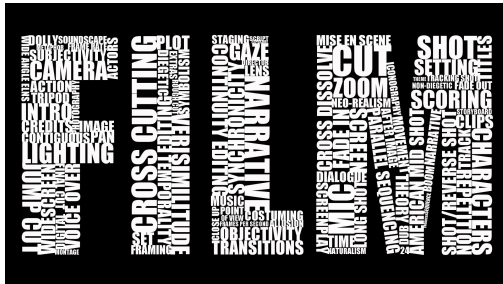


STEM/STEAM & The Movies



Just the name alone – [The Academy of Motion Picture Arts & Sciences](#)– reveals something about the people who make movies: these filmmakers consider themselves to be artists and scientists. Who are these people? What do they do? How do they use science, technology, engineering, arts and math (STEAM) in movie making? This web page is designed to provide you, the teacher, with readings, ideas and other resources for incorporating STEAM and film into instruction.

This is also a perfect opportunity to [introduce film careers](#) which utilize STEAM. There are a number of excellent features on DVDs which not only introduce those careers, but also take students behind-the-scenes into the making of a specific film. I have created a lengthy [list of those DVDs here](#) which you might wish to consider acquiring in order to help your students better appreciate the craft of filmmaking. (Many of these featurettes can also be found on YouTube.)

(NOTE: if you have a favorite resource or lesson plan that you would like to see added here, send it to me: fbaker1346@aol.com)

SCIENCE	FILM(S) REFERENCED	CONCEPTS
The Science Behind Pixar (exhibit, lessons)	All Pixar films	Many
Science of 3D Movies: How do images on a flat screen pop out?		depth perception; stereoscopic vision; polarized light
Visible invisibility: the science of cinematography	Saving Pvt Ryan Citizen Kane Vertigo Pulp Fiction Ben Hur Lawrence of Arabia A Space Odyssey Tangerine The Hateful Eight	exposure time chemicals resolution
The Future Science of Star Wars	Star Wars	
The Science in "The Martian"	The Martian	ion engines, orbital dynamics, interplanetary travel, chemistry, solar energy
The Physics of "Back To The Future"	Back To The Future	special relativity photons general relativity
How Science Helps Create Realistic Explosions in Movies	Avatar, Iron Man 3, Super 8, Man of Steel	wavelet turbulence
Physics Journal Recommends Teachers Use Interstellar	Interstellar; Star Trek; Stargate	Wormholes; black holes
Stunts Makes A Believer of Physics Expert	Fast & Furious 7	speed; terminal velocity; momentum
Neuroscientist Takes A Scientific Look at Art of Filmmaking	Airplane, Chicago, Moulin Rouge	Brain Science
The Physics of Spiderman's Webs	Spiderman	downward gravitational force; upward force; momentum; tension; velocity; kinematic equations;
Science Goes To The Movies	Various	Varies

Great & Realistic Physics Movies related: Good & Bad Examples from Movies (video)	Gravity, Apollo 13, October Sky, The Abyss, IQ, Infinity, 2001: A Space Odyssey	
Science of Hollywood Stunts (video)	The Firm; A Time to Kill; Spiderman; Mission Impossible;	solid, liquids, gas, steam, expansion, chemical reactions, metal, hydrocarbon, fluids, carbon, refraction, atoms, gravity, compression, pulleys, force, direction, load, friction, vectors, pressure, electrical circuits, magnet
Physics in Wall-E	Wall E	Applied Physics, Gravity
Interstellar Film Technology & Black Holes The Surprising Science Behind Interstellar Christopher Nolan/Kip Thorne Discuss Physics of Interstellar	Interstellar	Black Holes, Worm Holes, Caustics, Relativity
Movie Magic Conjured by Science	Toy Story, Harry Potter, Hellboy, Quantum of Solace, Chronicles of Narnia, Tron	Fluid Dynamics
Science of the Movies in 3D (Video)	Terminator 2; Metalstorm, Journey to The Center of the Earth	Stereo, Depth, Polarization, Light Waves
How Movies Makers Use Science to Make Magic	The Incredibles, Jurassic Park, Benjamin Button, Avengers, Pirates of the Caribbean, My Week With Marilyn, The Ten Commandments, Avatar	Visual effects, CG, third-degree polynomials, higher frame rates, 3D, linear perspective, aerial perspective, composition, X-Y graphing

TECHNOLOGY	FILM(S) REFERENCED	CONCEPTS
Motion Capture	Dawn of the Planet of the Apes	MoCap; CG
Animal Kingdom	Chronicles of Narnia	
How Does Green Screen Work?		ChromaKey; luminance keying; compression

How Blue Screens Work	ET, Star Wars, Return of the Jedi, Back to The Future	Traveling matte; Blue screen, CG; optical compositing, matte; diffusion
How do they create special effects	The Matrix; Lost in Space	rotation; slow motion

ENGINEERING	FILM(S) REFERENCED	CONCEPTS
Lights, Camera, Engineers	Avengers, Pearl Harbor	hydraulics, CG
The Arrrt of Engineering	Pirates of the Caribbean	fluid animation
An Engineer's Dream Comes True: Working on Avatar (page 9)	Avatar	3D
The Science & Engineering of Sound (video)		Vibration, compression, rarefaction, amplitude, frequency, longitudinal wave, harmonic content, logarithmic scale, decibel, dynamics, microphones

ARTS	FILM(S) REFERENCED	CONCEPTS
The Art of Designing Digital Sets	Charlie and the Chocolate Factory, Catwoman, V for Vendetta, Harry Potter and the Order of the Phoenix, The Golden Compass, Gladiator, Lord of the Rings, Avatar	Various
How Film Composers Shape Our Feelings	X-Men; Sunshine; Hoffa; Aliens; 12 Years A Slave; The Tree of Live; Gravity; Inception	Many
Animation adds STEAM to STEM		
Observations on Film Art	Many	Various
Visions of Light: The Art of Cinematography (vide0)		Various

The Art of Movie Storyboards (book)	Many	Various
Annual Art of Motion Picture Costume Design	Various	Various
The Art of Foley		Looping
Film Art Director		Various

MATH	FILM(S) REFERENCED	CONCEPTS
What type of math is involved in Pixar animation?	Inside/Out	Many (see article)
Math in Special Effects	Music video	Algebra, Distance, Light Intensity, Exposure (photography)
Film Aspect Ratio video Related	Captain America: Winter Solider; Citizen Kane; Ben Hur; A Serious Man; Oz: The Great And The Powerful; The Grand Budapest Hotel; Oliver; The Dark Knight	Aspect ratio
Jumping Out of Windows (stunts)		measuring, multiplication, division, and remainders
Math in the Film Industry		trigonometry, algebra, integral calculus, subdivision surfaces, division, geometry, and harmonic coordinates
How One Visual Effects Director Uses Math	Harry Potter, Sweeny Todd, Prince of Persia, GI Joe	fluid modeling, gravity, viscosity, voxels, density, 3D geometry
A Math Breakdown of Cinematography of "There Will Be Blood" Related article	There Will Be Blood	Geometry
Math Goes Movies	Jurrasic Park, Lord of the Rings	polygons, triangles, ray tracing, vectors, caustics, precomputed radiance transfer, radiosity
Film Lighting & Math		multiplication, angles, measurements, division, skip counting
Geometry of Lenses (Lesson plan)		geometry, areas, ratios, and square roots

Math Algorithm Claims to Predict Film's Success		algorithm
Pixar combines math to make its movies related video	The Incredibles Ratatouille Finding Nemo	algebra, geometry , calculus
Pixar Sr. Scientist Explains Math of Movies related video	Cars 2, Brave, Geri's Game	arithmetic, algebra, geometry, polygons, calculus, combinatronics, light, fluid, gases, compression algorithm, parabolas
Ryan Kavanaugh Uses Math To Make Movies	Batman, Zombieland, Charlie Wilson's War, Paul Blart: Mall Cop, Season of the Witch, The Perfect Getaway, Matrix, Waterworld, Jesse James, The Fighter, Evan Almighty, Bruce Almighty, Land of the Lost, Brothers, Somewhere in Time, Titanic	variables
Box Office Math (lesson plan)		Calculations, measures, box plots (both modified and non-modified), histograms, and stem-and-leaf plots.
Independent Filmmakers Talk Math		Calculations
The Croods & Math		Coding, effects tools, process control, fluid dynamics, Cloud computing
What is the average budget for a Hollywood movie?	The Brothers McMullen, Avatar, Pirates of the Caribbean	

[Science Lesson Plans Using The Movies](#) (Teach With Movies)