Comment – Given that all of the instruments we know of for measuring and learning CS1, do you have any explanation for the poor performance for students using these instruments.

Question – For all different ways to measuring CS1 learning (intro to CS), we have had abysmal findings. McCracken looked at 5 institutions and 4 different countries. The rubric had 120+ items and the highest score was 26. Why are the CS1 students doing so poorly.

Answer 1 – for math and engineering students taking CS1, a math pre-test was given. There was a linear correlation between math pre-test performance and engineering class performance. Students without Math background couldn't get the concepts being taught.

Answer 2 – For AP CS in high school. Some have been fairly successful. AP CS is an awful test and don't test student knowledge. It's the device. However, AP CS is not used to measure student learning.

Question – What can we do to make it better?

Answer 1 – Collaborative learning like pair programming to increase student learning and retain students.

Comment 1 – I've seen that retention is kept for CS1, but not performance for CS2. I'm not sure that it works.

Comment 2 – In CS we say the deficit is among students and not the teaching. Other fields consider the teachers. In CS Unplugged, there is an extension problem to make highways to be efficient to connect the cities. One researcher asked who knew what an algorithm was, but the word algorithm was never formalized. They could implement the use, but didn't have the formal definition. Constructivism is useful, but we need both the formal and implementation.

Question 2 – Is the test incorrect then?

Answer 1 – We need away from the test.

Comment – More fundamental research needed to see what students understand and don't understand. We know undergrads don't understand computer science. Their views of it is very negative.

Comment – Pair programming in terms of media computation. Beth at UCSD compared 2 sets of students using media computation. She saw retention for both media computation and pair programming. Here's the hypothesis: Both pedagogies address social and creative for computer science.

Comment – Pre-engineering for middle, high schools for science. Collaborative research and is statistically significant. For certain types of schools where students dominate, they become more comfortable and articulate to having thinking challenged in small groups. The application of logic and refinement speeds up myth busting.

Comment – Question about assessments themselves. Is this a pencil/paper.

Comment – People have tried to test too many facets at once. For another, there was a question for iteration. You had to put in the correct answer to make the iteration work (35% correct). Another was Multiple Choice independent language test. Matched to ACM curriculum to test 27 concepts. There
was a strong correlation between pseudocode and a native language. (Alice Ann Elliott 2)

Comment – In the previous section, even if we articulate the sequence of learning, we won't be able to get at a sequence of steps to get a foundation. In CS education, there is very little work.

Comment – We don't understand how people understand how to develop software or how those cognitive abilities come to exist. What is the development model?

Comment – Only in year 3 and 5 do we get to see patients. In year 1, medical students now see patients. In undergrad CS if we have more integrative. How do we introduce CS. There is tight ownership of what those intro courses should be. Rethinking what the curriculum should be. It doesn't work for all undergrads.

Comment – CS1 is prep to be a software developer. At what point do you introduce CS?

Question – Are all CS textbooks start in basic philosophical logic? American students don't understand logic.

Comment – There are discussions about starting with logic or discrete mathematics. CS1 varies from university to university. There are few that are intro to CS versus intro to computer programming.

Comment – The big ideas are being focused upon using CS Principles. How do you assess that without a common programming language?

Question – Is there literature that shows what's the right learning in educational research? AP Principles suggests going into breadth first course. We took the sharp people out of the class so they don't impact everyone else.

Comment – We're using the NRC to change AP CS classes to introduce computing and big ideas to avoid a mile wide and inch deep. There are 7 big ideas to have students know. Go deep on those 7 things. That would be a more successful learner.

Comment – Underrepresented students say I would do it, but I want to help my community. Make the connections more explicit for others.

Comment – Students are unsuccessful in first and second year, but they do great at the end in their jobs.

Comment – Some of the students are more self-motivated to engage outside the classroom. Is there some literature for that?

Comment - “Stuck in the Shallow End” shows that they are mostly white males. It's preparatory privilege, because they have relatives who did the same thing. It's informal education as well. They are inequitable and unsuccessful. CS needs more ideas to take an approach to begin at day one.

Comment – Every woman has someone in the family who was in CS.

Comment – Girls using computers outside the home tend to pursue CS.

Comment – Methodologies for teaching math exist, but not for CS. What methodology should we do to tell teachers how they should go about teaching at the K12 level. What content is new? How do we
formalize the teaching methodology?
Rephrase – A high school teacher asking how to teach CS in the class. Pair programming works in college, but what does that mean in HS?

Comment – Hands on, small groups, journaling to draw out informal learning. The challenge is that not everyone has that pedagogical content. We have a coaching program in the classroom with the teacher. Teachers should recognize the question and map it back to the curriculum. There is no literature about pedagogical content knowledge since there is no shared understanding of the content.

Comment – I’ve been blogging on peer instruction. I have a question about something I just lectured on. Everyone sees how they did, meet together, and discuss it. There is a social aspect. There is 0 data on effectiveness.

Question – For pedagogical content knowledge, can we refer to CS Unplugged?

Comment – The data does not show that. We can tell about retention, but not necessarily learning.

Comment – We don't know what the constructs are. Some are trying Alice and Scratch. Are they learning CS concepts? How does it translate and transfer outside the classroom? There is a positive transfer training.

Question – Isn’t there comparable inquiry based approach, since research evidence shows it works in other disciplines? Pattern recognition may be a key component to see that students can do more sophistication work later on?

Comment – There are a lot of educational researchers in the room, but there isn't a cross fertilization of CS educators and educational researchers who do the same thing. The CS community needs to sort out some things. Pedagogy and STEM learning is interesting.

Comment – Inquiry based CS education is interesting. Problem or project-based learning doesn't exist for CS. There are a lot of pedagogies that work in STEM.

Question – Where do I get the class that I’m comparing myself against? Think of an ethnographic approach by itself or against another instead of comparing. Different forms of educational research don't compromise student work.

Comment – Go beyond just measuring our own classes.

Comment – With respect to reform for math and process standards. They are devoid of experiences in high school. They are asked to do problem solving or inquiry oriented instruction without the experience themselves as teachers. They may not make decisions for assessments. If CS1 course, where are CS teachers able to engage the same types before in front of students?

Comment – In Georgia Computes – undergrad faculty at once. Teachers were interviewed about coming to workshops. There are 20% of faculty who care about CS. You got them already.

Comment – Teachers are desperate, but don't have resources. Disciplinary commons (CPATH) HS teachers come together about practices. Undergrad faculty learn a lot.
Comment – Pedagogical content knowledge – it's general pedagogical techniques. The field needs case studies reporting specific pedagogical techniques to teach a particular concept. It can be an inquiry to a specific idea. When others replicate it, you have a good understanding of a pedagogy. While you have to do comparison studies with a large quantity of case studies, you can do the research together.

Comment – I have a small institution that requires the documentation that you are requesting. If you are doing innovative pedagogy that's working, please talk to us about building a consortium. The average size of class makes a difference. Georgia Computes doesn't translate to the high schools.

Comment – What are your objectives, outcomes, observational methods that work? NJ has performance assessment.

Comment – To become a valid study, you'd want a multi-site doing the same thing. There are broader generalizations of like-minded folks. Some people would be doing regular stuff. Quasi and full experimental studies using summer camps.

Comment – Even with runoffs, they aren't documented.

Comment – we also need institutional and career support to make it possible.

Comment – In higher ed., we need to meet with high school teachers, but they don't have time for that. We need to do it during the summer or the weekend. We can't dictate what we believe would help them.

Comment – Have you done followup studies on students who don't do well. Do they truly have the skill sets that we think they have?

Comment – Seniors in CS vs Seniors who dropped out. Maureen Biggers. For those who stayed, CS was a broad field, for those who left it was programming.

Comment – I get rooms full of white girls who are going to be teachers. It would be valuable for them to introduce their students to integrability. Brian Orbits. Is there any guidance.

Comment – Almost every college of ed has an ed. Technology add-on. It's been vastly different. We've had them do scratch and CS Unplugged activities along with smart board. It's an underused place.

Question – What is computer science?

Comment - What are students beliefs lead to educationally non-productive decisions. High school students believe the covers of magazines of using an application. It's a bad decision. He is using ACM definition of CS education. It gives him a definition of it.

Comment – ABET defines computer science very differently.

Comment – I'm a chair at a small college in Ohio. Nobody studies math because they think it'll be socially engaging. They study math when they're 12 and 8. Why is it not the case that CS is not a part of the math curriculum up to grades 8 or 9? Why doesn't it bifurcate into algebra, trig, geometry, etc. CS is equated to dance as an elective. What's the rationale for it not being that way.
Comment – It's policy and politics. It's not tested, so it's not taught. If the teachers don't know what it is, it doesn't get taught.

Comment – In Ohio, we have new core standards. CS or computational thinking.

Comment – Most would like to see computing integrated into the curriculum. They tried to have Logo. In the Children's Machine, he said it was too radical for the math curriculum. It was easier to have it as a separate item.

Comment – Would be nice with math and computer science. It doesn't make any distinction.

Comment – Matteus – If you go backwards from CS1 into Algebra 1 to learn CS1 in Algebra (using Racket)

Comment – This community has used CTM. Statistics worked from the inside and not the outside of the community.

Comment - In the new core curriculum, CS is an option instead of Calculus.

Comment – I have a problem with thinking about the bridge between CS and math as the entry point with the learning point between learning curriculum and high school curriculum. It has to be in the writing curriculum as well. That is a vision necessary for you in educational research. That is my two cents.

Comment – 22% of schools offer AP CS. That is a fairly high number.

Comment – There is untapped intellectual community. So many writers have had to teach themselves to program. There are many writing teachers getting onboard. They are knocking on doors of CS professors to work together. It's not on the radar, but it exists.

Comment – We need a different pedagogy for teaching programming. Programming is one of the few things we teach at the HS freshmen level that they create innovative artifacts. They have to construct and invent novel artifacts. In writing you have to do the same thing.

Comment – I have research that corroborates what they're saying (Laura Faye – computational linguistics participant in “writing across America”. She teaches computational thinking through Scratch and video editing.) There is a small percentage of math teachers who want to teach CS1. Computational teaching is more fun than reading.

Comment – The Garage Band factor. Now all the kids are music producers. These kids have a facility and now think they are computer scientists. Is that literacy? They get into CS1. There is a cultural issue that is beyond an image issue.

Comment – Are we minding at all about the data you referred to earlier in the Clubhouse with “Preparatory Privilege.” They are the ones who do well, so why not do it in pre-schools. We can take away some of the privilege. In LA, there are spaces for informal learning. It requires infrastructural resources. It's not like school. It's a great CE21 project.

Comment – After school programs, summer camps, put all these together. We see robotics don't have
an impact, but alice & scratch do for girls.

Comment – Making connections is good, but I don't like pipelines, which is one single person. We need the connections to have the resources for intentionality.

Comment – Laura Faye's program for connecting CS with gardening. We have a spinoff of Urban Rural? Learning. Has math students, reading students, etc. Kids are putting in a garden to put in solar panels and sensors in the earth to collect data about moisture and climate. They are going to Mississippi to connect with urban farming in Mississippi. You have to have room to maneuver that way. They are into more interdisciplinary Learning. They are happening on a little level. They know about computing and things that can happen. They can ask questions about “How can this be applied?”

Comment – Tuskegee Airmen involved with Black history week. CS and Black history week is a way to percolate interest about what it is.

Comment – I do recommend pipeline models. The one student who drew concept maps was a person who saw they wanted to be a digital artist. Show there are connections between these concepts.

Comments – Georgia has a connection that is difficult to make. Have events like summer camp to get kids into CS1.

Comment – End user programs should be redefined.

Comment – It gets back to journalists who want to do CS.