A Choice Board for Using Browser-Based Media Design Software to Demonstrate Mastery of STEM Concepts

See https://science-creativity.com/projects for detailed descriptions, examples, and grading rubrics for each type of project and https://science-creativity.com/software-training/ for instructional videos on how to use the software.

The following table has brief descriptions of some possible projects that could be done in each concept category and for different types of software and projects. This is not an exhaustive list – the types of projects possible are only limited by your imagination. You can choose one of these or propose your own idea, but it does need to incorporate digital media production, demonstrate your mastery of the STEM concept you are presenting, show high levels of creativity and quality, and have the ability to teach other students about your topic.

Media Mode/ Software	Project Type	Project Descriptions
Photopea or Inkscape	Comic Book or Graphic Novel	Draw the frames, characters, scenery, and talk balloons by hand with pencil, then ink in the lines, erase the pencil, and photograph the pages. Clean up the panels in Photopea, then use the Colorizing Line Art video under Photopea to learn how to add color, textures, and text to your frames.
Image creation using pixels (Photopea) or vectors (Inkscape)	Collage or Scrapbook	Combine a series of photographs together inside Photopea by placing each one on its own layer, carefully selecting the edges using the QuickMask tool, and adding Layer Masks, drop shadows, captions, and other features as shown in the Isolating Images with Layer Masks video under Photopea. This can be used for making collages, scrapbooks, cover designs, photo essays, and more.
	Flip Book or Pop-Up Book	Using Photopea, you can design the parts of a pop-up children's book. You will need to look at examples to see how the parts are folded and glued onto the main page so that they will reliably fold up and unfold as the pages are opened and closed. Then once the outlines, folds, and tabs are designed in Photopea, they can be colored, printed, and assembled.
	Technical Diagrams or Illustrations	A technical illustration of diagram is an excellent way to demonstrate your understanding of a machine, process, or network of ideas. Inkscape and Photopea can both be used with the Type and Line tools to make shapes and show connections. For example, you could create a concept web or show the steps in a process. Place the different types of design elements (lines, shapes, text) on separate layers so that they can be moved and resized as needed. Use the Magic Wand to select areas and add colors. If you expand the selection by a pixel or two, then move to a new upper layer and fill the selection with color, you can set the layer blending mode to Darken and avoid any gray pixels around the edges.
	Illustrated Lecture Notes or Book Report	Some students have neat handwriting and take notes that are a work of art, will doodles and decorations. You can create a project to demonstrate your mastery of the concepts by using Photopea to clean up and add photographs, to your notes along with images, diagrams, and computer text to your notes.
	Blog Post w/ Images	If your teacher has a blog site you might dig deeply into a topic by writing your own blog post for the site, including finding images or illustrations, creating and laying out the post, and adding captions. Not only will you learn some web design principles and HTML, you will be sharing your knowledge with other people around the world.
Easel.ly, Canva, PiktoChart or Thinglink	Infographic or Linked Poster	An infographic is a poster on steroids. It includes data, charts, graphs, images, text, and is nicely designed and laid out to be eye-catching and informative. Using online infographic software such as Easel.ly or PictoChart, you can add the components of your research into an infographic. Canva also has templates. ThingLink allows you to add pop up captions, web links, and even video clips to create an interactive poster.
Desktop Publishing (DTP) and layout design	Brochure	Using both sides of a single sheet of 8.5 x 11 inch paper folded into thirds, you can use Canva to layout a brochure. It could be a travel advertisement for a planet, a brochure on careers in chemistry, or any other STEM topic. The first panel is at the right on the outside page and introduces the topic with an eye-catching image and simple text. The B panel is

		on the left of the outside page and pulls the reader into the topic more, with detailed text on the inside with panels C, D, and E. Panel F is for contact information and a return address.
	Newsletter or Magazine	Using Canva or other desktop publishing software, students can write articles on a subject, create illustrations with captions, and lay out everything in a multi-page newsletter or even student-created magazine. You can add automatic page numbers, jump links, tables of contents, banner images, sidebars, and other features. A good example is the newsletter my students created on astronomy topics called *Ad Astra Per Educare*: To the Stars Through Education.
	Illustrated Children's Book	You can use Canva to layout your own drawings and add text that wraps around the images to create an illustrated children's book or story on a STEM topic of your choice. This could be printed out and bound or converted to a PDF for online sharing.
	Illustrated Poem or Essay	If you are a poet or enjoy writing essays and opinion pieces, you can create illustrations, photograph them and clean them up in Photopea, then take them into Canva or other DTP software to add your poetry or essays in a nicely formatted book. You could take it further and add text effects, illuminated capitals, and create a complete artistic manuscript similar to what monks created in the Middle Ages, but using all the best digital tools.
	Board Game w/ Cards & Rules	A great way to demonstrate your knowledge of a subject is to create your own review game. It can be based on existing games or be entirely unique. Using Photopea or Inkscape, you can build the graphics for the board and cards, then bring the designs into Canva to add text for cards, the board, rules, and packaging, and put together a mock up for an entire board game. Imagine a game of Cellular Pursuit, Geology Monopoly, or a Game of Life for physics careers.
Animaker, Powtoons, Prezi, or Voki	Animated Presentation	GoogleSlides and other programs can create excellent presentations, but we have all seen too many of these, especially the poorly designed ones. To give your presentations more interest and effectiveness, Animaker and Powtoons add animated characters and elements such as text and other objects. Prezi changes the presentation into an animated concept web and allows the user to zoom in and out of different areas of the web.
Animated presentations and text to speech	Text to Speech Animation	Voki allows you to type in text, select a character and voice, and have that character read your text while it mimics your face and eyes. These "talking heads" can be used in videos or presentations. Imagine William Shakespeare with a British accent reading your own poetry or reciting your brilliantly written essay.
StoryBoardThat, or MakeBeliefs Comics	Cartoon Strip or Comic Book	If drawing comic strips or graphic novels by hand isn't your thing, StoryBoardThat and MakeBeliefsComics provide a range of characters, backdrops, props, and text effects and can do up to six frames at a time. You can change the colors of backdrops and characters, pose them in different ways, choose different expressions, and use them to tell a story or discuss a STEM concept. You can take a screen shot of the six frames, then make another.
Comic strip or storyboard creation	Video Storyboard	In addition to comic strips these programs can be used to plan out the positions and camera angels as a story board for a narrative film. It is very important to do this with as much detail as possible when planning a film so that the actors will know what to do and what to say and when to do them.
SculptGL, Tinkercad, Aero, and/or Mixamo	3D Still Images	Building a 3D model can have many applications for demonstrating STEM concepts, from showing a mock up of a final product or design to creating 3D animations. SculptGL allows you to make free-form models starting with a virtual ball of clay and pulling, pushing, smoothing, creasing, and pinching it into your final shape. The model can be painted inside SculptGL, then exported for use in other programs. The 2nd video on using SculptGL talks about adding textures, then exporting it through Adobe Photoshop (with 3D features) to flatten the texture, then save as a FBX file so that it can be brought into Adobe Mixamo for auto-rigging (adding bones) and animation. Tinkercad is used for more precise alignment and has a wide range of primitive objects, and it can do Boolean commands. These models can be brought into SculptGL for texturing, then Mixamo for animating.
3D modeling, texturing, rigging, and animation	3D Still Image Sequence	Neither SculptGL nor Tinkercad can do animation natively, but models can be rotated at precise angles on the X, Y, or Z axes in Tinkercad and screen images captured which can then be aligned and re-exported from Photopea and used to create rotation animations in a timeline-based program such as video software or Wick Editor. For example, when creating a 3D model of a product, it can be animated to rotate 10 degrees at a time and viewed from all angles.
	3D Animation w/ Mixamo	When a model with texture has been created in SculptGL or Tinkercad, it can be exported from Adobe Photoshop as an FBX file and imported into Adobe Mixamo, a free online program. It will walk you through how to set markers and auto-rig the model, then you can

		choose from hundreds of pre-created animations based on motion capture data and machine intelligence. The animations can be saved as FBX files for Blender or Adobe Aero, or the animation can be screen captured as a Quicktime video or image sequence, then controlled by programming in Wick Editor or Scratch. You will need to watch the Sculpt Video 2 to see this entire process.
	3D Prints to Mini-Musuem	Another pathway for 3D models is to save them as OBJ or STL files and the print them out on a 3D printer. They can be painted by hand using acrylic paint (for a matte finish) or fingernail polis (for a glossy finish). If you create an explanatory information card in Canva and print it out on card stock, they can be used as part of a mini-museum. My students have done this for a virus mini-museum and a display of extinct life forms.
	Build Models for Puppet Show	3D models can also be designed then printed, painted, and used as puppets for a live puppet show or stop motion animation. They can be designed with posable joints or with holes where a wooden skewer or lollipop stick can be inserted for moving the puppets around on a stage. By adding a script, backdrops, and props, a fun STEM project can result.
	Augmented Reality Scene w/ Layered Backdrops	Adobe Aero is both a desktop program (requiring a subscription) and a free phone app that allows you to load in 3D assets (including animated video clips) and layered 2D images from Photopea, which can have their layers spread out on the Z axis to provide the illusion of depth as a kind of billboard 2.5D object. These objects can be triggered by starting the program, by proximity, or by tapping the object. A person can then load up the program and record video of themselves interacting with the objects in a real scene. Imagine loading an animated 3D T-Rex dinosaur that can be scanned into Aero through activating a QR code on a museum display at a local dinosaur museum. This would greatly enhance the user experience and bring the displays to life.
Audacity, Soundation, or Vocaroo	Radio-style Drama	Creating an old-time radio drama in the style of the 1930s can be a fun way to explore a concept or present an idea. Vocaroo allows you to record your voice from your computer's microphone (although most computers come with a similar recording feature) and Soundation allows you to add sound effects and music loops, or to import your voice tracks and add special effects. You will need to write and practice reading a script so that you won't have to spend as much time editing the audio. Audacity is a free program that requires installing on your computer, but it is loaded with all the features you need including de-noise filters.
Sound recording and editing	Podcast	A podcast is a conversation, interview, or scripted audio recording that is part of a channel of similar recordings. As a group of students you could create your own podcast channel and build a series of episodes around a central theme related to your STEM classes.
	Original Song	Soundation allows for recording virtual instruments from a built-in keyboard but requires some practice to get used to playing your keyboard keys correctly. With some practice, you could compose your own music or original songs about your chosen STEM topic.
WeVideo Canva, Adobe Express, or iMovie	Still Image Sequence in Frames	The still image sequences you create from Photopea or from screen captures of 3D models, stop motion images, or other sources can be imported into video editing software including WeVideo, Adobe Express, and iMovie. Canva has some video editing capabilities as well. The still images can be brought in and dropped on the timeline at one image per frame.
Video recording and editing	Public Service Announcement	A Public Service Announcement (PSA) is a 30 second or 60 second video that tries to persuade people to participate in a public service such as recycling or getting immunizations. The format can be used to promote understanding of any STEM concept and should establish a need, provide a solution, and end with a call to action.
	Documentary	Any STEM concept can be approached as a documentary film by gathering evidence and interviewing experts. Experts can be contacted and interview questions prepared and shared in advance, then supporting footage and narration used to fill in the gaps of the story. Where possible, this should be a first-person account, or direct interviews of the participants in an event or issue. Good audio equipment is just as important as good video, and multiple cameras and microphones should be used whenever possible.
	Narrative Film	This type of film is scripted and fictional. Characters are developed as portrayed by actors who memorize their lines and actions. Settings and locations must be scouted, and a degree of cinematography is necessary including planning for camera angles, establishing long-range shots as well as medium and close-up shots all planned in advance with storyboards. Editing is extremely important to tell the story with the right pacing and emotion. A soundtrack of music should also be included to set the tone or mood of the scenes.

	Vodcast w/ Interviews	A vodcast is a video version of a podcast, where two or more people have a conversation on a subject where all have good microphones and camera angles, then the footage is edited together to keep the conversation going.
	Music Video	As long as you are creating your own original song, you might as well make a music video of it. Of course, you can create your own words to an existing song that have to do with a STEM concept and then plan and shoot a music video. You'll need someone who can sing well and doesn't mind being on camera. Multiple takes will be needed along with special effects. You can film in front of a green screen and add 3D images or animations.
	Network News Broadcast	In the style of a “Breaking News” report or a network news broadcast, you could create a video segment on new advancements in STEM fields, or as an historical broadcast when an important discovery was made or theory developed. “This just in – Galileo Galilei again defies the Church to claim that there are spots on the Sun!”
	Stop Motion Animation	Using a cell phone or iPod camera kept in the same position (using a frame or tripod), create a stage of butcher paper and move objects around such as pieces of paper, 3D printed models, or homemade puppets to create a frame-by-frame animation. It will need to include titles and labels for the parts and be carefully planned out. A good animation can have hundreds of frames. It works best to have several movers and a cameraperson who can say “Clear!” before taking a photo so that all hands and fingers can be moved offstage.
Wick Editor	Image sequence (1 per frame)	The sequence of images created using screen captures of 3D object rotations or from stop motion photos can be lined up by stacking the images in different layers of Photopea, then using opacity settings to align each frame. The whole stack can be cropped and each frame re-exported as exactly the same size of pixels. The stage in Wick Editor can be set to that size and each image loaded into the asset library and arranged on separate timeline frames. Additional tweened animations can be built in upper layers for complex animations.
Timeline-based tweened animations and interactivity	Tweened Animation	Simple objects can be created inside Wick Editor and turned into tweened animations. This would be great to demonstrate simple motion problems in a physics class, or designing and animating a Rube Goldberg device, or showing a nuclear chain reaction or other process.
	Website-style Branching Information	Frames in Wick Editor can be programmed with interactive buttons using three images for a rollover effect to jump from one paused frame to another anywhere in the timeline, then jump back. This allows for interactive branching programs; a list of options can be shown with individual buttons that link out to other frames and back. The whole project can be saved as an HTML document and loaded in a browser window just like a website. Examples can include the different pathways by which stars evolve, a program for deciding how to name chemical formulas, or descriptions of the design, building, testing and flight of the James Webb Space Telescope. Such programs as HTMLs can be easily shared.
	Interactive Game or Quiz	Wick Editor can be used for creating interactive games or quizzes using programming features including random number generators, variable controls, keyboard controls, and if-then statements.
	Simulation	User inputs can be programmed to change the variables in a Wick Editor program, thereby allowing simulations of different principles to be designed. For example, how much one's force of weight would vary from one planet to another or a calculation of total resistance in a parallel or series circuit depending on resistor ohm values.
Scratch	Linear Animation or Conversation	Scratch uses a theater metaphor to move, resize, and change costumes on sprites (characters) on a stage using scripts, or sequential blocks of code. The simplest form this can take is a linear conversation or animation between two sprites that walk in from opposite sides of the stage and then have a timed conversation of speech balloons to discuss a STEM concept back and forth, such as SI units or the scientific method.
Stage-based sprite & game programming	Interactive Game or Quiz	Scratch can use blocks of code to control any characteristic of a sprite interactively using buttons, keyboard controls, variables, random numbers, if-then statements, loops, and other programming handlers. For example, a student group could design the graphics, rollover effects for buttons, and construct the code blocks for a quiz on lab safety that randomly selects an image and asks a multiple choice question regarding that piece of lab equipment. Answers are automatically scored with a percentage of correct answers versus attempts.
	Simulation	Variables can be placed on stage as a slider control which will then input various numbers into formulas that control the movement of a sprite. This can be used to simulate many types of physics processes. For example, inputting different values as sliders can simulate how exoplanets of different orbital periods and masses affect the radial velocity of a nearby star. Scratch also has blocks for drawing controls which can be programmed to draw out

		the radial velocity graphs or create a virtual variable super spirograph.
Raspberry Pi or Makey Makey	Game Controller w/Sensor Hat	Using a Raspberry Pi computer board equipped with a sensor hat which includes a small LED screen and a micro-joystick, Scratch games can be controlled and programmed using specialized code bricks. A Makey Makey uses electrical contacts to control a Scratch game, such as building a homemade piano keyboard to play different notes.
Ozobot, Sphero Indi, or iRobot	Branching Programming	Many different robotics systems exist, each with their own capabilities. Ozobots are line-following robots that will change direction or movement when they encounter different sequences of colored lines. Sphero Indi responds to colored pads placed on the floor to turn different directions or speed up or slow down. Irobot uses a pen to draw lines according to its programming. LEGO Mindstorms uses a brick-based language to program a central control brick to turn motors, actuators, steppers, sensors, and other electronic controls.
Multi-Vector	Combination Project	Once you have mastered the various types of software listed here, you can combine them to make more complex projects with multiple parts. Ultimately, your projects should show a deep level of content mastery, creativity, quality, and the ability to teach your peers what you have learned about your topic. This may require using several different approaches. For example, at the end of the year, your teacher may have you design and perfect a presentation for a STEAM Showcase at your school, where you design a lesson plan with presentation using an animated presentation program (Animaker or Prezi), an animation or video, or an interactive program such as Wick Editor or Scratch. You will present a hands-on demonstration or activity, and then use Canva, Photopea, or Inkscape to create a handout for your audience where they can learn more about your topic. Another example would be in a biology class where your group chooses an organ system from human anatomy, such as the circulatory system, and designs a Wick Editor branching information program on the different parts of the heart along with arteries, veins, and capillaries. At the same time, you create a physical board game using Photopea laid out like the circulatory system with 3D printed game pieces and dice.

Let's walk you through a typical project. Your chemistry teacher assigns the overall topic of chemical reactions, with possible side topic choices of the one of the Five Types of Chemical Reactions, Balancing Chemical Equations, The Mole, Stoichiometry, and Limiting Reactants. Your team has four people in it, and you choose the side topic of the Five Types of Reactions. You then look through this Choice Board list to decide what kind of media design product you want to create and decide that a combination of stop motion animation and Wick Editor interactive presentation will be the best combination for demonstrating your deep understanding of how to balance a chemical reaction.

You spend the rest of the first day researching and gathering information and a second day planning and sketching storyboards, concept webs, and a list of assets you will need to create for the examples of chemical reactions you will be demonstrating.

On the third day your team creates all of the pieces you will need inside Photopea including the graphics for Wick Editor including the background interface, the button rollover images, and other parts that will move as transparent PNG files. For the stop motion animation, you cut circles out of colored construction paper. You also design and cut out titles and labels and gather supplies, such as yarn or string to make the call outs for labels.

On the fourth day, two members of your team set up a frame to stabilize your cell phone camera and build a stage out of a piece of white butcher paper, carefully marking out the boundaries of what the camera can see as the borders of the stage. One person runs the camera and calls out “Clear!” before each photograph while the second person moves the pieces. You start with outlines meant to show a two beakers of water, with water molecules moving around and jiggling between frames. You are going to show a double-replacement reaction, so you show molecules of lead (II) nitrate dropping into one beaker and dissolving as the ions separate and spread out in the water. In the second beaker, you drop in sodium iodide gradually and show it dissolving. Then one beaker is lifted up with its contents and poured into the other beaker. As all four ions mix together, the lead and iodide ions join together

and drop to the bottom of the beaker to form a precipitate while the sodium and nitrate ions remain in solution as a supernate. For each step, a title or label appears or moves in or out.

The other two members of your team work on the Wick Editor program. They import all of the assets into the library, change the size of the Wick Editor stage, and assemble the interface parts (background and button up-state images) and stretch them out over twenty frames, placing a stop command on Frame 20. Using the transparent background PNG files or just by making shapes in Wick Editor, they create a tweened animation of the pieces assembling into molecules as the reactants with text boxes labeling the parts. In this case, several reactions will be shown, each with its own Reaction button. They then program the buttons to link to different frames. A button for the reaction of barium nitrate with potassium sulfate will link to Frame 21 with a GotoAndPlay command, and when clicked will jump to Frame 21 and play forward over 20 more frames showing the barium, potassium, nitrate, and sulfate ions as atom circles moving around and reassembling into the products, with text blocks moving as a tweened animation into the correct product locations. Other buttons will jump to other frames to show other example reactions, and a final button will explain the basic pattern of double-replacement reactions.

The fifth and final preparation day will allow your team to put the stop-motion animation frames into a video program such as WeVideo or iMovie and add titles and music. The other part of your team will test and debug any problems with the Wick Editor program and export the final as an HTML file. You will discuss how your presentation will proceed and who will say what and even practice it to make sure everything runs well. You are ready to present!

On the sixth day of the project, you will be presenting to the rest of your class. Your presentation is allowed ten minutes, but you have practiced it and know exactly how this will go. You start with one member describing what a double-replacement reaction is, then showing the stop motion animation video. As it is shown a second time, another student explains how all nitrate compounds are soluble as are all sodium compounds, but when lead and iodide come together, they form an insoluble compound which becomes the precipitate. A third student then shows the Wick Editor program and asks the audience to pick different options. At every stop frame there is a back button, so you can keep demonstrating the program for a few minutes. At the end, in summary, the fourth student shows the general pattern of: AB + CD ------> AD + CB from your Wick Editor and asks for questions from the audience. Altogether, with questions, your presentation was exactly 10 minutes long.

Your peers in the class fill out the critique GoogleForm for your presentation, giving you ratings from 0 to 8 on mastery, creativity, quality, and teaching with suggestions for improvement. But since you did such an excellent job, your scores are good and you do not need to make revisions.

Of course, there were many possible choices so this is just one of hundreds or even thousands of different approaches for demonstrating and teaching your knowledge of the topic. You could have done a video of a kinematic activity of your classmates linking arms to show how the reaction occurs, or videotaped an actual double-replacement reaction or shown one in your presentation. You could have created a graphic novel or comic book about a group of atoms interacting. You could have designed a review game in Scratch or created a physical board game with designs in Photopea or Inkscape. If you were quite creative, you could create a branching board that classifies types of reactions using various questions that are answered with color codes that would then be followed by a Sphero Indi or Ozobot to identify the final type of reaction.

As I like to say, the possibilities are endless. If you need help learning how to use the various

categories of media design software, please visit: Https://science-creativity.com/software-training to learn more. Follow along with the videos and create your own practice projects and you will become masters at STEM learning and media design production, with marketable skills and enhanced creativity.