE FRIDAY.

And I want to thank her for being with us here today. Hi, Lynn.

LYNN DIERKING: Hi there, Ira. Great to be here.

FLATOW: Nice to have you. Susan Singer is a professor of natural sciences at Carleton College in Northfield, Minnesota. She joins us from Minnesota Public Radio in St. Paul. Thanks for being with us today.

SUSAN SINGER: Thanks, Ira.

FLATOW: And Linda Kekelis is executive director of Techbridge. That's in Oakland, California. Thank you, Linda, for being with us today.

LINDA KEKELIS: Hi, Ira. I'm looking forward to our discussion today.

FLATOW: Me, too. And let me kick it off - well, let me ask Lynn Dierking. You study informal science education. Tell us what that informal part means.

DIERKING: Well, it's about all the kinds of ways that we learn. And I would say, we've been talking - I know in the information you've provided, talked a lot about children. But it's the way that our society supports people of all ages and walks of life in exploring and learning about science and technology and engineering and mathematics. So you mentioned many of the places, museums, science centers, you know, radio programs, television.

I was fascinated, I - Flora's piece is one of my favorite SCIENCE FRIDAY pieces and I was fascinated to hear about the search for the imperial woodpecker. We've got a couple of free-choice science learners on our hands who are able to pursue their interests and hobbies around STEM.

FLATOW: Are you learning? Do your studies show that more people are learning science outside of the classroom in these informal places?

DIERKING: I wouldn't say more people, but I do think - and I wouldn't necessarily say that these are better places. But I think that what these opportunities do for children and adults is they help them understand at a deeper level some of the things that they have learned in school or they may get them excited about something that then they want to pursue in more depth in school. But there's definitely evidence in my work and the work of other people doing research on this area that these experiences can be exceedingly powerful.

They're very memorable, and actually they connect often to other experiences that children and adults have in their lives, both in school and out of school.

FLATOW: Linda Kekelis, you are director of a program called Techbridge. Tell us about that, please.

KEKELIS: Techbridge is a nonprofit that's based here in Oakland, California, and we turn girls on to science and engineering through enrichment programs outside of schools. The heart of Techbridge are our afterschool and summer programs where we have a chance to give girls time to tinker and build things and take things apart and discover their inner engineer or computer programmer.

FLATOW: We don't always think of girls as doing that.

KEKELIS: That's right. And the girls don't either until they have a chance to be in Techbridge and by being in the company of girls, they discover that they really do love science and technology when they get to work on projects that appeal to their interests.

FLATOW: And we actually have one of the students online. Norea Dubond(ph) is a 10th grader in Oakland Unity High School. And she's with us. Hi, there. Welcome to SCIENCE FRIDAY.

NOREA DUBOND: Hi.

FLATOW: Hi. Are you eager to go to these afterschool projects?

DUBOND: Huh? I'm sorry. Can you repeat that?

FLATOW: Do you like the - do you like working on these projects, taking things apart and learning how they work?

DUBOND: Yes. I love it. I love getting my hands, like, in there and just, like, doing something from scratch. And if I mess up, like, trying to figure out what I did wrong and just - I love Techbridge.

FLATOW: Yeah, and what got you interested in it? Did you always have that interest or did it have to bring someone like your teacher, like Linda, have to bring it out of you?

DUBOND: Well, I have always been interested in science and, like, learning about how stuff works and why it works like that and just a theory. But I - my teacher actually came and talked because I didn't know what Techbridge was really about until my biology teacher came and talked to us. And he was talking about this program that was really a hands-on program where girls got to build stuff and just get out there into the world of engineering and just, like, do what they have to do and learn about science, which you don't get to see a lot of girls engineering.

FLATOW: No, you don't. Do you find that Techbridge helps you in your schoolwork at all?

DUBOND: Yes. I can really relate to what I'm learning in Techbridge to other stuff that I'm learning in my school. Like, last year, I used to be in Biology class and I remember that a biology major came in and she was talking to us about science, biology and microscopes. And I could follow along with her because I was just learning about that in my biology class. And then, she taught us how to do a microscope out of, like, materials that were very tiny and then so that was really cool.

I was really excited to learn how to do something that was also related to my schoolwork.

FLATOW: And are you going to follow up and major in science in college, you think?

DUBOND: I am definitely going to major in science once I go to college. I love science. I think it's a great - it's just a concept where you can learn how to do something yourself and get to answer questions that you have and get to know why that happened. And I just love science.

FLATOW: Well, good luck to you, Norea, and thank you for taking time to be with us on the show.

DUBOND: Thank you so much.

FLATOW: You're welcome. Norea Dubond is a 10th grader at the Oakland Unity High School in California. Our number, 1-800-989-8255. We're talking about informal science education and how to get it and where it's happening.

Let me ask Susan Singer. Tell us what's happening once kids get to college. Now, she's going to start out, Norea, as a science major. What's going to happen to her? Is she going to drop out if she's like everybody else?

SINGER: Oh, I hope not, but I don't have all cheery news today, Ira. Actually, I coach a science Olympiad High School in Minnesota and I want all of my students, just like Norea, that are excited about science to go on and have a terrific experience. It turns out that nationally, the United States actually ranks 27th in the world in terms of the proportion of our college students that graduate with degrees in science and engineering and math. And it's not just because we don't have enough students coming to college excited about science.

We're losing - in fact, nationally about 40 percent of all students who come excited and say they're going to be science or engineering or math majors graduate within five years. The rest don't. And if we break it down demographically, it's a little more discouraging. Students from underrepresented groups graduate with one of those degrees in five years at a rate of about 20 percent, so we're losing folks. And we don't want anyone to have a bad experience, and beyond that I think we really have to think about what the national implications are. Right now, in terms of the U.S. population, about 28 percent of the U.S. population are members of underrepresented groups.

Yet in the workforce, only about nine percent of the science and engineering workforce are members of underrepresented groups.

FLATOW: What is an underrepresented group?

SINGER: In the statistics I've been giving you, they've been broken down in terms of blacks, Hispanics, Native Americans and also Asians, although Asian students tend to do better than white students overall in terms of retention.

FLATOW: Is there some way how we teach engineering and other topics? I remember when I was in engineering school, it was almost like they were trying to weed us out, you know?

SINGER: Yes.

FLATOW: Instead of encouraging us to become engineers. Like, okay, we're going to get the people who don't belong here out of here.

SINGER: Whether that's the intent or not, that seems to be what's happening. And Ira, I would confess to being one of those engineering dropouts. I got hooked on genetics. I'm a biologist, but perhaps my experience wasn't unlike what you saw. We know so much about how to teach effectively and engage students. But for a whole plethora of reasons, that seems to not be happening right now in undergraduate education. And one of the most common reasons students report leaving science as a major is the type of teaching they experienced.

FLATOW: Mm-hmm. 1-800-989-8255 is our number. We're talking with Lynn Dierking. She's Sea Grant professor in free-choice learning at the College of Science at Oregon State University in Corvallis. Susan Singer is professor of natural sciences at Carleton College in Northfield, Minnesota. And Linda Kekelis is the executive director of Techbridge in Oakland, California. Before we go to the break, Linda, Lynn, have you heard anything here that you can respond to, give us any ideas of how to teach these kids better?

DIERKING: Yeah, I think something that is really interesting in what Sarah was sharing is that some of the work that I'm doing - in fact, I know Linda because we've been tracking some of the young women who participated in Techbridge, you know, as many years ago as 10, 15 years. One of the things we're finding out is that the experiences that are provided in out-of-school settings can be extremely powerful and impactful for children and youth who are from underrepresented groups.

And it's not clear exactly why that might be the case. Clearly, part of it is an opportunity to become very engaged and have the hands-on experience. I think Norea spoke to that very, very well. But there's also this sense of other people like me who are interested and in the case of women specifically...

FLATOW: Okay, Lynn, hang on. We'll get to that point after the break so - I don't want to cut you off. We'll give you a full chance to answer that. Stay with us, we'll be right back after this break. I'm Ira Flatow. This is SCIENCE FRIDAY from NPR.

(SOUNDBITE OF MUSIC)

FLATOW: You're listening to SCIENCE FRIDAY. I'm Ira Flatow. We're talking about informal science education and its relationship to formal classroom learning with my guests Lynn Dierking. She's at Oregon State University. Susan Singer at Carleton College in Northfield, Minnesota, and Linda Kekelis, she's at Techbridge in Oakland, California. Our number, 1-800-989-8255. And when I rudely interrupted Lynn Dierking, she was telling us about her own experience.

DIERKING: Yeah, actually, I apologize. Actually, I realize I called Susan Sarah. I'm sorry, Susan.

SINGER: No worries.

DIERKING: I just wanted...

FLATOW: You're just like me. Just joining the spirit of me getting names wrong so you fit right in.

DIERKING: Yeah, I just wanted to add that this community piece seems to be really important among young women, a place where they feel safe being smart and being able to do things that are not maybe typically the things that girls, particularly in their community, might engage in. And I think

that that's a really important piece of this and the research supports that that seems to emerge. Also, knowing a scientist and knowing people that can give you advice, many of the young women in the study that I've been involved in with my colleague Dale Macready(ph) at the Franklin Institute, those young women are the first people in their families to go to college.

And so they don't have the background and history of knowing, you know, how do you apply for college and what's important? How do you visit a college and make a decision? So it really supports what Susan was saying about the importance of getting children and youth into college and then helping to support them while they're in college.

FLATOW: Linda Kekelis, we keep hearing from experts like those on this panel today that it's important to have a mentor for kids. Is that what Techbridge does, gives you, as Lynn Dierking was saying, a role model - and as Susan has been saying, a role model and a bridge to get you interested in college and to stay in college?

KEKELIS: We find role models are really important. We do lots of fun hands-on activities and the girls tell us that, you know, they really enjoy the experience. It's very different from the school day, but they see those sorts of projects as hobbies, but not as career interests, so it really takes a role model who can help dispel the stereotypes that kids might have about who does science or engineering and also help share their passion for what they do and show girls that science and engineering can help make the world a better place, which is a very great interest to the girls that we work with.

And what we've also discovered is that a lot of people want to support kids and be role models, but may not have the experience or the know-how for how to relate to kids or how to share their career, so it's really important that role models get support and training in advance. You know, we help them prepare for any classroom visit or field trip that they do with our girls and come up and share a personal story and help the girls relate to them, show that, you know, life is not all work, but they also have got, you know, hobbies and interests outside of work and family life that's important for kids to hear about.

And I think especially for the girls that we work with who are from under-resourced communities, you know, being able to see the wide range of careers that are available in science and engineering are so important for helping the girls to see new possibilities and what they can do.

FLATOW: Susan Singer, if you had to put your finger on one of the main reasons that college kids drop out of science and engineering majors, as majors, what would you say?

SINGER: Well, I think what happens is they're not feeling successful and they feel like they're working very, very hard and beating their heads against a wall and not making progress. And I think what we can collectively do in a way is like the mentoring piece, if we have better professional development for the people that are teaching them, to help structure their learning in a way that they make progress and feel good about what they're learning.

FLATOW: So we need to teach teachers to be better teachers is what you're saying.

SINGER: Absolutely. Right. We've learned that in K-12 and we're really starting to understand that in higher ed, where typically someone gets a PhD and knows a lot about the research field, but they

don't know about how people learn or what kind of instructional strategies are successful. And as a new faculty member, you're just tossed out there and people want to do their best and they're trying very hard, but they don't necessarily have the resources. And there are a lot of programs that are starting to emerge, both during the graduate school experience and after that that are helping.

FLATOW: And of course you may not see yourself as a teacher once you get in there. You're a scientist and a PhD.

SINGER: That's traditionally how we've prepared people. Exactly.

FLATOW: Yeah. And you don't have the training to do that. So that's like your secondary job, you view yourself as, not as your primary job of what you need to do is to teach these students.

SINGER: Right. And most young faculty would like to keep their jobs and obtain tenure. And in many, many institutions, research productivity's the currency of the realm.

FLATOW: Let's go to Laura in Fayetteville, Arkansas. Hi, Laura. Welcome to Science Friday.

LAURA: Hi.

FLATOW: Hi there.

LAURA: Hey. Well, I just wanted to say that I really think you have to have both programs going on. In my experience as a student, I liked science. I had good science teachers, but I also had the opportunity for a lot of experiences in museum programs and science camps and you would just going into museums that are some of the things that really stick with me. And I've also worked in both environmental education and then I taught high school for seven years.

And it's a lot harder in the classroom environment to make it interesting and exciting, especially with situations like, you know, crowded classrooms, lack of supplies. And I think a lot of kids just never find out the interesting things about science if they don't get a chance for those hands-on programs and, like, experiences that really engage them personally and make them feel like they're discovering something. So I think you're definitely on the right track with this.

The kids have got to have the opportunity for both. And I'm just starting a biology PhD program, but one of my long term goals is to really help support those programs that get kids involved in the interesting, like the exciting parts of science so they see what's going on with it.

FLATOW: Lynn Dierking, any reaction?

DIERKING: Yeah. I would absolutely say that I think something that we're beginning to understand and is starting to be a part of the conversation is how do we build bridges between what kids are doing in school with their out-of-school experiences and then how do we build bridges within the educational system. Building on what Susan said a few minutes ago, I was just at a meeting in D.C., actually yesterday and the day before, talking about how we need to better understand how children and youth move through both their in-school time and their out-of-school time and how they connect that to further education, further hobbies and pursuits.

And so this is a conversation that's happening at the national level, talking about the fact that we can't just focus in on improving classroom teachers' abilities. We need to think about the whole ecosystem of education and really support undergraduate, graduate education, technical education. Something that came up at this meeting were the number of youths that are dropping out, and to the point where in some communities that are not even talking about K12 anymore, they're talking about K-8.

Well, how do we reach children and youth who are disengaged and not even in the school system? So I think these notions of how we can connect and talk to one another in these different educational settings is really important.

FLATOW: All right. That's depressing to hear, K-8 versus K-12.

DIERKING: Indeed it is.

FLATOW: Wow. So people aren't even getting a high school education - many more people are not getting a high school education. They're trying to reach them before they get to the 8th grade.

DIERKING: Yup, yup. And once again, that relates to these statistics that Susan was sharing. I mean, 50 percent of the children in school don't move on. They may get a high school diploma, but they don't move on into the system. And then, of course, the ones that do get there, the sobering statistic Susan was sharing about how many of them don't complete their degrees, is very, you know, very sobering.

FLATOW: So Susan, last comment. It doesn't sound - it sounds like things are getting worse instead of getting better.

SINGER: Well, I think the situation is serious, but I tend to be more optimistic than that. I think there is a growing awareness of this and I think there's a collective will at all levels of education and an evidence base that's out there about what we can do. And I think we're collectively going to find a way to do this.

FLATOW: Mm-hmm. With the resources we have?

SINGER: Well, that's the sticking point, Ira.

FLATOW: Ah, the details, details.

SINGER: We certainly have to rethink some things.

FLATOW: All right. Well, we'll save that for another time because that's a whole 'nother discussion. Thank you for being with us today. Susan Singer, professor of natural sciences at Carleton College in Northfield, Minnesota. Lynn Dierking, she's a Sea Grant professor in free-choice learning in the College of Science at Oregon State University in Corvallis. And Linda Kekelis is executive director of Techbridge in Oakland, Calif. Thank you for being with us today.

SINGER: Thank you.

DIERKING: Thanks so much.

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