

Room 215 Session I

Facilitator: Lynn Farrin

Convener: Emily Higgins Boothbay Region High School

Topic of Presentation: How do we encourage students to continue on with computer science?

My name is X I teach at Boothbay Region HS. I was hired for this past fall and I teach mostly STEM classes. I teach chemistry, graphic computer programming, robotics, intro to engineering and it looks like next year we'll have [**] computer science and that's what made me...

Hi, my name is X and I also teach at Boothbay Region High School. I teach general bio, general chem., oceanography, ecology and freshmen science.

Oh, many hats! I'm X. I teach at Southern Maine Community College. Right at the moment, I'm in computer technology, but the best kept in the state of Maine is that we're starting a computer science program in the fall. One of the things I'm looking at is promoting that pipeline—ways to get kids into the program.

I'm X Andrea Maker and I'm the program/project manager of the computer science initiative that X spoke of this morning.

Yeah, nice to have you here! There was something I wanted to ask you guys about, but I can't remember what it was.

So, we are interested in building a pipeline and helping support students through community college, private college, university coursework to come through and be good quality employees. Billboard [**].

If I do say so myself, we're putting together a fine program at Southern Maine CC.

Well, I was just talking to a Mr. X? X is the right last name. He said he does the architectural pre-engineering up at that end of the place. But looking at it from the other end of the place, I've just started teaching graphic computer programming and with the help of some more knowledgeable friends I chose Alice 2.2 because of its success at getting kids to continue on. And it's worked incredibly well. I have a class of 22 kids that signed up for the fall. You probably know better why they signed up.

They are just excited to have something different.

Boothbay's a very small high school, 225 kids.

Alice is great.

They love it. And I did survey of what we wanted to do next. Because we were sort of working our way through different things and eighty percent of them said they wanted to learn a more difficult computer language. So, we're starting Java.

Alice 3 puts you right into Java.

I think I might try Alice 3 next year. However what I see with my robotics, and engineering and Alice, the kids love it. But the next step of getting them to go to college and say "I want to do computer science or information technology." They're afraid of that. I think you can say in general that it's a very rural population. A lot of these kids that we're seeing in these classes might be first generation college students. It's scary step and that why I was talking to people from SMCC earlier. I taught for ten years in Poland, Maine, and I saw that the step from high school to community college is really *doable* for kids. They can do that and they can transfer the credits if they want to keep going.

But a two-year degree, the two-year that we've put together is really a pretty nice stepping stone into the industry if they don't feel like into a Bachelor's.

Yes it is. I've been surfing your website. But that's the thing. I have these kids and they love these classes. They come in and I don't have to do much but get them started; they love it. But then how do I get them to go to the next step.

So what do you think would help them overcome that fear?

One thing is to go visit SMCC. But also, they've never met anyone that's done it. They don't know anybody who does this. In programming classes, the students ask, "Can we go on a field trip and see someone actually do this?" But I don't know where to go to take them.

Yeah, there are parts of the country where the population that's involved is very dense and it would be very easy, but I can see how that would be difficult to work.

Especially if you're in a place where you're just starting a [computer science] program. I can't show you someone who has gone through the program, because they don't exist yet. But part of the beauty of being one of the first ones through the program is that we'll do just anything to get them through! Which doesn't mean we will pass people who shouldn't be passed, but it does mean ... we have no tutors. Oh, yes we do: change hats. So that means for the first year at least, we're going to have to be our own tutors, which is going to put a lot of hours in the day. Because there is no way to run a tutoring session for the kids that run an hour. You've got to run them long enough for them to get out of class.

They like podcasts!

I can do that.

We've both worked both worked on flipping our classrooms and sending our instruction home with the kids, then they work on it in class. That's been very successful.

I just saw a talk on flipping your class, at a conference, not two weeks ago. Very interesting.

OK, just imagine that you became aware or your students became aware through a Facebook page, that they can friend, that gets marketed to them, that they can go to and you can go to, a web hub that will give information about computer camps, which colleges have computer science or IT classes. You can click onto little 30-second clips of 20-something year-olds that are doing a computer science job and they tell you how cool the job is. So they get to see it. And you can click on field trip opportunities or what employers around the state are receiving field trips, or what day the folks at UNUM are having an open house to meet the tech folks. Or they might have the engineering folks down at...or I should say IT. We want to build this template. There is a hub for engineering, and another hub for another discipline. And when you are ready to go to college, it also links to sites for internships and scholarships to help get you through college. And then the college-readiness piece and the tutor piece; there's a connection there...it's unfortunate that you have to do so much tutoring. So what do we need to do to help high schools so the kids come in and not need the tutor?

I don't know that they're going to need the tutor because what I'm going to do this time is totally different that what I've done in CS I before. I'm going to use something that's been used at Georgia Tech recently. It's something called "Media "Computation," using video, audio and still images to teach programming. They're using Pipeline. So I'm adopting that.

Before you go on, let me close the thought on this. What I want to hear is: what does that sound like to you?

I really like that, because one of the things I can do with that is link it to a webpage, for example. Right now for example, here's an example of a problem. They need the computer lab for testing, for 5 of my next 9 classes, which is a problem, because that's where I teach. I don't like to generate ridiculous projects, but I could send them to that site and have them report out: what are they finding, where could they go. And that would be great. Because otherwise it's this course; it's over here, but how can they put that into the rest of the world? Because you open up a lot of university computer science, computer engineering sites and there's this list of classes that they don't what that means. So I think that would be a really nice entry point for kids to be able to see their options, the support, the other things that are out there. And they'd like that, they'd love it. They love exploring web pages.

I think another disconnect with kids is that they don't know how to match their skills with jobs. They know what they like to do, but they don't know what to call it. They don't know there's a job in "computer whatever."

And their parents may not know about it, because their parents are in those fields or never knew what name to call it. I know, I have two kids in high school and I can see where they might have interest, but the jobs out there that they haven't thought about or what they could do with their skills—they don't know what to call it or what to look for.

When I was young, looking at colleges in the early 90s, no one *ever* suggested engineering. And when I went to college, I majored in Biology. The people majoring in computer science were working so hard, and it was so scary. I took programming in high school; my father made me learn BASIC when I was little, but I said, "There is no way I'm going to take a class here. No way." And I didn't.

One of kids has gone through what they call "Career Prep." They're actually making it a new course next year. I don't know who will do that piece, but my student kind of had an idea of I can see myself doing six or seven different things.

Or the classic thing is, I want to make/write video games. Well, what do you need to be able to do that? Well, you need to learn to program, and enroll in one of these programs to do that.

So the critical piece will be connecting, marketing, getting the information out.

That's where Engineering is doing a pretty good job right now.

How are they doing that?

There are tons on things: The Windblade challenge; my class just did a Sea Perch challenge. BIW sends an engineer to my classroom, paid-time, to help us with the project. And they said, we'll send more. Orono pays for the field trip, feeds us and says, bring back 20 girls to the engineering program, because we need girls. It's tangible, the kids can see it; they can see the money. Whether or not they go into engineering, that one field trip, kids are like "Hmm, I can go to school for free, get a good education, make money and it's right there and I went there and I saw what they do." And that's what got my husband to go to Orono for engineering. He went to summer camp for engineers in the late 90s, went to Orono for mechanical engineering on a Maine scholars scholarship, went for free and his two best friends went for free on Pulp and Paper. I don't think it would have done it otherwise.

One of the things that Barb Ericson, at Georgia Tech, does on her site (coweb.gatech.edu) is outreach to high school students. That is all she does. They run summer camps. They send out letters to kids who get good PSATs scores, suggesting that they might look at computer science. And if your high school doesn't have an AP computer science, you should ask for one. The college itself sends out those letters to all of the area high school students and what the high school teachers have seen is a growth of from 4 or 5 or 6 students in those classes to 25 or 30 students, who are wanting to get into their AP classes. SO that's significant and it's just the price to post it.

Yeah, I think a marketing idea would be spectacular. Seeing girls with this **HOWs** (?) program that we worked on, and they have this guy named Don Slater. I can send in questions about the programming that I can't figure out; I can send in an email with the question, and you get an email back. Teachers from all over the world send him emails with different ideas and suggestions. I know that I can get stuck in a corner with something, but it's easy for me to get some help. They're through Carnegie-Mellon. If you type in Alice 2.2, their website pops right up....It's a big problem, you know where we are the kids have jobs in the summer. And the kids in Boothbay can make a ton of money in the summer. There needs to be paid internships, because they kids are saying they're not going to computer camp because they lose out on all their money and they use that money to do some pretty cool things.

They can't lose a week going to a computer camp?

Not unless they're paid. They make a ton of money. Our school, this tiny school, has three international trips in the next month. The kids save up their summer money and then go. So, it's one of those things that it's harder in Boothbay to get kids to do things in the summer than other places, because they have an income. Some of the things that I have seen, both where I taught before and here, is the Keller Bloom program for 5 days at the end of May that's great for kids. The kids sign up for it because they get to miss a couple of days of school. They get the experience and they're not missing their income. And for a lot of kids income is just for fun, but for a lot of kids is helping to support their families save up for college.

Keller Bloom was developed by Bigelow Labs, right in Boothbay. And it's a four-day experience where the students live at the lab and study ocean science. They take one student from each county. It's incredible.

It's different from when I was a kid, kids like to buy things; they're consumers and like to buy things and have stuff.

My only question to you is: what can we do to make the job easier? What can we do to make it easier to pull more students into computer science? What can we do to pull more *women* into computer science?

Well, honestly, my biggest challenge right now, is that I did not go to school for computer science and I would hazard a guess that the majority of high school teachers did not go to school for computer science.

See, you would like some training yourself.

I need some help. I don't need help with curriculum, but with learning all these different languages. I learned robotics, then Alice, now I'm trying to learn Java. I looked online for an online Java class, but I don't have Internet at home. It's a classic problem, that common to a lot of teachers. I need help with the programming language. I'm picking it up by myself, basically

because that is my life experience. But to get more teachers to do computer science, you need to get more teachers that either know how to program or are willing to take the risk to learn. And understand that when you teach it to kids, they're going to pick up parts of it fast. The kids are better at Alice than I am, hands down. And that's OK with me. I have to muscle on. I think I can generalize and say that the best part of being a teacher is to learn a whole new thing while teaching. So that's something I've never seen, come across my email or mail box: something to help teachers learn how to computer program.

[New participant joins]

I happen to have a computer science degree, but my exposure to some of those languages you just mentioned is limited, while I would think that you would get some internships for computer science students to go and do units while pairing off with industry where they want to encourage interest in a field and that's basically how they would get that collaboration started. A man or woman visits, especially if you want to interest more women in the field to find some IT folks that are looking for service learning.

But where do you find these people. It's sounds stupid, but I looked online and looked up computer programming companies in Lincoln county and I don't even know where these people are.

Actually one of the things that I was thinking when I heard the conversation was that every school district has a technology director, has technology people and they're on listservs with other technology and education people. Many of them have those skills and interests. So, that would be a very close link to create and then putting the word out there in the professional field that we're looking for those bridges between education and computer technology, information technology.

Also, especially in a community where we are, I want to say: hey all you retired software engineers, do you want to come help?

I would be happy to help you with Java. I teach Java.

So what is this program that you are going to use next year?

Python.

Is that Java?

It's a different language. It's an imperative language, we used to call them. Although I think you can do objects in Python. The nice thing about its syntax is that it doesn't have those pesky little semi-colons or periods or any of that stuff. It's all apparently done with indentation. So can indicate what's inside of a loop by indenting a few spaces and then coming back out. And those are the kind of things I try to get kids to do even when we're using Java: indentation is

meaningful! So this way, if this is their first language before college-level, they're probably going to do that with all of their languages all the way through!

And which Alice does in its own funky little way too.

[New participant]: I'm a graduate student finishing my master's degree in secondary education. And I came as a potential teacher/professional that has a background in computer science and the interest in education looking for opportunities—where is the bridge that needs to be built to get both roads to connect? I guess I would say, how do we get out the image of what is computer technology and computer science. I don't think a lot of students really know. I ran into someone from marketing, and it's really an opportunity for really developing kind of a branding message. Potentially looking at the IT culture and seeing if it's filtering only a certain of person and that's why we're having difficulty recruiting. And it's not just in Maine that I have experience. I graduated out of a program in Montreal, worked professionally in many different firms and industry and businesses. So I've got sweep of experience from programming, system administration, data project implementation. I think the HR, the recruiting, what they're looking for in IT. I'd say that attributes are competency, ability to communicate. I came out of a computer science program where we didn't have to write a single paper or present a single one of our ideas.

That's a shame.

But that was basically what the focus was. And I think right now if you look at industry, the focus, the skills and the work involved, is really imbedded in business, and finding solutions. And it's those partnerships. To me, information technology doesn't exist in itself, in a vacuum; it's really integrated. So when we're looking at STEM projects and initiatives like bio research. Well, they're gathering data. They're obviously building data structures to store that, they're building programs to analyze, trendlines. That's how you really bring it into the curriculum, which is really focused on math and science, but you bring in computer technology and programming that way.

I think one of the things that I've seen, since I started teaching is that technology teachers are being cut. And that I think has had a huge affect on kids. So, they can use a computer, but their ability to make good presentations, to do interesting things with the computer. Even things like accounting to programming, those have been very much cut. The way that I ended up with this job is, well, I'm actually a science teacher, which goes around the issue of technology certification. I think if you do go on to secondary education, one of the things you might look at is getting science certification, so you can go around the issue of technology certification.

Why do we need to go around it?

At lunch, I was sitting with three men who were trained as shop teachers and are now technology teachers, and have transformed their teaching into doing things with computers and robotics. A

lot of places look at technology as shop and it's not necessary for our work force. I think it's very incorrect, but people in trying to save money say it's less necessary than some of these other things. I have worked under three different system administrators in districts that I've worked for. One of them is a computer science person, understands how the network works. She's extremely knowledgeable, can fix anything. And the other two are people who kind of got into it in different ways and don't know how to program, and don't know really how to run a network. This also reflects the lack of people who are trained to do what needs to be done. At Boothbay, I am literally the only adult for this program, the only adult. There's one guy that plays with it a little bit; but that's it. The network administrator for this district is not up on it at all, at all.

You're working in an atmosphere with no peers.

Well, people are very supportive. The technology coordinator covered my classes so I could work on Java for a day.

You have a helpful peer group.

Yes, but I'd say that's very common. That's the norm rather than the exception. The bigger districts they have to have people that are true tech people.

Clarify: the main endorsement, there's technology endorsement and there's a computer technology endorsement, to teach. For schools to receive federal funds, they need highly qualified teachers, which means they need these certifications.

See, I'm certified for physical and life science.

But not for technology.

No, but because they've cut the technology position, if they wanted to add STEM positions they would have to hire a science teacher so they wouldn't be affecting the rift that occurs with the reduced technology. It's much easier to get the districts to hire a science teacher.

And you're not being penalized for teaching other topics...

Nope. I'm highly qualified for physical and life science and you can put robotics, engineering and chemistry under the sciences. I don't know about computers; I'd be surprised if that fit. But as long as the majority of your classes are in your endorsement, you're fine.

So you're teaching the context of those endorsements.

Yes.

Wow.

So you were saying that there are two endorsements. I should get the computer endorsement.

Yes, there are two separate endorsements. One is computer technology and one is, when you hear technology, when you hear technology people in IT associate it with what they're doing. But in fact it's occasional technology, which is much more toward...

Shop?

No, I don't think it's shop, it's physics. At the middle school my kids go to they built these rockets, hands-on, they learn about friction.

I think you're right and I would wonder which of those little compartments need to be in your background, because I don't think that's clear.

Um, it is at the state of Maine, if you go to their website and click...

Yes, that's right.

And the exam, I looked at getting that vocational technology endorsement. Well, I don't know much about electronics. I'd have to take some classes to get that one. I just came back from the robotics talk, and I robotics they do the programming. But I think someone was explaining is that it's hard to get a block of time to do the robotics because there are so many parts and components. Those of you who have taught programming, how long of a block do you have and how does that work? Do you do it in the normal day?

Where I am now, there is a 4-day rotating schedule and I have an hour each day. So every 4 days, I have 3 hours. And it does cause some problems in continuing your train of thought, but at the same time I see them almost every day. With robotics, I actually don't have a problem with that; it fits into the attention span of your average teenager. They plug away and they often get stuck right around 45 minutes, sort of puzzle, and then come back the next day with a fresh view.

I've taught CS I 3 different ways. I've taught 3 50-minute blocks with a closed 2-hour lab. I've taught it 4 50-minute blocks with little hands-on things scattered wherever. And I've taught it as a simple 3 50-minute blocks; and 4 hours is definitely better than 3. The punctuated lecture is better.

I post up assignments on GoogleDocs, they open it up. Then they follow through my example and do a parallel one and they a second project that builds on that. Then you just work through, so you can have your classes on different projects at different times.

We have three questions to answer. And the first one is: How does this conversation inform our understanding of what it looks like when we do STEM teaching at learning well?

I that bringing together the professional world and different levels of education is absolutely critical for STEM classes, so that you're connecting what you're doing now with what you're going to do in the future. To give students a vision of where they can go with it.

One of the things that I'm getting out of it is to use the technology to share information and to reduce the sense of silos. This is wonderful, but it is only a small portion of the teachers in Maine who are sitting in this conference today right?

Right. Very true.

And the second question is: What should partnerships that support students look like?

For me the partnerships are cross-functional: that we need representation from each segment of the education-career paths to understand the linkages and reinforce them and support the students along that path.

Any other ideas?

From the high school-college vantage point, the advertising and marketing part is important; if you made it small enough to make it person-to-person. It's extremely helpful.

To really market it?

And to encourage contact between individuals and companies and teachers.

When you say marketing, what do you mean?

There are two pieces to that. One is what computer science IS and how to get people interested in it. My image of a computer scientist is this geeky guy, sitting in his dorm all day trying to do some program or playing video games. The second is direct interactions between individuals.

The next is: Given our different roles, what specific steps can we take to support STEM?

One of the things that pops into my mind is something that Barb Ericson does: running several workshops for area high school teachers. That sounds to me like that's a need. Now of course we'd have to find funding for that. I've been shot down by the NSF twice on that. You spend so much time putting a proposal together and it comes back...

So I have now have 7 priority goals for this initiative of ours to draw kids in.

Engagement in computer activities—now what could I do?

I think, if I had to pick one: the marketing, to take the mystery out of what computer science is. And the technology hub, so that people around the state can link in to it. And I have two marketing proposals that came in Friday in response to our RFP. So we're hoping this grant can reach out to high school seniors and juniors.

So you have this plan developed, this tool, other than Facebook how do you make it catch on? Do you go to teachers?

Let's hire this marketing guy...

One of the firms that summated a proposal, has worked for years and years with Maine teenagers to reduce smoking. And we've gone from one of the states with the highest percentage of teen smokers to one of the lowest. So there's been lots of research on how to communicate effectively with teenagers and how to reach them. They've recently launched a Facebook page for middle-schoolers and asking them to post on why they don't smoke and within 6 weeks they had over 2500 middle-schoolers on their page as friends. They know something.

I think one of the great untapped opportunities is to bring your son or daughter to work, if you're an IT professional. I remember when my dad was a branch manager, and I didn't know what that was. So he took me to the office because those words meant nothing. I think IT apart from that geeky image of "guy" or Geek Squad is appealing; you want a geek squad or hat, don't you? Not just looking at IT in business, but IT in hospitals and manufacturing and how IT ties into process control at big paper manufacturers. I seen the crossover from process engineering to information technology is very attractive to anybody that likes mechanics, and conceptual stuff. I think engineers and technology professionals reaching out to the people closest to them and having them be able to do a presentation. You need time. You need two weeks. We need to encourage those internships that they do at the end of their high school terms. Those are opportunities. Career exploration is supposed to be embedded in the curriculum from kindergarten through 12th, but the reality is it isn't and that's basically what you need to work on.

I told my 8th grade daughter that I want to start a "career camp" with her and her friends. I'm going to have their moms and me bring the girls to our different jobs.

My dad worked at IBM for 42, 43 years. He went to college for applied math and I never visited him at work. You weren't supposed to bring your kids to work. He was a real company man. He did everything from sales to real estate over his career. I never saw what he did, only if he went in the basement to work more. But I saw what my mom did; she was a teacher [the speaker is a teacher now].

Research shows that the biggest correlation they could find in what someone does when they grow up is if they can envision doing it in the 8th grade.