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Welcome and thank you for standing by. I would like to remind all parties have been placed on listen only until the question-and-answer portion. At that time if you wish to ask the question please press *1 and make sure that your phone is unmuted and records your name. Today's conference is being recorded. If you should have any objection you may disconnect at this time. It is now my pleasure to call over to Karen Geary. You may begin.

I'm not Karen I have Chris and this is Karen who is something to make this event. Happy to welcome you years first distinguished lecture in the cyberlearning series. The cyberlearning program at the country sponsor research to help imagine the future of learning technology but building on contributing back to best available learning sciences research. Is housed in the computer and information science directorate and it is run in partnership with the engineering directorate, education directorate and the social behavior and signs directorate at NSF. This is a team effort that we are proud of. The police to introduce the first speaker, Erica Rosenfeld Halverson, an associate professor in the department and University of Wisconsin Madison. She is going to talk a bit about research she has been doing on the Of acres. One reason we invited Erica to get this talk is to help showcase how cyberlearning is a theme that crosscut many areas of research that we fund. We will have a brief discussion afterward from other program officers and NSF. Donna Riley from the engineering directorate and [indiscernible] from the education directorate to give comments after her talk. Connect with people over discussion two and a and comments -- Q and a and comments. If you have something to say and you are out there in cyber space please press *1 at that time. Without further ado I will turn it over to Erica Hello. Thank you so much for having me here. I love cyber face-to-face format so I have a vision of a bunch of people sitting in their underwear.

It makes it so much more delightful.

[laughter]

Thank you to Chris and Janet the program officers that shepherded through these grants around which this work is based. I will tell you about this. We've been at this work officially funded for a little over two years. What I'm able to share with you our results from this initial two-year time. Before I do that I would like to tell you a little bit about myself because as a lot of this work is interdisciplinary I, as many are, also an interdisciplinary it. My PhD is in the learning sciences and my background is what it means to learn things and know things. We devised learning environments to take advantage what we understand about knowing and learning so in that way it could be in line with what the post here about.

-- The folks here care about.

I have a performing arts by training. In my life before academia I started and ran a nonprofit arts organization in Chicago called barrel of monkeys. It is still a vibrant organization in Chicago. If you ever find yourself in that part of the world I recommend taking a couple of their public performances. The work is about how we engage elementary school kids in the credit process primarily with writing and performance with emphasis on how artists can take kids work and professionalize it ring and bring it back to them as legitimate work in the arts world.

This is what I am a passionate about and what brought me to graduate school in education. To learn about 30. I was fascinated by the fact that a bunch of musicians and clouds were going into classrooms and kids were learning things. We didn't know why. I was fascinated by that.

My graduate work which I will not belabor that is important as a background was on how teenagers all identified as [indiscernible] used playwriting and performance for identity and literacy work. My initial form way in to learning theory and art was in people of producing original work focused on self toward and stored developmental and also content areas and literacy practices that we care about in high school classrooms and beyond.

I had the privilege of migrating north to the great white tundra of Wisconsin where I picked up with the fabulous people in the games and learning society many of whom work with NSF and cyberlearning and other directories. When I got there I was frankly a bit of a lead right. I sent artist and I can work with Charlie Brown process and technology seemed a little bit of a version of that. These posts said we think the work that you do with identity and performance and representation is really relevant in the kind of creative endeavors that people here do. People in digital media do this. I said I don't know. They said the MacArthur foundation would like to find it and I said I like computers.

[laughter]

Through that I need to be transition to looking at digital art and with a focus on the importance of digital technology for the presentation and learning. I got to spend several years with you media arts organizations looking at how to work with disaffiliated used to create original productions, though, documentary, standalone digital art. With an eye toward identity and also academic outcomes around literacy, engineering, and it's very interesting how was you introduce digital technology into the mix what was a literacy activity because that engineering activity which is what I am interested in.

I was working in that world and wanted to give a few gaming -- framing constructs. I want to explain what motivates my work at the intersection of learning and technology and production. I am really inspired by the work characterizing you media environments. Most notably the work by Henry Jenkins and his colleagues. This white paper -- if it is not familiar are highly recommended. He talks about framing participation in successful online learning environments as participatory cultures. Briefly and participatory culture is a culture with relatively low barriers to artistic expression and civic engagement, strong support for creation and sharing information that some type of informal mentorship. And most importantly ever to support culture is one which was believed their contributions matter and feel some degree of social connection with one another.

There are other frames for characterizing participation in online learning environments that I also enjoy. Many of us may be familiar with the work on Alan Collins and his earlier work on passionate communities. [indiscernible] on affinity groups and his collaborators like that he hates and interest driven networks. All of these frames point to a similar way to understand how people participate in legitimate social networks revolving around production.

It is this frame that inspired me thinking about how to design better environment for young people to become engaged and then they can participate in production oriented tasks.

Most of his work has focused on ethnographic characterizations. They said what is happening here? That's the dominant question characterizing a lot of this work.

I'm much more interested in taking an intentional stance. Looking at -- so, participatory cultures are the way that people successfully participate, how we design for them and how do we decide for them when we particular outcomes in mind

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I need a learning theory. I'm a good learning scientists and I am uncomfortable without doing what learning means and it looks like. Toward that end I am inspired by a lot of the three summers from the new nurse's framework. I don't know how familiar that is to you, but you literacies takes a reframing of what it means to learn and to do literacy focusing on understanding and confidence in control of the representational forms becoming increasingly significant in the overall communication environment. That's the fancy way of saying it.

What it means to me is that ideas like Cindy, representation of production are at the center of what it needs to to literacy.

Hopefully these ideas resonate a lot with perspectives on engineering, perspectives on that design thinking, perspectives on the kinds of multidisciplinary learning environments that a lot of us work in. It comes from a literacy background -- I feel like there is a lot of natural mapping for the kinds of things that stem designers and stem educators care about.

Finally I have a brilliant colleague who is also a friend of NSF, Kurt Squire is a great paper on digital analog learning environments. He calls this designed experiences. Rather than thinking about a design as a being that people do and give to others current things about the experience of design as a learning environment where the design is constructed essentially in a distributed way between people who have certain outcomes in mind and people who use what ever the boundary object is and the user to in the environment. Currents work on rethinking design as an experience has also been really inspirational to me.

Taking all of this together, myself and my colleagues Dr. Sheridan who is local here and George Mason University like myself works at the intersection of art and learning sciences, we take essentially the arts as a friend to understand learning and design because these notions of representation of design of production that are so central to literacy and central to stem education are a part of what needs to me and to art which turns out to be a crazy circles where I started as somebody wearing a funny hat performing a story written by sexual about Tiger and feel.

I have to share this picture. This has given me an opportunity to get to the art form that inspires me. I have to be in a fantastic production of Assassins. I would be happy to talk about that another time. I thought I would share this. To be an academic working on serious work also means making a doing art on a regular basis. I couldn't resist.

The ideas that help us understand the intersection of design representation of production is that the arts really deliver on -- first the arts are centrally a representational domain. We can learn a lot about how we can decide for getting smarter about representation and what it means to be a successful user and designer of representation. By taking an art making frame to the work.

In the arts form and meaning are deeply integrated. We might call that content and process. We are moving towards a world in which the design of learning environments don't just focus on one but think about those and they are inextricably linked so you can't do content without understanding process. In art making any natural mapping. Finally, work in the arts explicitly involves exploring an eye exam and he identity and culture. Sociocultural toward learning and doing it becomes important when we put design and representation of production at the center of learning.

Taking all of that -- I could give you a paper on representation of production and design and you could have all these ideas. We had the privilege to work through these cyberlearning initiatives to engage in 2, mentoring studies in what we call the learning in the making lab. The first is a general angiographic and design oriented study that explores Makers experiences. What are they and what is happening in her goals under what conditions? How can we introduce design interventions that make people more successful thinkers and doers of these interdisciplinary art. More recently as a result of these studies we have taken of a particular design approach that we are calling leveraging technologies for impact that aims to engage participants in make her spaces more deeply with the iterative and critique oriented nature of making.

This is where I get to learning is a long game. Most of this work has taken place in informal spaces which are due to me. The public library, UCS, afterschool community centers. One of the main things that we don't stop about is that these environments -- AppleTalk or about this later -- great an initial experiences that are people in. You have great -- it's really cool to create my own robot that doesn't something. That was fun. Thanks. See you. As a learning environment and an opportunity to pull more people into ideas about design and production of representation that is affecting to me. It actually takes a long time to learn to be a successful designer. You can't have one design experience anytime. We've been working on cyber technical

solutions to that challenge. We have a long way to go. But I think we have some good ideas for how it might work.

Here's my team -- they are great. I mentioned camp. She has several students. Her current student is Abby [last name indiscernible]. And now Dr. always just took a position at [indiscernible]. The fantastic Dr. Lisa bronze is head of research and the Make Shop in Pittsburgh and we been able to use this as a lab. I have several fantastic students including the recently minted doctor Litts. She will start at an assistant professor at Utah State University. We have a broad array of scholars as well as fantastic partners. We been able to partner with Makers from the Mississippi River over. The initiative didn't fit on a member wanted to include but we also have the opportunity to work with them and I would be happy to tell you more about what this is if you are interested.

What have we learned? One thing we learned which may seem a little obvious but I think it's worth mentioning -- we decided to separate our findings into buckets. What I mean is that the Maker movement is a broad agenda and very broad idea. What we found quickly is that what you can say about making as a set of activities is not the same as what you can say about Maker spaces and learning environments and not the same as what you can say about Makers as an identity of practice. We started to tease out what it means to think about the making as an activity. We need to think about Maker spaces of communities of practice and think about Maker as identity and where other problems between those and where are they disconnected? Where is it okay to say we are designing Maker activities that are not activities that are happening in Maker spaces? Where is it okay to say we want to create a Maker space for all people not all me identify as Makers was a particularly interesting finding in light of the fact that we talk about student identity but we don't really think about the intersection between classroom and student in the same way. This begs a lot of interesting questions about classroom and community and student identity.

We have to piece that came out in the Harvard education review that highlights some of these things and try to identify other researchers working in these buckets. Where there might be overlap.

One interesting thing I want to point out about these activities is that we observed and have the opportunity to do a design experiment and make up shop. We observed the tension -- open-ended activities in structured activities. We set out to find what you get when you take the same set of tools and materials and processes and structures out in a more get like fashion. We kept calling it traditional instructional environments. In traditional science lab. Essentially we put together a kit for making a fresh box -- a robot with a toothbrush. In one condition we said we are going to make brush box. Take these things out. Step two -- you will a motor. Here's how to do that. The other condition we gave the kids the material and show them some examples and said make something with this stuff. There was still mentorship and answers if we didn't say the end of this to make a [indiscernible - multiple speakers]. We observed this and found what is not so, but interesting when you think about what it means to design for learning in these spaces is that in the open and condition -- open ended condition with statistical significance which is amazing to me, we have a quantitative rate was on our team -- what the students have a PhD in literature was six. She is now getting one in educational psychology. Great for us. Delightful. We found that with statistical significance became the open-ended condition displayed much greater agency about their desire ability and interest to make one. The kids were given the materials and told they could do they wanted linguistically at the end said -- provided much more positive comments about their experience. I see myself as a Maker. I can do this. I want to do more things like this.

On the other side the kids in the structured condition made stuff that worked. From an instructional perspective often times that is what we care about. We care about if you are making a robot we want you to make a robot that works because that demonstrates that you understand these processes and practices. And perhaps give you greater inroads into future experiences because you have the experience of putting these things together that does the thing is supposed to do.

We are now taking and talking about when it's appropriate to have a more structured condition and when it's more appropriate to have an open-ended condition and can we be more mindful about that. Instead of saying today's the day we do a structured activity to say when a developmental trajectory is it appropriate to do that and when it might be a more appropriate to afford a much more open-ended environment.

In terms of findings around Makers and identities I'm going to talk about preamps -- Briand's dissertation. These urges that already identified as Makers. These urges that sees itself this way. She gave get a prompt which we developed and user tested -- asking kids to make flow without telling them what we mean and asking them to produce something that flows. We found that kids bring a stance to adapt. There are three we think we've identified. One is aesthetic -- I wanted to to have an aesthetic quality of flow. I want it to look like it close and feel like it close and it seemed like it flows.

One is what we call a pragmatic stance -- closest to engineering. I want to have an elegant -- sorry -- and functional stance is more of an engineering stance. There is an elegant solution to the problem of the flow. Kids would say I'm thinking about how to get water from place A to place B and the thing I am making should elegantly do that. You could have a lot of non-elegant approaches like a bucket that you walk from place to place. But the functional stance is about a more elegant solution.

The third is the pragmatic stance which is the -- it solves a problem that I have. It's not necessarily elegant. But it feels a niche or fills a need. I kids might say we don't really have anything that allows us to flow this kind of material from this place to that place. I'm going to make something that does that in it doesn't look pretty and even if there is a similar solution to it. I'm solving a problem that identified that we.

She was able to see the stands they can't brought in and there was a very consistent approach that the stands guided to the process that they undertook. The processes of making look very different across these three stanzas. -- Stances. This is interesting from an assessment perspective. We typically think about the assessment of learning as something that we've all agreed upon that somebody will get out of an experience. And we will know that they can do it when they meet metric ABC. We started to think about assessment as grounded in stance. Rather than having an external measure of success the assessment is based upon the stands that the young person brings to the task. It's unfair to ask a person with an aesthetic stance to be assessed on a pragmatic stance. Likewise it's unfair to be assessed based on the design as an aesthetic object. It's also true that kids -- makers in general -- gives we been studying -- seem to be malleable in their stance. If you take an aesthetic stance it doesn't always mean you do it this way. It's not an identity marker in a you are an aesthetic person arrive there seems to be an intersection between the task and the stance and wanted me to trying to accomplish. My perspective when it needs to be assessing. Rather than one size fits all it means that in Maker we have a relativism to assessment. It's challenging but one of the real values of these spaces.

Finally, what we know about maker spaces? We have a piece in the Harvard educational review. Case studies of three different spaces that we outlined is a much greater detail. The three big finding someone to highlight is that though there were large, large differences in the spaces and what it meant and the duration and, across the board multidisciplinary team was the unifying feature. Rather than a bunch of people who could all do the same thing, the fact that there were lots of different people who could do what the different things was what made the space go. For me this really challenges our notion that all learners need to do the same thing at the same time and when we walk into a fifth-grade math class the goal is for everybody to come out being able to do the same thing at the same time. Here what the old the space is that Chris is a great welder. I am a really fabulous video production person. Together we are able to create some new artifact that engages my digital expertise, his physical expertise, and some community need. That was true across all the spaces. There was also a diversity in learning a racist. This is similar to what we talked about with the structured activities and open-ended activities. All the spaces did all the things. From a design perspective that means the learning arrangements don't guide the design of the space. The design of the space opens up the possibility for a range of learning arrangements.

Sometimes you have a small lecture class where kids were learning some particular soldering technique they didn't know. It wasn't that there was never direct instruction. It happened on a relatively regular basis. But in an ad hoc way that service the needs of a group of people trying to solve a problem. These spaces afforded this rate of -- this diverse array of learning a racist.

Finally when we say that learning is [indiscernible] and making, we started by trying to say what discipline is this like ? How can we put together existing disciplines to say making is art plus engineering plus

something equal making. It turns out that making it is a discipline in and of itself it has components of each of those pre-existing frames per thinking of learning and doing. Actually it is a discipline and of itself. We need to think about what that means. Connecting back to the disciplinary frameworks we have in [indiscernible] and higher education. Does that mean that you should take in our class and engineering class at that making class? I don't know, but it's interesting. We started by trying to classify making as a collection of disciplines but we think now it turns out to be that it is a discipline in and of itself.

Briefly I mentioned this initial work led us to think about how we design for more extended engagement with the space with a particular focus on iteration, critique, reflection, and the revisiting of work overtime and our desire to think about those ideas that comes from what Kim and I know about what makes good are making learning environments.

Camp is a co-author -- Kim is a co-author of project Zero thinking routines work around our to classrooms. Studio thinking. That's the name of the book.

They spent a lot of time looking at how the core of instruction in court -- art classrooms -- I know this to be true from my work in art. We also explored ethnographic work and that is what's good makers day. Good Makers don't just forgot something for an hour as it started to get (Michelle. They can take -- make and take is not a common practice for people who see making as her discipline. We've been working on how to move these spaces in a designed based way away from make and take? The first thing that we had to do was eager out how to help these spaces engaged in critique? It turns out that critique technological or otherwise is not something that people are particularly good at.Quite nervous about risk-taking involved in critique. We've been working with the children's Museum for to develop critique routines that can be used with young people both where more expert others engage you in critique and also how care's can learn to -- peers can learn to conduct this iterative positive critical look at work.

We've experimented with a range of tools. They afford us the opportunity to offload critique into an asynchronous digital durable environment.

Here are some reasons this is a good idea.

One, these spaces do not have regular attendance. By that I don't mean that people don't come back. I mean that if you are in an afternoon at school program and there is bad weather and the buses canceled you don't make it there for two weeks. Or if you are coming to MakeShop with your family once a month or, etc. Unlike in school we can't say this group of people will be back together in a day and a half and this is what we will do. Providing an asynchronous environment allow for those conversations to continue and the pace at which it makes sense for the individual makers. It also affords a durability of the work process. So, one thing that is hard about it regular engagement is that you forget where you are. You work on something and you come to a place and you are away from it for a month and a half -- knows what you're thinking when you wired into this way? How could you possibly remember? We are trying to scaffold documentation that allows for the return of work when you don't know it when it is going to be.

Finally the dream of. -- Kids from maker spaces in different places will be able to engage in this work together. There is an affinity group reason for doing that. I may be interested in making tutus while a lot of the kids in my maker space are doing a lot of innovations in woodworking. I would rather talk to somebody who is really invested in sewing. I have a person in my bigger space. The one in Detroit has a cadre of young people doing wearable electronics and they would be delighted to offer critical feedback on my two that lights up when I moving different ways. That's the dream of.

The technical challenge has been greater than I would've anticipated. We started with a tool designed for concerts. It was really going on the features that afford scaffolded feedback but really terrible on usability.

So, one of the things about any technology particularly technology in informal spaces is that it is not easy to lose -- to use notes what to use it. -- No one was to use it. We have now moved toward a product marketplace that perhaps affords the same kind of scaffolding but has a much easier in Rome. Of course

everybody says all you want to do that -- how about DIY? Got about interest? -- Thought about interest -- Pinterest?

Here's what the feedback is -- often -- also. I want to try that. There is little scaffolding that allow people to get better at making. We are working with the developers of a tool called TACKK that is one such tool but we are stuck on this. As probably a lot of you working with public marketplace items know as soon as it starts to smack of the school, the developers are knows about it. There is a on a dance between having ideas about what works in terms of learning we also wanted to be a tool that people want to use. That is where we are at. I have a strong belief that this kind of reaching tool -- bridging tool so we can make the greatest inroads in terms of design because maker spaces look a lot of ways. We have a lot of parts. They: unique features and different goals for participants. I just started a new project through id. LS with the Madison Public Library system tried to taking maker focused approach to libraries. As you can imagine it looks quite different. It looks different in MakeShop than one of the museum. Rather than the design principles that I typically thought about -- what to be tell is based they should be doing -- I am a much more interested in the design for the bridging technology that afford these spaces the opportunity to do their maker work in a way that makes sense for their context with the people they have.

To say we know -- I've never said to me space we think critique, information, production and revisiting is really important in making and we want to design tool that help your makers get better. Not one of them has said that's ridiculous. This is a problem that a lot of the spaces are trying to solve. Maybe a lot of questions and they are trying to solve. I am more interested in helping will solve this problem.

I had an opportunity in the cyberlearning meeting the last several days to think about what the future of cyberlearning might look like. I use this slide because I like the idea of the king about the future of cyberlearning as research practice participant that stretch the where and how of learning. Cyberlearning is well poised to be the research branch of informal 21st century learning environments. These are environments that have more opportunities for working with marginalized young people in ways that maybe schools have constraints that are not possible. We are the kind of people that like to think about -- if all of these things are possible, how can we do it and what kind of research on we to do that gives them access to the kinds of learning tools that will help these young people to become more affiliated with the kinds of 21st century institutions we all value.

That's what I want to today. I am happy to take questions.

[Applause]

Are there any clarification questions we can take them. Otherwise we will get to [indiscernible] Quick clarifications?

When you talk about the open-ended versus structured, the structured design -- was that working them through the process of developing or was it an end goal of what you should try to accomplish?

Of instruction process. We weren't trying to do good with and gallant because that's hard. -- Gallant always versus history. Go this think people never get cavities. We were trying to avoid that by making the structured condition -- now everyone will do this. But we did want to scaffold success. There was a lot of -- you will make a robot of a toothbrush. The first thing you will need to do is build a motor. Here eventually. The first thing you are going to do is this -- different tables and worked together. Be the facilitator didn't move on until all of the kids had done the thing that would for them the opportunity to go to the next step. We tried to avoid it being overly prescriptive and with was disingenuous that we did really wanted to give all the kids in the space the opportunity to be able to say here is the goal and IT did.

Great. Have we decided was going first?

Al [last name indiscernible] is in the division of research and has an extensive background in museums and also one of the experts here at NSF in steam .

He will give us his remarks first.

Erika, does a wonderful job. I would like to talk a lot time about it but I only have a couple of minutes. I wanted to put this into context a little bit because I been involved as Chris has upset and others in our division and all of NSF with the respect to the Maker movement and other activities in the arts and science and technology arena. One thing you learn in this -- I have to be in the thick of it because I am processing board is a proposal having to do with a combination of art, science, making, invention, innovation, education engineering design and goes on. The world you haven't and making wonderful strides from the perspective is in this big landscape that is really a turbulent sea out there right now. I've come back from a two-day workshop at the children's Museum in Pittsburgh with a lot of folks in the museum the field and library field. Public libraries and also University libraries which I didn't realize getting into this. A serious way. As well as other parts of universities. Time to figure out what we are doing. One of learning? Things of that sort. A couple of reflections. There's a real question here, I think, still, what is it and what was the landscape and how doesn't intersect with other designations? You can't even say that making is it because not everybody thinks that in the same way. A number of folks at this conference is that I consider making to be this and that. How do we were here in a conference actually say that we are doing the same thing? I will talk about that briefly. Even in addition to the folks that self identify as being in a community interested in making there are others involved in invention and entrepreneurship education and making for them is a piece of this. It can be vice versa -- making with invention -- people they call themselves innovation education. If you get into what we might call the serious end of it there is a question of the democratization of scientific instruments and how this leads to job creation and economic development. This obviously -- the semantics around the green and that. There is, I think, still a landscape that -- I don't ultimately settled down. Maybe it doesn't need to. My bottom point here is that no matter what you call yourself you need to be clear about what you are trying to do.

What kind of evidence and assessment count and maybe applying new evidence to be able to better handle on the press, why, and how well you are doing. It is also a question of who is engaged or not. How disciplinary or interdisciplinary and institutional perspectives on it. Erica, I'm sure you've done of the work that this is one component of the kind of institution and how these institutions design themselves in a broader context and how the making they are trying to fit in actually embodies their values and things of that sort which can change over time. There's a dynamic involved with that. I should think that is very apparent that most of these have some combination of science technology engineering mathematics are in humanities. Many of them are really interested and proactive in how to make sure that no matter what we call it that we are intending to diversity and inclusiveness. That's the major theme of the workshop I just came from.

There is also a question of who owns it related to the question of what is it, I think. You got the maker movement and it is branded. Do they own it or to somebody else on it? Think about four.

Quickly alternate over to [indiscernible] -- how to characterize the It. This is important to try to come up with some parameters. We came up with a number of parameters. One has to do with the outcomes were you are really interested in generating interest motivation identity and all that stuff all the way to a particular part of NSF that is interested in entrepreneurship and commercialization side of things. We were actually trying to get things from a decent idea of it to market. -- Out into market. Some people are not into that. The artisans asylum in Boston is. There's that kind of stress. There are learning dimensions that came up during the conference. Some are focusing on process and some focus on product. Some of. Low-tech and some are high-tech. Some have no facilitation and low facilitation of them are high facilitation. Staff and volunteers. Some have individual activities that they are focusing on and some are really collaborative. Of course it is also in between mixes.

There somewhere the organization tries to define or structure the problems they and others where they will key and open-ended process. One thing I will close with -- they are trying to designate what they call learning practices which is beyond knowledge and skills and learning practices -- one approach -- there are a number of approaches -- not to get into the details, but some of the learning practices that people are observing with you go to these spaces are process of inquiry, decree, seeking and sharing resources, reproducing, expressing intention, developing policy, simplifying versus complex applying.

The last thing is -- this goes to the good work that Eric is doing -- how do you study this? There are so many interesting things -- how does the research and practice dynamics work? The researchers are not only contributing to understand what is going on but also helping to inform and the practitioners of the for pay attention to practitioners how to define the questions that the researchers are looking at. The bottom line is I think it's really important as we go through all of this that we be as clear as possible about the outcomes account and what evidence can convince. There is a range of all those. Thanks.

Next -- Donna Riley, a program officer in the division of engineering education and centers. She also has an extensive history in not only education in the engineering also in gender studies and applying different kind of theoretical legends to running participation. Thank you for coming, Donna.

Thanks, Chris and Erica for a deliciously interdisciplinary talk. Fantastic. I'm intrigued by the way that you are blending the culture of production with the production of culture which is something that engineering is so at home in one of those areas and so not at all at home in the other.

That is where maker space is challenging engineers and engineering to grow and expand. We are and what we do.

I want to talk about two things. First I'm intrigued but with that identity and import performance are welcome in the spaces that you talked about. With your background working with LBGT I wondered what it would mean to career a maker space and you could be the person to answer that. It is an answer to Debbie's critique of making -- it came out in the Atlantic this month she said why a moneymaker. She basically says that making is a male activity. It is exclusively focused on creation and never on deconstruction. It is focused on materialistic consumption.

A lot of what you talked about really belies all that. It talks about diverse spaces and the spaces where critique is welcome and where people reflect and iterate and deconstruct is much as they construct.

Engineering as an engineering program officer at think a lot about the potential of making and I worry about making being co-opted in engineering as a something that is no longer retaining the spirit of what making is and can be. I think particularly about making as citizen engineering. We talk a lot about citizen science but nobody has really explore what we need to be a citizen engineer. Making offers to do that but as engineering schools begin to build your spaces out of their shops it makes me wonder who is really welcoming these spaces and what activities are going on in these spaces and how do we bring the spirit of making into those spaces and what has to change about that structurally? In terms of what activities are going on there and who is there.

It was awful to think about makers and making it maker spaces in that way at you think about how to design spaces within engineering context -- how to make them transdisciplinary enough to retain the spirit of making. Engineers value what works over what people in agency is and can we use some of your lessons to help engineers think differently about how we process activities? Can engineers actually adopt the aesthetic in the optional as well as automatic? I think engineers are more on the pragmatic skill. Elegant solutions are not necessarily the engineering way. Sometimes. [laughter]

To have the possibility in assessment particularly with all of the talks about multidisciplinary teams and engineering to actually have things that are truly multidisciplinary that might truly have students that are good at one thing and maybe not in another and value each student for who they are what they bring rather than saying we will have a multidisciplinary team but what is really got it here is your differential equation about ability in that person and that is considered irrigators engineer and the other folks any happy critique of -- create potential or team of potential the don't get reported within formal engineering education. Thank you for all that you brought to us today.

We have time for discussion. Now is the best time to reach out to cyberspace. There are a lot of folks that have joined us. Mary said that we have 55 people signed up for the webinar. There may be a lot more out there.

There are way more people here.

[laughter]. You can see it on camera but there are thousands of people in the room.

In both on line have comments or reactions when we kick off with a reaction from cyberspace and then we will open up the discussion.

Thank you. From the parties on the telephone line wishing to ask a question please *1 press and record your and clearly at the prompt so your question can be introduced. Once again if you wish to ask a question or make a comment please press *1 at this time.

One moment.

It's always fun to have this embodies the voices in your conversation.

-- Disembodied voices in the conversation.

The first question comes from Tracy to Sandusky.

Can you hear me?

Yes.

I'm calling from Vermont. My work is with Vermont after school Inc. and I work to support 21st century community centers and Vermont as well as other licensed afterschool and summer learning providers. My background is also in STEM. My interest is in making maker spaces portable and accessible that have some clear training for both that are often in positions that are a revolving door in the afterschool world. We need to really look at the progression of experiences that will really help kids maintain momentum of what it means to be a maker is the person who is standing in the room nightmare experience continues to shift.

I don't know if that is curriculum or training or what have you. There's also a lot of kids they can be reached that can't make it to the sophisticated Maker space which can sometimes feel a little foreign are daunting. I hope to have some support on that. This is exciting work and very different than the engineering work I've been doing with kids.

Poseable fantastic research questions and testing point. One thing I wanted to say that is an obsession of mine right now -- I think it is really important that we we value teaching as a distributed act. What I mean is in a world where we no longer think of learning spaces anything contained classroom with an expert teacher, we will not be able to re-create that in the 21st century learning environment for many of the points that Tracy raised another point. Nor do I think we want to. So I think we can think about how we design learning environments that take a distributed notion of teaching seriously. Where the distribution includes people, tools, structures, that a fourth war expert people opportunities to see themselves as teachers. In the learning sciences we think about thinking as a distributed and I think that is a relatively well accepted construct. But we have not reported that over to teaching and learning. I think we can get a lot of traction by saying one instead of worrying about training the teacher we worried about understanding where and how the teaching. Some spaces are more successful than others either because they understand it or because it is involved in actually. I think we could design for that. But we have to say -- state at the outset that what we mean by teaching is a distributed act across people and tools in time. So, Tracy, I don't know if that is interesting to you but it sounds like in your work that can be a potentially useful frame to think about the design of the spaces that you work in.

Are there other cyber questions?

If we had anyone wishing to ask a question or make a comment *1 please press at this time.

One moment.

At this time I show no additional questions. We had in the room -- let me get near the microphone. We have a room -- a microphone in the room for people to pass around. Apologies to those online that will not see that speaking but will hear them.

Thank you.

Thank you, Erica. I am anti-Ruben from [indiscernible]. I feel like I could talk to use for an hour. I have been scrolling through things to say. This is the most recent affect -- based on your comments about querying the maker space and the lack of deconstruction. I want to mention something. Things to think with. One is that there is a wonderful science Center in Calgary called [indiscernible]. I have three examples. There was a recent maker fair and the New York Hall of science and they did a workshop in which it was all about deconstruction. They ran around Calgary and gathered all the old artifacts and brought them in and took them apart. I have not had so much fun in my life. I made a necklace out of a disk drive. I think it's helpful to have these examples to think with. Another one -- this is a response to what to Tracy said -- maker spaces and making doesn't have to be big and intimidating. At the New York: MySpace have a design space where the materials are dowel rod and rubber bands or paper and scissors and like to make shadow puppets. A lot of those kinds of activities are very affordable and don't have to be an informal space. It doesn't need a lot of of the facilitation either. Again it is about a broad swath that we mentioned.

Finally, I have an art culture for many years. I would go to her studio once a week and pay a small fee and she had materials. We did not take Texoma very often. We made a stop and play with the materials, sometimes we took pictures. Sometimes we documented our process but I think the idea that things don't have to go anywhere -- they don't have to become a product -- they can be about playing with materials. That they get another perspective. I need to read the Atlantic article. Just a bit of a counter narrative to that.

Those are great. I have many things that we can talk about.

Yes.

I am [indiscernible]. By big concern about this movement is safety. Could you address that?

Sure. I have a glib answer and a less glib answer. The glib answer is sometimes things are dangerous. We do the best we can to make sure nobody gets her. It is a glib answer but I think it is also the reality of spaces and places where risk-taking is involved.

[This event has exceeded scheduled time. Captioner must proceed to next scheduled event in 5 minutes.]

Something we think about less is psychological safety.

I thought about that when you are doing -- talking about the electronic experience.

Yes.

I completely agree with you. Typically when people ask this question they ask about physical safety. I know that they say yes, sometimes we are playing with dangerous tools and we do the best we can to make sure nobody gets hurt. The psychological safety issue -- I have noticed -- is like I have a hammer -- everything is a nail -- are making is risky. As a teacher of art making I see one of my primary scaffolding tasks as a risk. Some of the design principles that some spaces have and some see the need to have but don't involve scaffolding risk-taking. I think one of the challenges with designing a tool that allows for asynchronous critique and engagement and not face to face is how to scaffold that form of risk-taking into a design environment? So I think it becomes a design question. The question is not how to mitigate safety, but how to design for the scaffolding of risk-taking so that people are willing to put themselves out there? I have some training in improv comedy. It is like the far end of risk-taking. [laughter]. Trying to say things

that are funny and most of the time they won't be. A lot of the tools and materials we used to scaffold risk-taking could be used to design into these sorts of psychological risk-taking.

I'm so sorry to say this but we are out of time.

I wanted to thank not only both have spoken today also some of the folks that helped to arrange this, especially Mary Patterson who works with the cyberlearning program and Karen who helped us make sure that people outside the room could participate. Let's get a big hand to everyone and spoke today.

[Applause]

[Event concluded]