AEM for Math and Science

Shelby
Well hello and welcome. Thank you for watching this webinar today we are talking about accessible educational materials for math and science. My name is Shelby Kappler, and I work with the Wyoming Institute for Disabilities in our Wyoming Accessible Educational Materials Clearinghouse, and my co-presenter today is Michael.

Michael
Hello Hello my name is Michael. I am an occupational therapy student completing a fieldwork rotation at Wyoming Assistive Technology Resources. So, to jump into the presentation, our three learning objectives are: First, name the three principles of universal design for learning. Second, identify at least three considerations for teaching math and science to students with print disabilities. Three, describe at least three strategies, devices, and tools that can make math and science more accessible for students with print disabilities. There are three types of print disabilities, visual impairments slash blindness, learning difficulty and physical impairment. So I'll briefly explain those three types of print disabilities. And then provide an example of a student in a math class, or a science class, who might be affected by that particular disability. Visual impairment slash blindness is applicable for a student who has limited or no vision, and this student may have difficulty with close up and or distance viewing, light, color, and depth perception. So an example in the math or science context is a student might have trouble seeing a teacher demonstrate a science experiment. In terms of learning difficulty, a student may have difficulty focusing, reading letters or numbers, processing auditory or visual information. So an example in the math or science context is a student might have trouble comprehending verbal classroom instructions. In terms of physical impairment, a student may have difficulty with gross or fine motor skills, reaching, lifting, holding, isolating fingers, and coordinating movement. And an example in the math or science context is a student might have trouble using a calculator with small buttons. So why does this all matter? Students with print disabilities are underrepresented in STEM, which stands for science, technology, engineering and math. About 13.4% of the US population, between 18 years and 44 years has a disability. However, only 10% of undergraduates enrolled in STEM courses have a disability. And that number drops to 6% when you look at graduate students, so only 6% of STEM graduate students have a disability. And those statistics are from the University of Delaware. We believe strongly that all students should be given equitable opportunity to participate in their learning. Without support these students may not gain self confidence or self advocacy skills. Unfortunately, students with disabilities may be overlooked or ignored in class. And if these students are not participating, they are not developing confidence and the advocacy skills they need but instead, they may be developing learned helplessness. Additionally, automatic dismissal from class activities and provision of alternative assignments or alternative activities is not equitable. So the purpose of this presentation is to provide you with strategies so that students with disabilities can be integrated into class activities, so they develop the confidence they need to be really excited about pursuing careers in STEM, so they can be like the individuals pictured on the right side of this slide, who are sitting at a desk looking at a computer image of scientific materials so these are individuals who are either studying STEM, or employed in the STEM workforce. This slide contains some images that represent

some of the challenges that students with print disabilities might face in the math classroom or in a science classroom. Starting in the upper left corner of the screen, we have a teacher who is pouring chemicals from one graduated cylinder into a beaker. And this may be difficult for a student with a visual impairment who might be sitting in the back of the classroom. In the center of the top row we have several math problems such as addition problems, and subtraction problems, as well as number sequences. These types of sequences, and addition and subtraction problems can be challenging for students with learning disabilities such as dyscalculia, on the upper right corner of the screen we have several chemicals in small bottles with small labels and the small labels can be challenging for a student with a vision impairment, and the small bottle could be challenging for a student with a physical impairment such as impaired fine motor skills. The student with impaired fine motor skills might find it difficult to manipulate those small bottles and pour the chemicals appropriately. On the lower left corner of the screen, we have a teacher, presenting her lesson on a large screen TV. It might be a math lesson, it might be a science lesson. In either case, it would be difficult for a student to see if the student is sitting in the back of the classroom. In the center of the bottom row we have two students who are viewing an item under a microscope. And this activity could be challenging for a student with a vision impairment. Later in the presentation we'll discuss strategies for magnifying the image under a microscope via large screen TV. On the lower right corner of the screen we have a graphing calculator. The screen output could be difficult for a student with vision impairment to see, and the calculator has relatively small buttons, which could be a challenge for a student with impaired fine motor skills.

Shelby
All right, so I want to talk a little bit about the principles of Universal Design for Learning. So Universal Design for Learning is a pedagogical strategy, which is intended to be inclusive of all students. There are three main principles of UDL. And that's to offer multiple means of engagement, multiple means of representation, and multiple means of action and expression. So under each of these there are some subcategories. Under multiple means of engagement, we have recruiting interest, which would be developing interest and motivation for student, as well as creating value in what they're learning. The next sub-principle is sustaining effort and persistence. So again, really developing that why for students. Why are they learning this why is it valuable to them, as well as sort of a reward system. And lastly, would be self regulation, such as students being able to self reflect on the work that they have done. And, and be able to take criticism and be able to put that forward into something positive and meaningful for improving work next time. In terms of multiple means of representation, one of the first sub-principles is perception. And this would be representing the material in many different means of formats. So this could be a visual format such as a presentation, it could be a verbal or audio format such as a lecture. So providing different means of representation so that different styles of learning are accommodated in your lessons. Next would be language and symbols. And so this would be taking into consideration how you're using language, ensuring that the language that you're using is suitable for all learners' levels in your classrooms, and then using symbols and pictures also to represent what it is that you're teaching. And finally, assessing comprehension, to see if students are following with what you're learning. The last principle of UDL is action and expression. This includes physical action. So how can a student show that they have engaged with the material and that they're comfortable with what they've learned? Physical action- maybe the student can write a play or perform a skit, rather than writing a paper. Again with expression and communication So considering that not all students are able to express themselves or communicate in the same way. So maybe again instead of a writing

assignment, a student could draw a picture or somehow communicate in a different way, that they have understood the material. And lastly, looking at executive function. So considering how students are able to make goals for themselves and keep themselves on track and timely. So next here we wanted to discuss a few accessible teaching strategies. These kind of strategies could be used in a variety of settings, and in many different subjects, and they might be familiar to you something that you've already implemented. If so it's a good refresher. If not, might be something to consider doing. So in the classroom, try and choose your course materials as early as you can. And in order to ensure that they can be produced in an alternate format. Alternate formats might include Braille, large print, audio, or digital texts, and sometimes these can take a long time to produce. So consider these materials in advance and anything that you may need. And so that you can get those produced a few weeks if not months prior to class. Additionally offer all of these materials, offer assignments and instructions in multiple different formats. Again that multiple means of representation. You should consider facing the class when speaking and repeat your instructions, important information, as well as any discussion questions to ensure that all students have heard them, and are following along. You can write any key phrases or lecture outlines on the board or the projector so that again students can follow along, visually and verbally, and then allow extra time for students to process information or questions. Some students may have difficulty with what they've heard or what they've read. So, ensure that they've got enough time to really process what you've asked them to do. In the laboratory some things you might consider: maybe give students individual tours of the lab space. This would be an opportunity to address any safety concerns, especially students with a visual impairment or physical impairment or even a cognitive impairment, allow the students to kind of acquaint themselves with the layout of the room and then the materials in it. You could consider assigning group lab projects, instead of individual projects, which would allow all students to be able to contribute, according to their abilities. So no student is singled out or left behind. Maybe arrange your lab equipment so that it can be easily accessed by all students. This would mean ensuring that students with visual impairments can see what chemicals or supplies they're using. And students with a mobility impairment are able to reach or grasp those materials. And finally offer written and verbal lab instructions, just to ensure that all students can follow along. And lastly in consideration of field trips, I know science might be an area where a field trip would be a great opportunity to let the students get some hands-on experiences and really acquaint themselves with the topic at hand. So this would be an area where you should consult with the student on how they might best be able to participate in a field trip. Please do not automatically dismiss a student from activities or a field trip or assign an alternate, chances are they will be able to participate one way or another, you'll just have to kind of figure that out with the student. And of course, it might go without saying but consider any sort of accessibility needs in your field trip planning. If you need a wheelchair accessible vehicle, or, or a bus that will accommodate a wheelchair, as well as any sort of tours, or presentations ensure that they are accessible as well. So next would be a few more strategies for how to engage students with print disabilities. And these are going to be a little bit more specific to students with print disabilities. So a good idea would be to dim the lights when working on a projector. This will minimize eyestrain, as well as potential distractions. Remember that there are some environmental factors that could cause difficulties for students, such as buzzing lights, fans, air conditioners. These can be really distracting. And so take those into consideration in your seating arrangements. As I kind of discussed before being called on in class without prior knowledge could be really disorienting, or confusing, or embarrassing for some students. So if you are going to call on a certain student in class maybe let them know ahead of time so that they can compose their thoughts

and have their response ready when you do call on them. Also, again offer hard copies of your lecture notes or outlines, so that students can follow along. That's another example of multiple means of representation, as well as students will be able to take their own notes and add to that lecture outline. It's best to keep any oral instructions logical and to the point. Sometimes going off on tangents or other stories could be a little bit confusing to students trying to keep their thoughts in line. And finally, when you assign homework, you might think about allowing students to have several days to work on the homework. This would allow them to take it home, interact with it develop any questions, process what they've been asked, and then ask any questions, and then process that feedback in order to get you a really successful final product. So this is the fourth step accommodation model. And I think this is a really useful tool when considering how you might accommodate a student in a particular class. In this case we're talking about math and science classes so I'll kind of use the science example as we walk through this model. So the first step would be what does the task or assignment require. So if we've got a lab experiment involving pouring chemicals together and watching the reaction. Sometimes teachers can be too close to see everything that's involved with a particular assignment. So it might be helpful to take a step back and really break down that assignment into the very small tasks involved. So a student would need to walk over to the equipment area, grab the equipment and materials that they need. Come back to their seating area, set up all of the equipment, and then conduct the experiment maybe they need to check the temperature of chemicals or measure the amount of liquid, and then watch for a color change reaction. So considering this lab experiment: Step two would be asking what physical sensory and or cognitive skills are needed. So in this particular example, a student would need to be able to navigate across the classroom to pick up and carry any of their materials back to their desk. Sensory: they're going to need to be able to maybe hear any verbal instructions, then need to see the chemicals to measure them, or to check the temperature in order to be able to see the thermometer, as well as be able to process all of the instructions and complete them in the right order. As we know some science experiments could be dangerous if done in the wrong order. So that would be a cognitive skill that needs to be there. Step three, would be what components of the task require accommodations. So again, this would be closely related to step two, if a student needs to navigate across the classroom to pick up their equipment, but they've got a physical disability where they're unable to hold or carry objects that might need to be accommodated. Students with a sensory impairment such as visual impairment may need an alternative way to access the thermometer to measure the temperature of the liquids or another way to know when the solution is changing color, and students with a cognitive impairment may need additional support in order to complete all the steps in the correct order. Lastly, what accommodation options exist. So this is where we can get really creative and start thinking about multiple different options. The student with the physical impairment, needing to carry the supplies across the room, you might consider a lab tray or a lab partner in order to help carry some of those supplies, the student with the visual impairment might benefit from a talking thermometer, and students needing to follow the instructions very carefully, also might benefit from a lab partner or having very specific outlined instructions into how to complete each task. So I think this is a really good model for breaking down a particular activity and seeing what sort of options are out there to accommodate a student.

Michael
Let's jump into math, and then we'll transition to science next. What are some of the challenges that students with disabilities face with math? First math expressions and equations are often not readable,

or they're read incorrectly, by screen reading software and some screen reading software might even treat a math expression as a picture or an image, and not even attempt to read it. Next we will view a video of one example of a screen reader, that is designed for math problems. So we just wanted to give you an example of a screen reader and how it could read a math expression. My personal opinion is that it might be useful to trial several different screen readers and see which one works best for your particular student. And it may also depend on what type of math is your students studying at the moment. Some screen readers might work better for you know trigonometry expressions. Some screen readers might work better for something like statistics, so my personal opinion is that experimentation and trying several different screen readers and really asking your student what works best for him or her. Another challenge with math is that math expressions use very specific language, which again can be tricky with certain screen readers. And finally, some types of math involve abstract or highly conceptual thinking, which can be challenging for both students with disabilities as well as students without disabilities. So in terms of math for students with visual impairments or blindness, some strategies include: considering the seating arrangement, particularly placing students with visual impairments close to the chalkboard or dry erase board. The teacher should clearly describe what is being written on the chalkboard or the dry erase board. This is consistent with the concept of multiple means of representation. In other words, giving the students the information in both an auditory and visual format. Students can use calculators with large text on the screen readouts large buttons, high contrast on both the screen readout, as well as the buttons and students can also consider using talking calculators or calculators with voiceover features which we'll discuss later in the presentation. A teacher can present graphs in tactile format. And we'll discuss how to do that, both in terms of low tech options and high tech options- we'll discuss that later in the presentation. The student can try a program such as EquatIO. EquatIO is a math to speech software. It can be integrated with Read and Write, and Browsealoud for text to speech functionality. And I should note that Read and Write is compatible with Math ML which stands for Math Markup Language. Next will view a YouTube video that will give you an idea of how EquatIO operates. So as you see on the screen at the moment, the student can handwrite on his or her tablet, and the software will convert the handwriting into math as you see here

YouTube Video
allows you to dictate math using your microphone and have it written out for you. Two x cubed plus 14 equals negative two.

Michael
So, you see here that EquatIO has several different features. It has a handwriting to math feature. As you see here with the two x cubed plus 14 equals negative two, it has like a speech to math ability. And it also has a math to to speech capability where it can read math expressions to the student. Next we'll talk about math for students with learning disabilities such as dyslexia and dyscalculia. The teacher should consider using both visual and auditory examples in order to adhere to Universal Design for Learning best practices in terms of multiple means of representation. The teacher should give extra time for processing instructions and completing tasks. The teacher can consider seating a struggling student near a student with strong math skills. It might be beneficial for the teacher to try to get buy in from both of the students in order for that to be a good relationship with the two students. The teacher should provide supervised practice. I've always personally disliked the expression "practice makes perfect" because in my opinion, practice makes permanent. In other words, if you're practicing

something the wrong way you're not going to achieve perfection. So, my personal opinion is that the teacher should provide supervised practice. So the student is doing the math correctly. And then, once the student is doing the math correctly, then and only then, will practice make perfect. The teacher should avoid memory overload. The teacher should review difficult skills. Using uncluttered worksheets can be very beneficial. Using graph paper to keep numbers in line, can also be very beneficial for certain students, as we see here on the right side of this slide, we have some basic addition problems, and the numbers are aligned in a vertical fashion, which makes it easier to complete these problems. So graph paper can help students keep their numbers in line in order to make the math problems easier to complete. And finally, teachers should consider using real life situations that make problems applicable to daily life. Math for students with physical impairments: The teacher should consider seating and positioning, particularly in terms of ensuring that the student has supportive seating. We don't want the student to expend all of his or her energy just trying to maintain an upright posture. That could contribute to muscle fatigue. And it could take away some brain power if the student is struggling just to maintain an upright posture. Similarly, we want the student positioned close to his or her materials. Again, we don't want the student to be reaching or expending unnecessary effort in order to access his or her materials. A slant board such as the one you see pictured here could be beneficial for a student so that instead of using one hand to write and the other hand to stabilize the paper, the clip that you see here on the right side of the screen, could hold the paper, which could free up the second hand to manipulate a calculator or turn the pages of a math textbook for instance. So with all of these seating and positioning considerations, it could be beneficial for the teacher to consult with an occupational therapist. A teacher can consider making manipulatives larger, and possibly attaching Velcro to the manipulatives which would make it easier for the student to arrange those manipulatives. A teacher can also consider using virtual manipulatives. Enlarged worksheets, enlarged tests and enlarged graph paper could be very beneficial for particular students with particular physical impairments. Some students may struggle to use small handwriting. So they may appreciate having a test with an enlarged format so they have a large space in which to write their answers. Large button calculators, can also be beneficial for students with certain physical impairments and EquatIO can also be very beneficial. As we saw earlier in the presentation, EquatIO has a math to speech correction, a speech to math function, in which the student can speak his or her math problems into the software, and this represents multiple means of expression in the language of universal design for learning.

Shelby
We're gonna jump into some science considerations. So we'll start out with just a few challenges that students may face, much like math, some science content may be very difficult to conceptualize. This is why we often present diagrams or graphs or charts to kind of illustrate what it is that we're teaching. And if this content is still inaccessible in the visual or alternate format then a student might have difficulty with science. Also many experiments are likely to require that students use their physical sensory or cognitive skills and so these may require accommodations. So we'll look at some ways to do that. Science for students with visual impairments or blindness: Here's some tips to consider. Michael talked a little bit about seating arrangement and how that can be beneficial for students, and being able to access their materials in terms of science, you want to ensure that students can see the demonstrations, and that you've got a safe layout for your laboratory. You don't want students who have difficulty seeing, trying to walk across the classroom carrying potentially hazardous materials or bump into another workstation and compromise another experiment. So consider your seating

arrangements, orally describe any demonstrations or visual information that you're showing. If you do have a movie, try and turn on audio description where it's available. And this is a lot like closed captioning in many ways, except nothing appears on the screen, but the narrator will describe what's going on in any silence so it won't interfere with any dialogue on the movie, but will enhance the visual components of that movie. Another option would be to connect lab equipment to a large TV monitor or screen. So, you could try this with a microscope, or another camera-like object. Use adaptive lab equipment, with audio output or other formats such as Braille large print or tactile markings. This could be a talking thermometer or talking scale. Consider lab materials in large print or Braille- we've talked about that a little bit. If your lab has any sort of warning system, maybe a red light, ensure that that is also audible, so that students with a visual impairment can hear if there's some sort of emergency. And finally, consider providing a lab partner. This may or may not be necessary but that would be something to consult with your student on. Next, we'll talk a little bit about science for students with learning disabilities. So again, providing materials in audio or digital formats could be beneficial. Incorporating visua,l tactile, and oral components into instruction. Again, multiple means of representation. We've talked a little bit about giving extra time for processing instructions and completing tasks for students with learning disabilities. Turning on closed captioning in any movies or films being shown could be beneficial. And again seat students away from distractions, such as windows or air vents, fans. And maybe seat them near a student who is successful with the lab experiment. And then for students with physical impairments: Again, we want to make sure that these students can see the demonstrations, from a seated position. I know that it's common for students to often crowd around maybe a demonstration area, but you want to ensure that your students with physical impairments, are toward the front and can still access that demonstration. You want to make sure that students have access to an accessible workstation. So on the right hand side of this slide, there is an example of a horseshoe-shaped table. This could be a nice accomodation to limit the reach that a student would have to do in order to get to all of their materials. In theory, they would have everything pretty accessible right around them instead of across the table. Placing lab materials within reach from a sitting position goes right along with that accessible workstation. Again, this could be an option where you could provide a lab assistant or scribe, or even have students work in groups in order to ensure that all students can participate and contribute, according to their abilities, and in some cases you might be able to use computer controlled lab equipment or an alternate input device. So maybe connecting a microscope to a computer, and then using keystrokes or different key commands to manipulate that microscope, rather than having to rely on fine motor skills for focusing or magnifying. And just some final considerations here for math or science. Consult with a specialist for your particular student. So for students with visual impairments or blindness, this would be a teacher of the visually impaired; a student with a learning disability may have an IEP or a 504. So think about talking with that team or students with physical impairments, might work with occupational therapists or physical therapists. All of these professionals will know how to accommodate students with these sorts of disabilities, every student is different but they're probably working with a specialist who knows that student, or they'll have suggestions for options that might work for a particular student. So don't be afraid to consult a specialist or professional even discussing with other members on your team could be beneficial. So ensure that the student is included in class discussions and projects. This will help them develop the confidence and advocacy skills that we discussed earlier. Ask the student, what is best for them. Chances are, they've had similar difficulties or something in the past. They'll know what has worked best for them, or what hasn't worked for them. So just keep in mind that the student is the expert on their own disability

and abilities. You should allow and encourage the use of assistive technology in the classroom. And then on top of that, be creative and be flexible when it comes to finding solutions. It may not be the first thing or the easiest thing that comes to mind. But there is going to be something out there that we can do, and sometimes we just need to think outside the box.

Michael
At this point in the presentation we're going to jump into specific devices for accessible math and science. Some do it yourself, math, and science hacks include using 3D objects for geometric shapes. So in the upper right corner of this slide, you can see six 3D shapes. So that could be useful for a student in a geometry class who might be required to calculate the perimeter of these 3D shapes or the area of these 3D shapes, a teacher could consider using a 3D printer to create custom objects. Those custom objects could be geometric shapes for a math class, or something like a heart in a science class, or an anatomy class. A lower-tech version of using a 3D printer could be to use a pegboard with golf tees and rubber bands to draw shapes or develop spatial awareness. A teacher can make tactile graphs. By using glue guns or fabric paint. Later in the presentation, we'll discuss a higher-tech way to make graphs tactile. A teacher could use staples on a ruler to label increments so again that's a low-tech kind of low cost way of making a ruler accessible for a student is to put a staple every centimeter or every half centimeter or every inch or every quarter inch. And the teacher can also make a tactile graduated cylinder. Using cork, or styrofoam since cork or styrofoam float so you could sort of attach a tactile ruler to the cork or styrofoam, and you can contact us for a detailed explanation of how to do that in your class.

Shelby
So some hacks continued... thinking about maybe some options for science. You could make a syringe tactile by cutting notches in the plunger at five milliliter increments as recommended but again whatever would suit your needs best. Similarly you can make a triple beam balance tactile by filing deep notches for each gram increment. And then you could add drops of glue on either side of the balance line, so that the student would be able to know when the weights are, in fact, balanced. A way to identify units of temperature on a stove would be to put drops of fabric paint or sticker bump dots around certain intervals, each interval or again as needed. Consider using different textures, like sandpaper or yarn. Really, you've got a lot of options here. In order to identify drawers, cabinets, or equipment areas around your classroom, around your laboratory, even at home, could be a possibility. And also you could think about making models, out of clay, Plaster of Paris or Papier-mâché, and whether this is you as the teacher, creating these models in advance, or having the student create it in class, those could be some fun ways, and relatively cheap ways, to demonstrate some of these concepts.

Michael
In terms of a math class, certain students might benefit from a hands free calculator. And one example is called the Newton. It is an iOS app. It is free, and the student can either use his or her voice, or keyboard to input calculations and using the voice to input calculations could be beneficial for a student with a motor impairment who might struggle to use a traditional calculator that has small buttons. An additional benefit of the Newton is that the user can export his or her calculations. And the Newton was last updated in 2015. Another calculator is called the Talking Calculator. Talking Calculator is its official name. It is an iOS app. It's $2. When you press a button that number or function is read aloud to you.

And then when you press the equals button, the answer is also read aloud. One of the benefits of Talking Calculator is the user can switch between high and low contrast. So you see pictured on the right side of the screen: two versions with different contrast levels. Talking Calculator is compatible with voiceover. One benefit of Talking Calculator is that the student can record a new voice in about five minutes. So the student could record his or her own voice, his or her parent's voice, his or her teacher's voice his or her friend's voice. So when the student presses eight instead of hearing that computerized version of eight, the student could hear Mom or Dad saying eight or the math teacher saying eight. So that could be a great option for the student to really customize the calculator and make it feel more familiar and more personal. Calculations are recorded and can be viewed or emailed. So that could be a great solution for a student who is able to email his or her math from this calculator app directly to the teacher. And as the student moves into more advanced math and science courses, other options, made by the same publisher, include Talking Scientific Calculator and Talking Statistics Calculator. The Orion IT 84 Plus talking graphing calculator is a graphing calculator that provides visual, auditory, and haptic feedback, and the auditory feedback is quite unique on this calculator insofar as when you're graphing complex equations, it can be difficult to see what does the graph look like. So, this particular device provides feedback as the graph goes up and down. So I'll show you a video, which shows you the audio feedback that this calculator provides. So as you can see from that video as the graph goes up and down, the auditory feedback goes up and down. Other options include large print and Braille rulers, and large print and Braille protractors. As we discussed earlier in the presentation, there are low-tech ways to create 3D graphs. A high tech way to create 3D graphs, as well as other 3D images is a device called Pictures in a Flash or PIAF. It is a machine that makes raised line drawings on special paper called capsule or swell paper. The PIAF device is pictured on the right side of this screen, and a teacher could use this device for any number of different applications. The picture on the right side of this slide shows a graph with the x axis and the y axis as well as the graph itself. A teacher could also use this device to create an image of an atom, or a molecule, or cell in the human body. Or if the student is in a science class, learning about various geographical features such as mountains or valleys, those could also be demonstrated in a 3D format using this device.

Shelby
So this next piece of equipment or assistive technology is a bundle made by the company called Rocketbook. So this is the collaboration bundle, and it comes with a few different devices. Primarily what Rocketbook does is allows the user to take pictures of the notebook or the whiteboard and make it into a digital format. So this comes with a notebook which has reusable notebook pages, the student can write with one of the rocket book pens, and then take a picture using the Rocketbook app of the notebook page, and it will convert that page into a graphic, a digital graphic format, and the student can then go back in on their computer and access and manipulate their notes as needed. Similarly, this comes with a 10 by 15 inch whiteboard, which has the same capability to be scanned with the Rocketbook app. This might be helpful when completing math problems or doing group work, drawing out diagrams. So, a student could snap pictures and follow along with what their peers are doing. And another cool tool are the Rocketbook beacons, which are approximately three inch or so triangles that look like photo corners. They can be placed in the corners of a whiteboard or another writing surface, and will essentially turn that whiteboard into a smart board. You can also try taking a snap cast, which is similar to a live feed; what will happen is the beacons will snap a picture every five seconds of what is on the whiteboard, and that will be transmitted digitally to maybe a student's device. And so they could

see what's happening on the whiteboard in pretty close to real time. Another option which would be good for math or science is this app called Vital. It's a digital tactile graphic maker. And I know this sounds counterintuitive, but this is a pretty cool app, which uses audio feedback, like tones, as well as haptic feedback, or vibrations, in order to help a student navigate what's on the screen. So for example, this graph here is a pie chart on this image. And so the student could move their finger across the touchscreen. And each time they get to a different slice of the pie, the tone would change, and maybe there would be a vibration to indicate the different pieces of the graph. So Michael's got a video here which he'll pull up and we'll demonstrate a little bit more about how that works. So that was a good demonstration. Next is our adapted science materials kit, which is a pretty cool kit. It's got accessible beakers and graduated cylinders with a float, which will help indicate the level of liquid in the beaker. The student can feel the tactile markings to know how far out the ruler is sticking, which will indicate the level of the liquid inside. In addition, this kit comes with a balance, as well as one five and ten gram mass blocks. So a student can weigh different objects and identify those different mass blocks by color and texture. There's a funnel and a funnel stand to help pour chemicals or other materials, as well as a talking thermometer and a few other pretty cool devices in here. And this next option is a really good guide called Adapting Science for Students with Visual Impairments. This is a guide for teachers on how to make their science labs and experiments accessible, as well as just how to teach science to students with visual impairments. It could be beneficial for a science teacher, or for a teacher of the visually impaired. And you don't need background on science or working with students with visual impairments. So this is a really nice comprehensive resource. Next, as we discussed earlier in the presentation, there are ways to make microscopes accessible. So this is one option. And this is a wireless digital microscope by the company called Pancellent. So this is a small microscope, maybe six inches wide by an inch and a half in diameter, and it sits on a little four by six platform with a grid. And it magnifies up to about 1000 times. And it will connect wirelessly to a tablet or mobile device, or you can use a USB cord to connect it to a computer or a laptop, which would enlarge the screen, and allow the user to be able to see a little bit better what it is they're looking at. And in addition, they would be able to use any of the built-in accessibility features on the device that they're using in addition to the standard magnificatio of the microscope. This next device is a tactile device so there are two devices here. This is the DNA twist model, and our DNA and RNA model kit. So the DNA twist model has... it looks like a ladder, so it's got foam on the outside for the DNA backbone. And then each base pair- in the middle are the rungs, and they are represented by different colors and textures and those colors translate into the DNA, RNA model kit, which is more of a 2D puzzle. And so each base pair will match with its given pair and will not match together with the ones that it does not go with. So a good visual and tactile representation of DNA and RNA.

Michael
These are some resources that can benefit you as you move forward. The first is the American Printing House for the Blind, or APH. And I'll let Shelby discuss this in a little more detail.

Shelby
Yeah, so the American Printing House for the Blind is a great resource for students with visual impairments or blindness. They've got a lot of resources that are tactile or Braille. And several of the devices that we've discussed today are available through APH. APH has a program called federal quota funds, where these funds are distributed to schools or states, and then can be used to purchase

APH equipment. So if that's something that you're interested in, please contact Vision Outreach Services. This is who manages the federal quota funds. And I know that they also have some APH equipment available for schools to borrow or try out. Additionally here on this resource page, we talked a little bit about 3D printing, and making your own objects. Here at the University of Wyoming we've got the University of Wyoming Wyrkshop is a makerspace available for use, you just need to go through some training courses to learn how to use the equipment, and then you can go in and print some of your own devices and materials to use. Along with this, there's a website called thingiverse.com. And this is a repository of 3D print files for free that people have put out, and so you can browse and they've got a number of learning aids as well as assistive technology out there.

Michael
Some additional resources for you include the Wyoming Accessible Educational Materials Clearinghouse. And you see here the telephone number, email address, and website. Similarly, Wyoming Assistive Technology Resources can be a great resource for you. And the phone number, email address, and website of Wyoming Assistive Technology Resources or WATR is listed on this slide. And finally, we'd like to draw your attention to the AT 4 All device database. The website is located at the bottom of this slide. The lending library is administered by Wyoming Assistive Technology Resources or WATR. And you could think of it as a library except instead of having primarily books, we have primarily assistive technologies, so many of the devices you saw in our presentation are available for a free six week rental. So go to that website and you can see the devices that are available. Here are some references we used, and these may be of benefit to you. I will hand it over to Shelby to make some concluding remarks.

Shelby
Thanks, Michael, and thanks everyone for attending and watching this webinar. If you have any follow up questions please feel free to contact us. You found the contact information on the previous slide, or it's available through the Accessible Educational Materials or Wyoming Assistive Technology Resources website. Good luck with your math and science for students with print disabilitiess.