Susan Riley - Makerspace Madness Transcript

- Well, hello, everyone. I'm excited to be back presenting this year. Now you know I've been in a creative cave for the past few months developing our brand new STEAM leadership certification. So STEAM and makerspaces and design thinking have been swirling around my brain for a while now. Today, I wanted to share some very practical ways to bring makerspaces into your classroom. For the past two years, anything hands on was pretty scary, right, given the pandemic. So makerspaces took on a backseat for a while, but I think it's time that we bring them back. Research is showing us more and more that students need tactile learning experiences that engage all of their senses, and makerspaces are a perfect fit for that. I actually think makerspaces have a bit of an identity crisis. Lots of people get these confused with STEAM labs, and many schools don't know where to put them. And then there's the misconception of what goes into a makerspace. I think many of us envision makerspaces with 3D printers, lots of computers or tablets, and other expensive or large items. Really, though, makerspaces are so much simpler than that. A makerspace is a DIY space for exploration where people can gather to create, invent, and learn. And it's in these active making center areas that they can happen anywhere, in a school, on a bus, in a home, Anywhere that creativity lives, makerspaces can flourish. In K12 schools, makerspaces are dedicated areas where students can use hands-on techniques and tools to make something new, discover problems and solutions, and to consider their learning of discreet skills and concepts, which can be applied in real life. Some schools are developing dedicated makerspace areas in empty spaces or classrooms in the building. Others are retooling their libraries to contain a makerspace zone, and still others have makerspaces within the general classroom. No matter where you put them, setting up makerspaces and using them effectively, and ensuring these areas are more than a fun activity can be a challenge. So today's session is going to help you to create a makerspace on a budget, and offer some practical ways that you can put this space to use. Now, one of the first stumbling blocks schools run into with makerspaces is where to put them, and why. Should they go into the art room, or perhaps revitalize an underused library, or perhaps we should create a STEAM lab, and house the makerspace inside? It's important to understand the difference between each of these areas, and how to find a solution that fits your vision for a future-ready school. We wanna make sure we're not just using technology for the sake of technology, or creating makerspaces and STEAM labs because it's a current trend in education. So here's an overview of what makes each of these areas different, just for your own reference. A makerspace is a DIY space for exploration where people can gather to create and vent and learn. We've just talked about that. A library is a collection of informational resources for reference or borrowing. Sometimes this is a place where schools house their computer labs, 3D printers, or other technology tools. Now a STEAM lab is a place for teachers to lead pre-planned guided content that integrates science, technology, engineering, the arts, and math standards. STEAM labs often serve as the springboard to moving from a peer makerspace to a more focused lesson using the makerspace foundation. Now while similar, each of these areas serves a different purpose. So consider the intention of what you'd like to create. Certainly a

makerspace could be housed in a library or a STEAM lab, but it serves a distinct purpose of exploration, creation, invention, and hands-on learning. So how do you actually create a makerspace on a budget? Now as you begin your makerspace design, consider the type of place and partnerships, if any, that you wanna cultivate. If you're working with partners, you may wanna ask local businesses, organizations, and arts groups for support, and this support can be in supplies, funding, or even hands-on classes. In terms of what items to include, most makerspaces can be built inexpensively to start. Many people think you need expensive supplies, like little bits or 3D printers to start, but that's not always the case. Take a look at your resource from this session, the 114 tips to Create a makerspace. It has a list of supplies, from least expensive to most pricey. This is a good place to begin when looking at pricing out your effort, because you'll be able to start with the small, and get bigger as you gradually go along. Let's talk about how to build your actual makerspace. Depending on your intention for the space, the options for building out the space are widely varied. Remember, the makerspace definition shares these spaces are intended to allow for creating, inventing, and learning, kind of tooling around. So what items would allow you to do that with students in new and interesting ways? Certainly you can go with 3D printing stations, and have students explore the process of taking a design, and turning it into a 3D, tangible object. That's cool. Right? So you know AR and all of that good stuff, but you could just as easily include items like sewing machines, culinary tools, and Autodesk stations. You can also go for a more budget-friendly approach and include things like a tinker station, that has random parts from old machines, like this. Think about bolts, washers, random chips from old computers, as well as some adhesives and connectors for students to build and create models for specific lessons and designs, things like this mesh that we have, or even duct tape, or packing tape. Take a look at all of these items that I have here. These are all items that could be included in a basic Maker's classroom space. They provide variety, interesting movement, color, and many different purposes. Students can come to a table like this, and just explore as a starting point. None of these items cost very much, and many can be downloaded from leftovers found at home. Now we're gonna come back to these in a few minutes to see how they can be used in a variety of lessons and activities, but everything here costs me less than 100 bucks. One big idea I want you to consider about makerspaces is the intention behind creating one. Are you looking for this to be a place for more organic discovery, or do you only want students to use the makerspace for specific projects or ideas? That's going to determine what items you need, and how you design the layout. Now connecting your makerspace to the curriculum is the single best way to ensure that these spaces are most effective for student learning. Making just to make is absolutely necessary for students to explore their own creative practice. But at some point, that needs to move into a direct connection and application with what they're learning in the classroom. This is where makerspaces can really go to the next level. If you design a makerspace for kids that is flexible enough to create in a variety of methods, while also providing the framework of a learning experience, students will make stronger connections to the discreet content that they're studying. These connections are what enable them to experiment, reflect, and revise. By creating an intentional lesson design that includes time for making, the makerspace becomes an extension of the learning process, rather than an event in and of itself. And to do

this, I want you to try working backwards. So you want students to create an art bot. You've gotta discuss circuitry, and artistic design first. Want them to design a new playground? Well, then students need to learn about measurement, the design process, and environmental changes that could affect the equipment. Start with the end in mind, and determine where that fits into the components of your curriculum as it stands now, then weave a makerspace in as part of your new lesson process. This way, you're leveraging your curriculum without adding one more thing to your plate. There are a number of things that we sometimes forget when creating a makerspace. So be sure you have thought about the following items: first, carts and storage, like this, including bins, labels, cubbies, shelving, rolling carts, and a checkout system of sorts. Power and charging. So including charging stations, laptop or tablet bins, cord wrappers, power strips and a labeling system, and workspaces. So think about including collapsible tables, long work benches, desk groupings, a creating area, lab tables, and a presentation space, if possible. And remember what I said about having an intention for your makerspace, and connecting it back to your curriculum. Let's take a look at a few ways to do that here with the simple materials that I have on this table. Now, there are lots of other ways that you can leverage makerspaces. So here are some other STEAM units of study that our whole team loves for makerspace areas. So you could use creating string art with linear equations, designing musical instruments, developing a new set design, animating a story, exploring robotic movement, exploring sound and light waves like we've done before, a study in microscopy, looking at architecture and working with blueprints. That's always great, and you can do that with as young as first grade, creating a LEGO pixelation wall, developing coded grid art, energy and space exploration through movement, models, structures and sculptures, and costume and lighting design. Maybe my favorite of all of this is the art forgery and chemistry unit. In this upper middle school unit, you can provide students with similar colors of paint, but one is a natural dye, and the other is synthetic. And students can use the paints in the makerspace area to explore their viscosity, the best brushes and papers to use with each type, and more. Use this as a jumping off point for discussing how forgers of famous paintings are caught by investigators. Many forgers use the same paintings, but use a different chemical compound base for their selected paint, so experiment with students with chemical reactors from your science teachers, and see how paint is affected. Then have students create two sets of paintings in the makerspace, one done with one type of paint, and the other done with the second. Give the paintings to a science class, and have them use the chemical reactors to determine which painting is the fake. Okay. So let's talk about a couple of lesson ideas. We could start super simple. The students could start at this table and begin constructing just out of what they're seeing in terms of playing with what they're seeing, so that we have some washers here, some bolts. Do they fit? Where would they go? How would you piece them together? Do they make sounds? What kind of sounds? Just kind of exploring in general. We have some construction paper here. We have a translucent piece so that we could add this construction piece, and the translucent cover, and create some 3D work, so we can add some additional pieces in here, and then secure it so that this becomes more 3D-esque. Okay, so we could just have them purely explore the space that we have, and I think there's value in that. If you want a little bit more structure, let's start with our youngest students. And oftentimes, our

younger students are looking at push and pull in their science lessons, and sound. So how sound happens, sound waves. And so certainly you could use this area to kind of create some of those experiences. So I have, again, this whole table of items that I have here cost me less than $100 to purchase. And so I think under 100 bucks, any school can purchase a makerspace area that kids can play with. And in this particular container, I have a straws container, and they come with these plastic straws, and then all kinds of different attachments, so wheels, and these components, which you can stick in the straw to attach to the wheel, which is great. And it allows students to kind of explore with those items. This is great for those push and pull lessons. So how can you create something that you can push and pull, and if you add different weight to it, what happens? Right, so you can create these kinds of movable parts, what that looks like, have them experiment. If something doesn't work, why didn't it work? Go through the scientific process of just hypothesis and experiment, and see what worked what didn't work, and why? That's a great lesson idea, especially for push and pull. If you're, again, working with students on sound, you could look at different ways to create an instrument with different supplies. So right here, I have just some simple cable wire, really light. You could use telephone wire, anything that you find around your home, your office space, whatever, if you have a telephone provider, or a wireless provider of sorts, I'm sure that local businesses have access to some of this stuff. So that's a great thing to kind of collect. You can build an instrument out of the items that you have on the table, and then if it's a stringed instrument, what kind of different sounds can you get at different thicknesses of string material? So maybe this cable, you could have a piece of yarn. You could have telephone wire. You could have a guitar wire that you could just have a a local music store donate. And then in that container that they create, whatever that is, perhaps they use shoe boxes, whatever, they're exploring different sounds based on tension of the material, as well as the material itself. So students can explore how that happens, why that happens, all through just different pieces here on this makerspace. So that's one idea for young students. If I'm looking for older students, so my middle school students, I wanna look at this idea of visualizing harmony. There's a great researcher who uses the musical circle of fifths. So you kind of, you'll see that on this chart here, and it goes around, that it starts with C. So that would be where we're beginning on our circle of fifths. And then you just count out by five. So five letter spaces, C, D, E, F, G, right? And you'll see G right next door. This is how musicians begin learning about harmony and how notes go together. So frequencies of notes go together. So in the circle of fifths, you move by five around the circle, and musicians will then build chords, and a chord is simply three pieces, three notes or more on top of each other. So C, E, G. So they'll have thirds that will begin chords. With me so far? So when they're doing that, they have C, E, G, they'll build that out, and that's a C-major chord, 'cause C is at the bottom. So what this researcher has done is she's taken the C chord, the base, and looked at a composition from various different composers, and she'll figure out how many times in that piece of music do we start at C, and then where does the chord get built above that C for that progression? So you'll see where the string comes out, right? So the first chord here goes across from that C, and you'll see where the color goes, where it's connected. You'll see how many times that root chord is built, and where it goes. This begins to look almost like parabolic structures with algebra. And so you can have students recreate that

with a simple loom. So this, you can get this for under 10 bucks at any local craft store. It's a circle loom. You can use it to create woven hats, but then you can start with different colors of yarn, and you can have students recreate the chord structure based on a piece of music that they're listening to. So for example, if you're listening to the Black Eyed Peas' "I Gotta Feeling," that chord structure is very clear, that. Those are the three chords that they're beginning with. So start with that first note, and then where does it go? Okay, and start dragging that, and mark your circle of fifths on your loom, and go across, and see if you can string out where those chords go, and kind of map out a piece of music with that circular loom, yarn, and even then, mathematically map that, because you have the markings of the fifths around the circle. Okay, again, that's upper middle school. You're probably looking at seventh or eighth grade there. Now what about in the middle? We've done young. We've done our older students. What about in the middle? One that I would suggest for that is Chibitronics, okay? The woman who developed this was at our conference way back in 2015, and she is amazing. She developed this as a college student. This little kit right here cost me 20 bucks. It's one of the most expensive items in this entire makerspace area, but you can get three, four lessons out of this one little kit for all of your students. It's a great buy. And so I wanna show you something in this kit, and I love this. When you open up the box, it even says, hack this box. And it gives you examples of how you can do that with the items in the kit. It's awesome. When you open up the kit, it comes with a circuit sticker sketchbook, which is gonna have the lessons inside of this for you, with your students. It also comes with these awesome LED lights that are sticker lights, that are right there. It has batteries and binder clips, as well as your copper tape. Okay, all of that is included in this little box, which is great. And so I just wanna show you one of the lessons that's in here. I'll show you how I create it. So you flip through, and it gives you all of these directions and what you'll need from the kit. And then it teaches students about circuitry while they're creating. So look at this awesome example here. If I were to remove the binder clip so that you could kind of just see what happens, it gives me the instructions of how to tape down the copper tape, Okay, explains why that's important in terms of the conduction, because this is just a simple circuit. Okay, so it tells you don't cut it. It gives you one length of tape here, gives you a gap here for your LED light, and then another space here. So the LED light is now touching both of the copper pieces here. It tells you how to place the battery, so that you place it right where it tells you to with the negative side over here. So you place it right there. And then when you fold down the edge of the paper, and you press down, the LED lights up. So the binder clip allows you to hold that in place, so that it continues to light. And then check out when I turn the page. The next page has a sketch of a light bulb on there. And the light is lit, which is so awesome, right? It's a fun little experiment. And third and fourth graders love this. Now this is just the first page, and it'll encourage students to then create their own. How would you make something different that fills in that light? And then it'll teach you about other circuits as well, like parallel circuits, and then, again, gives you those instructions. This little kit is amazing, because it gives you permission to copy those pages, so that you can distribute them for your students. And then all you need are these items, and they're not expensive to purchase, and you have students being able to create different kinds of circuits just out of this one little box. It's awesome. Again, I'm gonna have links to that on the

114 tips. Lastly, something else that when you're working in a circuitry unit with students, I love this, this little key of squishy circuits. This is a nice to have, not a need to have, but again, you can use this set. So you'll see the insulating dough here, and then all of the conductive dough, and all the colors. So students can create all kinds of different structures and sculptures, just using these, as well as the insulating dough, and some circuit components. It's so simple, and students love it. So those are some ideas of lessons that you can use at any grade level with the simple items that you find here in your makerspace.