Hello. Welcome. Thank you for joining me today as we talk about making connections between visual arts and math in the middle school. My name is Jim McKowen. I'm a math and STEAM teacher at Hopatcong Middle School in Hopatcong, New Jersey. Throughout my teaching career, one thing that I've always tried to incorporate into my class are projects and activities that tie in what we're doing in class to the real world. I also try to allow students to show their knowledge in creative ways, whether that means allowing them to make connections with sports, or music, or use their artistic abilities to express themselves. I always look for those opportunities. Today I'm going to show you guys two activities that I've come up with that work really well in this regard. If you have any questions about either of these activities, please feel free to reach out to me. Email is JMcKowen@hopatcongschools.org or you can tweet me @MrMcKowen.

The first activity that we're going to talk about is a project I call eight bit art. And I got the inspiration for this project from an article I read in NCTM magazine called Masterpieces to Mathematics using art to teach fraction, decimal, and present equivalents. And the article talks about the artwork of Ellsworth Kelly and using that to express fraction, decimal, percent equivalents. I think I took it to the next level and brought in something that relates to a few more students and looking at eight bit or pixel art characters. So, with this project they have students either choose a pixel art character or a recognizable symbol or they can create their own artwork piece in the style of Ellsworth Kelly and then use that to find the number of squares in the grid for each color that they've used and express that as a fraction, a decimal, and a percent. With this project, I recommend that students use a minimum of four colors and that just gives us more room for these calculations.

This project can tie into either sixth or seventh grade math standards depending on where your focus is. You can look at the ratio concepts or finding a percent as the rate of a hundred at the sixth grade level or you can look at division of integers and converting rational numbers to decimals at the seventh grade level. From the visual arts standards we can look at their creative process, how students are coming up with their artwork piece or choosing their character, performance in visual art, actually creating that artwork. And then if you wanted to you can probably even tie this in to an aesthetic response and critique methodologies if you want to have students peer evaluate each other's works. So, let's take a look at some examples.

The first student example I'm going to show you here does a very nice job. You can see that the student chose to do a checkerboard pattern in the background which was very nice because a lot of students will just leave that background all white. We've got all the different colors in our table here. We've got the number of blocks of each color. You can see that for this project, the student used a 12 by 12 grid, so our fractions are each number of the color over 144. One thing that this student could have done is simplify the fractions. I always like to recommend that students should be expressing their fractions in the simplest form. So, that's one thing that this student could have done a bit better. Then you've got your decimal equivalents for each color and finally your percent equivalent for each color. Overall, this student did a very nice job.

The second example I'm going to show you guys here. I show you this one because it highlights something that I recommend you try to avoid and that is what's going on up here at the stem of the apple. If we look at at the stem here, this student is using portions of blocks of different colors and I try to avoid this because it could lead to some complications in calculating the number of blocks of each color and then your fraction decimal percents. This student did handle that nicely and you can see that each of those partial blocks can combine with another one to create a full block, but something to avoid. Again, this student probably could have simplified their fractions in the simplest form but you've got a nice job fraction, decimal, and percent equivalents. Great, so that's the first activity I want to show you.

The second activity is at an eighth grade level or an advanced seventh grade level if you talk about geometric transformations. This project is going to use a pixel art figure character of your choosing. Students are going to plot those characters in the first quadrant of a coordinate plane and then apply a number of geometric transformations to that pre image.

When I was brainstorming this project idea, I was working with the art teacher at my school and he showed me a color theory project that he does that he thought might tie in nicely to this and after a little bit of brainstorming we came up with a way to merge those two ideas. So, each geometric transformation that we look at here is going to utilize a different color theory idea. All right. And we'll go through that as we go.

With this project I like to print out and even blow up a color wheel and this will really help the students with the color theory ideas. If you have students that don't have an

art class or have never seen the color wheel like this it can really help to have an enlarged version or even a version that you can give each student Standards for this project, you've got all your eighth grade geometry standards focusing on geometric transformations, rotations, reflections, translations, dilations, all that's covered. From the visual arts, synthesizing early knowledge and personal experience to make art and then refine and complete artistic work, how students are choosing their character, and then making sure that each color theory idea is being executed properly.

When I assign this project, I also like to give my students an example that they can work off of. So, I'll put a fully completed example project up on Google classroom and allow the students to use that as a model. All right. So, part one of the project I always share with students uses Mario. We've got Mario plotted in the first quadrant here. He's colored the way he normally would be. And then we highlight a number of points around Mario and list those coordinates. The number of points that you choose to have your students highlight is up to you. I usually go with six to eight because that does give us a good idea all the way around our character.

The second part of the project, we're going to start looking at the geometric transformations. And part two focuses on translations. I like to give the translation rule to my students in arrow notation, and I do this because it gives an algebraic method for students to find their coordinates or double check that they did the translation properly. So, we've got our first translation here. From a color theory standpoint, we're using a monochromatic color scheme so we're going to color Mario in different shades of red for the first transformation. The second transformation then we're going to use a secondary color so we've got different shades of blue. And you can see the second translation picks up from where the first translation left off.

Let's move on to part three. Part three now talks about reflections. We're going to do three reflections here, one over the X axis, one over the y axis, and then one over the origin or the line Y equals negative X. The color theory idea we're using here is opposite or complementary colors and this can be a difficult idea for students to grasp. So, I like to utilize that color wheel again here to show them how to do it. If we think about the opposite colors, we can think about Mario's hat is red. The opposite color for red is going to be the color that is across from red, so green. So, one of our reflections here, all the red pieces should be colored in green. The other two reflections are going

to use complementary colors. Complementary colors are the colors on either side of the opposite. So, we've got blue green and we've got yellow green.

Part four, now we're going to look at rotations. We're going to do two rotations here, a 90 degree clockwise rotation and then a 180 degree counterclockwise rotation. The color theory idea we're using here are warm and cool colors. We decided to go with warm colors for our clockwise rotation and then cool colors for our counterclockwise rotation. So, our warm colors are going to be our reds and oranges, our cool colors would be our blues and greens.

Part five then, now we get into dilations and again this can be tough for some students. We're going to do two dilations here and enlargement with a scale factor of three and that's going to blow up our figure. So, we're going to use a lighter tint of our colors as our color theory idea. Second dilation is going to be a reduction with a scale factor of one half and with that our color theory idea is going to focus on darker shades. So, we're going to color in darker versions of our original colors.

Next we have part six which is an extra credit opportunity focuses on multiple transformations and multiple color theory ideas. Some students will choose to do this others will skip it. From a grading standpoint here, I like to give my students the rubric ahead of time. It allows them to see what I'm going to be looking for as I grad it but it also gives them the opportunity to self assess and self reflect as they work.

So for this rubric, we've got a checklist. They did each thing, they kind of did it, or they didn't, easy to follow along with. For the students, it should be easy enough for them to anticipate their grade. Let's look at some examples. The first student example I'll show you here is this parrot. Lots of colors. This student was able to do both translations on the same graph so we've got monochrome reds and monochrome blues for the second.

The next part of the project was our reflections and you've got opposite and complementary colors here. So, our reds go to greens and so on and so forth. Nice job there. We then have our warm and cool colors with our rotations. The student did a nice job with that as well. We've got our enlargement using a lighter tint of our original colors and we've gotten our reduction using darker shades. The student did a very nice job. \

The second student example I'll show you, they used one of the Ninja Turtles. So, we've got our pre image here. You've got our first translation using monochrome green colors, our second translation using monochrome reds. We've got our opposite and complementary color reflections. And we've got our warm and cool color rotations. This student chose not to do the dilation so of course lost points on that but overall a nice job on the parts they did do. So, there you have my two activities, the eight bit art activity focusing on fraction, decimal, percent equivalents, and the geometric transformations and color theory project focusing on geometric transformations and using different ideas of color theory.

Here are a couple other ideas that I've used or had over the years. The cartoon character blow up project is a great project focusing on ratios and proportions. I know it's a common project in art classes so team up with your art teacher and I'm sure you can make a great activity out of that. The second one here is the dilated superhero. This is another project that I've seen on NCTM it's an activity where you draw your students as superheros using a dark room and a flashlight and then you find the scale factor of their shadow enlargement. You can probably tie into the marvel cinematic universe with this activity if you want to by looking at Captain America before and after he took the super soldier serum or by looking at the incredible hulk before and after he transforms.

The next one is a Greek temples project. We do this at the seventh grade, piggyback with the Social Studies and ELA classes on their ancient Greece unit and their Greek mythology unit. Students build a temple to a god or goddess and then use that temple to find the surface area and volume of all the pieces. Or you can use this project idea to build any type of building you want. I've seen it done as building an addition on a school, building a new playground, things like that.

And then, finally to tie in music we've got the creative ringtone activity. I got the idea for this one from Thirteen.organization, a program they call get the math. The tiny URL is there if you want to check it out. I know the website is no longer actively supported so some of the links and documents may not work the way they used to but last I checked most of it is still available. It's a great activity.

That's all I've got for today. Thank you for joining me. Again, my name is Jim McKowen. If you have any questions, please feel free to reach out to me. Email JMcKowen@hopatcongschools.org or you can tweet me @Mr McKowen. I'll try and get back to everyone as quickly as I can. Thanks and enjoy the rest of your day.