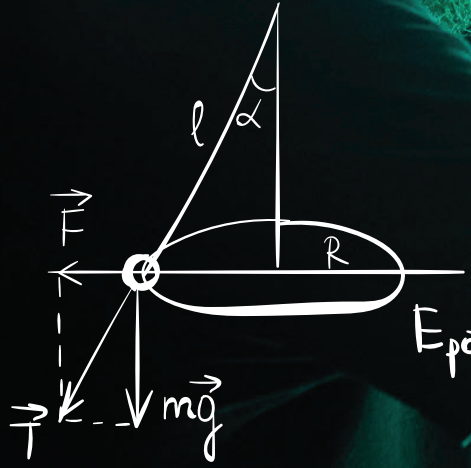
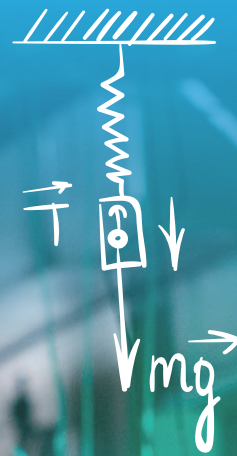


# STEM 2025

STEM IN THE ARTS



$$E = mc^2$$



$$E_{pot} = \int h F_y dy$$

$$(a + b)^2 = a^2 + 2ab + b^2$$

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# EDITOR'S LETTER

The acronym STEM did not exist when I was a kid, but obviously science, technology, engineering, and math were part of my educational experience.

I knew from an early age that I was going to pursue a career in STEM and I was convinced that I was going to be an archaeologist. Science fairs provided the opportunity to explore everything from bugs to trees to the brain. I even forced my brother to play school as I gave being a science teacher a try (trust me, the sibling torture was a give and take). In the grown-up part of my life I have been able to use my love of STEM in so many ways from biomedical research in cancer to education and even state policy. I know that there is considerable creativity in STEM, and innovation is at the heart of STEM pursuits, but I never really saw myself as an "artsy" person.

Then something really cool happened for me. I took a chance and tried something that I have always thought looked fun. I decided to take a welding class. I fell in love with it and have been welding for about four years. The ability to use my knowledge of STEM to create sculptures has been amazing. I have developed an appreciation for the importance of the design process, as well as learning new areas of STEM. I also learned something about myself. There has been a part of my brain just waiting to be used for art.

I have seen students trying to figure how to balance their love of STEM with other interests and passions. My advice to them has always been that they are lucky because STEM overlaps with so many other education and career paths. I hope that you enjoy the stories in our magazine that highlight how STEM is critical to many facets of art, music, and dance.

**Dr. Tami Goetz, Director  
Utah STEM Action Center**



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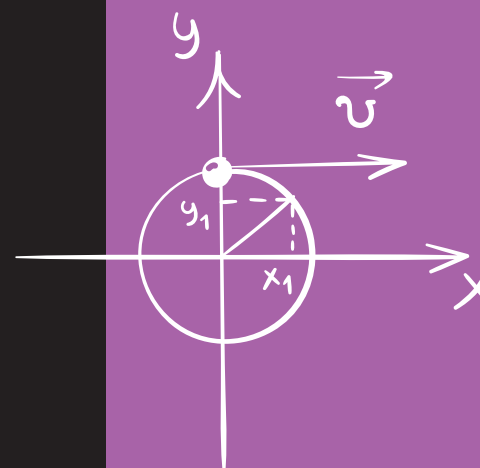


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Fueling the moments that matter



## Enbridge Gas proudly supports STEM in Utah communities

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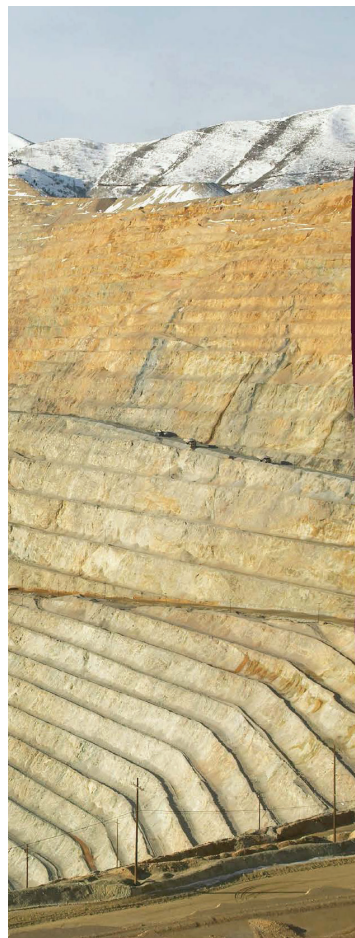
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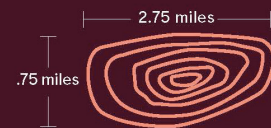
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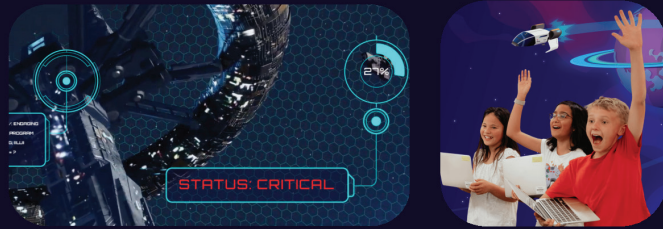
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# USING PHYSICS TO CREATE NEON SIGNS

By Dave Brimley

Our family neon sign business was  
founded by my grandfather Leonard  
Brimley and his brother Harvey Brimley  
in 1930. They were trying hard to provide  
for their families during the depression,  
and Harvey had some sign painting  
experience and so began Brimley Bros.  
Sign Co.



**THE PROBLEM WAS THEY THOUGHT THEY WOULD FREEZE TO DEATH HAND PAINTING UTAH OIL CO. BILLBOARDS IN THE WINTER IN NEVADA.**

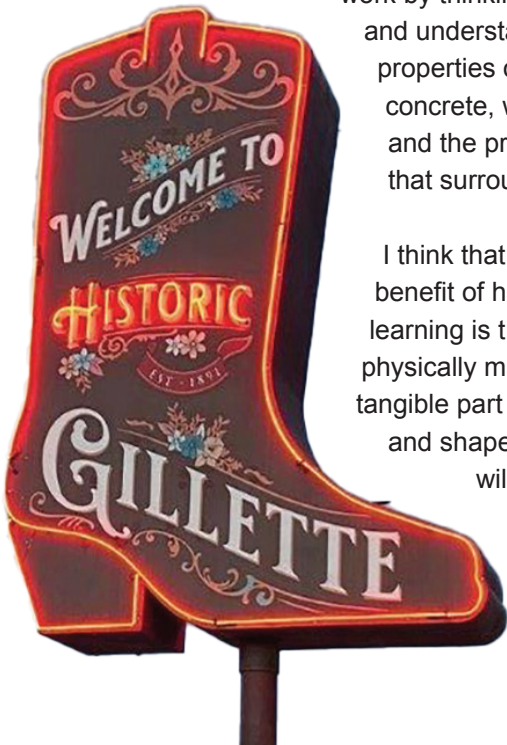
Neon had just come to the USA from France in 1928 and inspired a huge interest in the new light medium. My grandfather drove his Model A Ford to Chicago, picked up a bunch of neon building equipment, and drove it back to Salt Lake on a flatbed trailer. He then taught himself to make neon, and their business became Brimley Bros. Neon Sign Co.

I was literally born into the trade. One of my earliest memories from around three years old is of a neon Santa Claus face that was outside my bedroom window at Christmas. There was so much magic in watching my dad and grandpa create colored lights from glass, gas, and electricity, that I decided it had to be my life's work, too.

Generally most people have no clue what neon is, or how it works. Very basically, it is the northern lights phenomena captured in a glass tube.

Neon is a natural element of the universe, and as a gas it ionizes or emits light photons when stimulated by electrical energy. It is called ionization. Producing neon tubes is literally hands-on physics put to creative use, with a working knowledge of glass heat forming, creating vacuums, properties of inert gasses, and

their color on the light spectrum, electrical current and amperage,



transformers, circuitry, chemistry, light output or lumens, and combining it all with artistic knowledge and a wizard's craft.

*PRODUCING NEON TUBES IS LITERALLY HANDS-ON PHYSICS PUT TO CREATIVE USE, WITH A WORKING KNOWLEDGE OF GLASS HEAT FORMING, CREATING VACUUMS, PROPERTIES OF INERT GASSES, AND THEIR COLOR ON THE LIGHT SPECTRUM, ELECTRICAL CURRENT AND AMPERAGE, TRANSFORMERS, CIRCUITRY, CHEMISTRY, LIGHT OUTPUT OR LUMENS*

My favorite school subjects were science, physics, geology, art, music, and physiology. I loved anything that was hands-on skill learning, such as shop classes or building trades classes. By the time I was 16, I had already helped my dad build his entire house completely by hand, from footings and foundations to roof and shingles. We did it all, there was nothing we couldn't figure out how to make it

work by thinking it through, and understanding the properties of steel, concrete, wood, glass, and the practical physics that surround us.

I think that the greatest benefit of hands-on learning is that once you physically manipulate a tangible part of this world and shape it to your will, it leaves

a learning impression that will always stay with you, and usually only takes once to form a permanent memory. This way your knowledge compounds daily. Working abilities constantly improve, artistic skill and creativity grow past anything you thought possible, and comprehension of our universe just becomes natural.

STEM studies as we call them today must be connected to physical experiences in order to be useful. Hopefully, creating knowledge

in people that is practical allows them to watch the flowing waves of the ocean and the flutter of the leaves on a tree in a breeze and know exactly what is happening, instead of having no clue.



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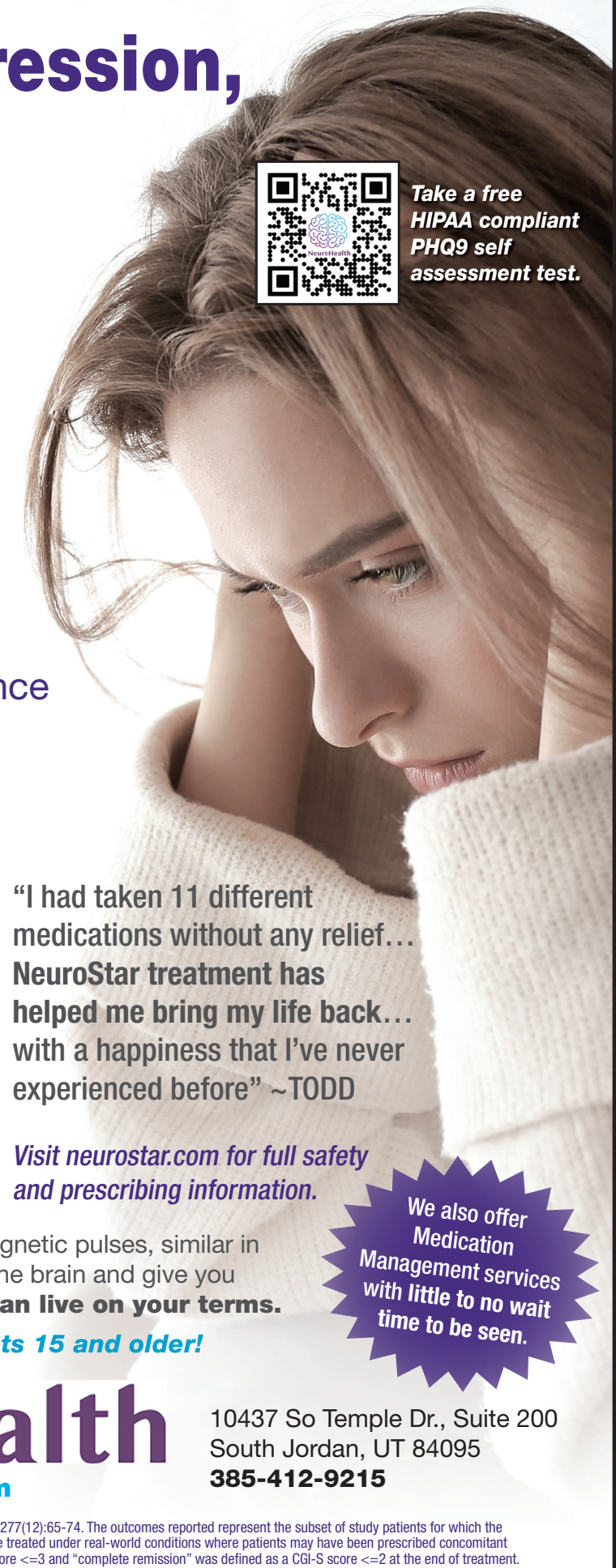
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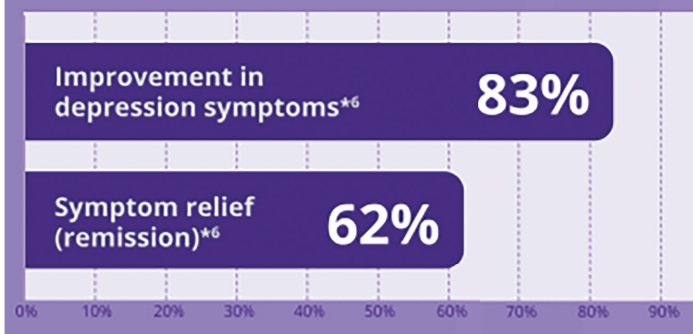


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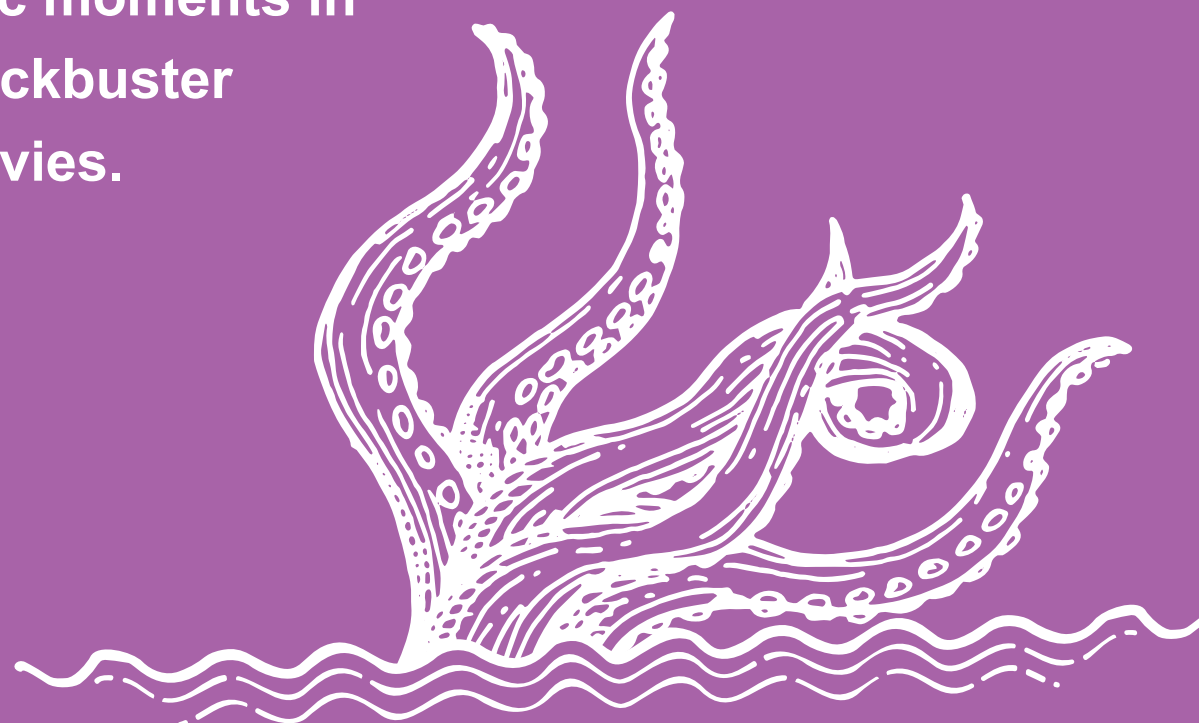
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Outcomes Registry data was published by Sackeim HA, et al. J Affective Disorders, 2020, 277(12):65-74. The outcomes reported represent the subset of study patients for which the CGI-S data was reported before and after an acute course of NeuroStar TMS. Patients were treated under real-world conditions where patients may have been prescribed concomitant depression treatments including medications. \*Measurable relief" was defined as a CGI-S score <=3 and "complete remission" was defined as a CGI-S score <=2 at the end of treatment.

# MONSTERS, ROBOTS, AND ZOMBIES: THE MATH THAT MAKES THE MOVIES

By Adam Sidwell, Future House Studios

While bringing monsters, robots, and zombies to life on screen, I discovered a secret: math and programming are the unsung heroes behind some of the most epic moments in blockbuster movies.



## STEM IS AT THE HEART OF THE ART OF MOVIES!

From *Tron: Legacy* to *Pirates of the Caribbean: At World's End* to *King Kong*, math drives the creation of each story and character, making it possible for digital worlds to come alive.

I want to take you behind the curtain to show how math shaped these films — and how it's powering our studio's latest project, the mobile adventure game *Swords of Secret*. Oh, and we're inviting students to join in by becoming gameplay testers. More on that soon...

## STEM IN TRON: LEGACY, PIRATES OF THE CARIBBEAN, AND KING KONG

I've worked with some brilliant engineers, programmers, mathematicians and artists over the course of my career. They all knew the same thing: without geometry, programming, and physics, the art of movie visual effects (VFX) would be stuck in the last millenia. I'll use a few examples from a few decades of experience making over a dozen blockbuster VFX movies.

Remember those iconic light walls on the digital grid in *Tron: Legacy*? I used vector math and programming to ensure every glowing barrier formed perfectly as the light cycles sliced through the arena. Some fancy coding made sure those walls lined up just right, giving them that razor-sharp, high-speed feel.



Jump to *King Kong*, and we're suddenly in the middle of a city full of cars trying to escape the wrath of a rampaging gorilla. Instead of building each vehicle by hand, I used modular programming to generate a fleet of cars, each with its own unique body type and dimensions, but all based on the same components. Animators were able to quickly share animation between cars to speed up their workflow. So we flipped, crashed, and drove those cars through the streets, all thanks to the magic of coding.

*King Kong* himself? He's a bundle full of matrices! It was matrix math that made each vertex move and his skin deform on top of his virtual skeleton.

That math is a key part of computer graphics.



And then there's *Pirates of the Caribbean: At World's End*, where I had the amusing task of using physics simulations to bring pirate zombies to life. These weren't your standard undead — their barnacles, slimy tentacles, and tattered trousers all had to move just right during epic sea battles. Physics simulations ensured every wave, cannon

I LAUNCHED A NEW STUDIO RIGHT HERE IN THE STATE OF UTAH, AND SHIFTED GEARS TO GAME DEVELOPMENT, BRINGING THOSE SAME STEM PRINCIPLES TO EVERY GAME WE BUILD. OUR LATEST PROJECT, SWORDS OF SECRET, USES MATH AND PROGRAMMING TO TURN THE WORLD AROUND US INTO A VIDEO GAME.

blast, and pirate stumble felt real, even though

we were dealing with a bunch of fishy supernatural creatures.

We could go on and on: without STEM, we'd have neither Avengers nor Jedis.

**FROM MOVIES TO GAMES: SWORDS OF SECRET**

After all the monster-making and zombie-tweaking in Hollywood, I launched a new studio right here in the state of Utah, and shifted gears to game development, bringing those same STEM principles to every game we build. Our latest project, *Swords of Secret*, uses math and programming to turn the world around us into a video game.

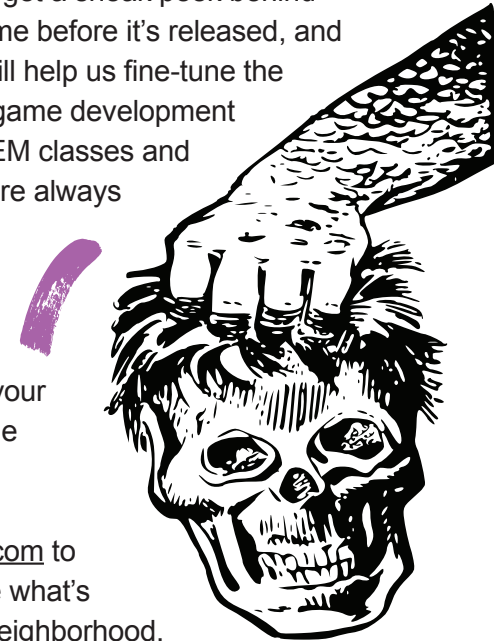
It's an epic augmented reality mobile role-playing game (RPG) filled with mythical monsters, daring quests, and more algorithms than a math book. Imagine discovering a wizard's tower down your street, or a foreboding fortress hiding a treasure chest near your school. We use augmented reality (which is a fancy way of saying "algorithms and geometry to put games into the real world") to take

you on quests through your neighborhood in search of real world treasures!

**CALLING ALL VIDEO GAME PLAYERS: HELP SHAPE SWORDS OF SECRET!**

Now, here's where you come in: we're looking for gameplay testers. You'll get a sneak peek behind the scenes, play the game before it's released, and provide feedback that will help us fine-tune the experience. I've taught game development sessions in multiple STEM classes and students and teachers are always enthusiastic to join the playtest experience. Whether you're into math, programming, or just love games, this is your chance to see how all the pieces come together.

Go to [SwordsOfSecret.com](http://SwordsOfSecret.com) to start your quest and see what's waiting for you in your neighborhood.



**STEM IS THE WAY**

Math and programming may seem like technical skills, but they're the building blocks of creativity in film and game development. From iconic movie characters to epic worlds, math helped create some of the most visually stunning moments in cinema and games.

The future of entertainment is in the hands of the next generation of creators, and we're excited for students to join the adventure. Who knows? Maybe your ideas will shape the next blockbuster — or the next great video game.

ABOUT ADAM SIDWELL

As Head of Studio at Future House Studios, a game development, animation, virtual reality, and creative development studio, Adam directs content for animated projects in multiple mediums and has assembled a world-class team with alumni from ILM, Disney, Microsoft, Epic Games, and more. Adam's roots are in building and directing the art and technology so that teams can bring animated characters to life. A full list of film credits can be found on [IMDB.com](http://IMDB.com).

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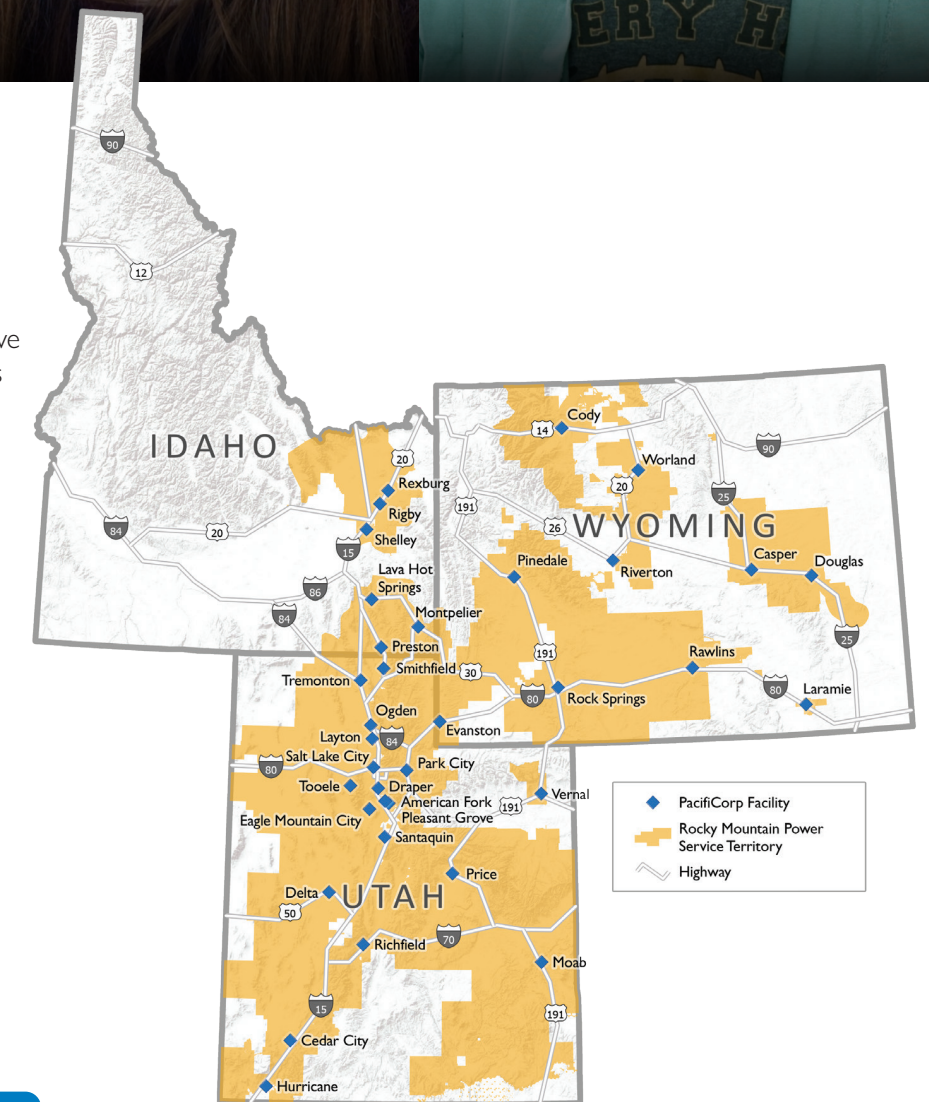


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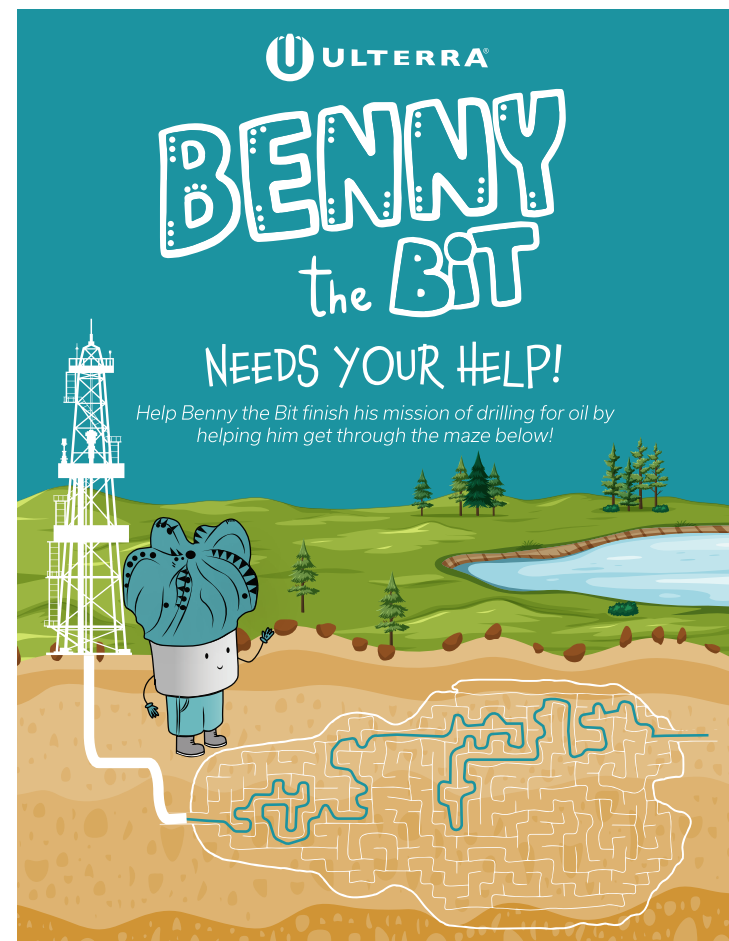
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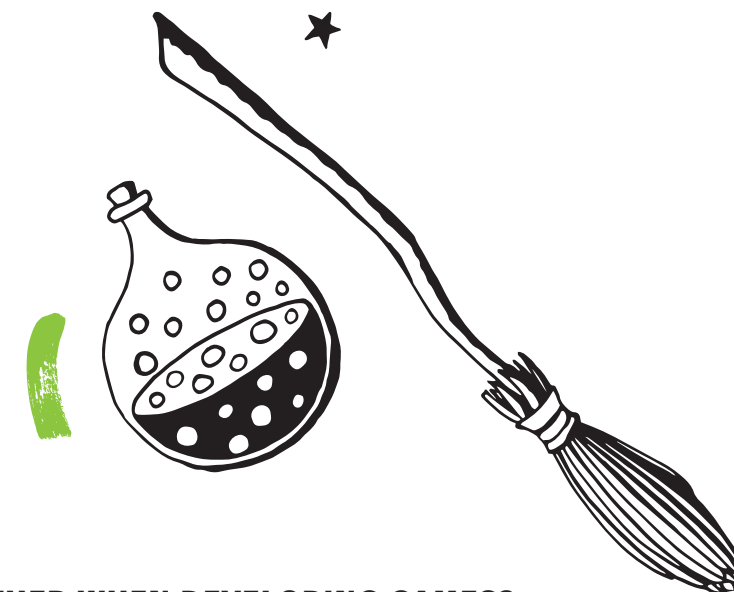


# DISCOVER HOW STEM AND ARTISTRY WORK IN THE HOGWARTS LEGACY GAME DEVELOPMENT

Exploring the enchanting realm of video game development, art and STEM are intricately woven together to create the games we love.



**IN THE CREATION OF HOGWARTS LEGACY, THE AVALANCHE SOFTWARE TEAM BASED IN SALT LAKE CITY RECOGNIZES THE CRUCIAL ROLES OF NARRATIVE DESIGNER, MISSION IMPLEMENTER, ENGINEER, AND MOTION CAPTURE TECHNICIAN.** Each team member has a critical role in building an immersive and realistic role-playing game. Teamwork is essential as a 21st century classroom skill and a principle of STEM.



## HOW DO STEM AND THE ARTS WORK TOGETHER WHEN DEVELOPING GAMES?

“On a more general level, games often communicate so much more than just ‘entertainment’ — they showcase the emotion of connecting with characters, the awe of discovery, the beauty of landscapes or architecture, the grandiosity of music, et cetera. And yet they are still, essentially, software. In order to have an excellent game that means something to people, you need to understand how to deliver the art/experience in a way that functions well.”

— Jennifer Egan, mission implementer

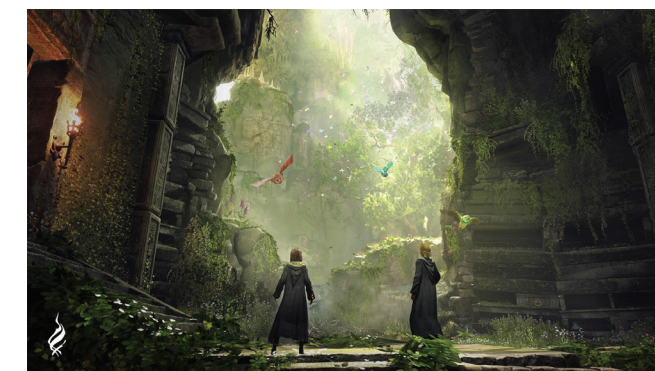
“Video games are an art form that uses every aspect of STEM. Because video games are an interactive art form, technology, engineering, and math are intertwined to give the player an incredible experience. Our game engines are highly advanced, code bases written, maintained, and manipulated by brilliant programmers. They need to know how to make something feel a certain way while writing lines of code. They must be players as much as developers to allow for it to feel seamless. Art is meant to evoke feelings and STEM is one of the backbones to ensure those feelings are felt.”

— Genese Davis, narrative designer

“There’s also a good amount of science involved in motion capture, especially when it comes to anatomy. As a motion capture technician, you are responsible for placing sensors on actors that represent their anatomy so we can create a virtual skeleton of them. Knowing the names of bones and how joints work is really important in this process to create realistic, lifelike characters.”

— Brady Campbell, motion capture technician

“A video-game is the perfect combination of art and engineering. Games are ultimately running software so engineering



knowledge is needed to know how things work and run. This is key to learn so [that] you are ready to fix bugs that may arise and/or issues that need technical resolution. On the other hand, games are highly visual experiences. Games have evolved from black and white 2D games to full photo-realistic 3D games that match or exceed movie-like content. So everyone that works on games is an artist since they are contributing to a visual, interactive medium.”

— Jose Villeta, director of software engineering

“Games offer a unique story-avenue that invites audiences to interact directly. It’s almost as if we can tell stories in limitless ways. Letting someone explore the world developed by a multi-branching creative team is an incredible experience. It’s exciting to offer players amazing visuals from talented artists and directors combined with impactful storylines that offer personal and lasting impressions. Every element of STEM has a place within the arts, and if your strength is in any part of STEM, then there is a place for you in video game development.”

— Genese Davis, narrative designer



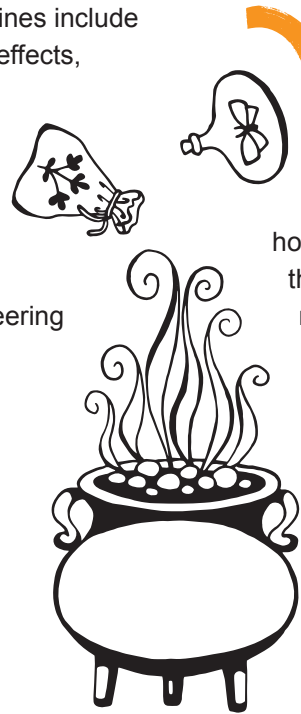
## WHAT SKILLS ARE SHARED BY STEM AND THE ARTS?

“Skills vary per discipline. The main disciplines include art, animation, engineering, audio, visual effects, design, production, and storytelling.

Since games take much longer to make with a large team size, it’s important to learn how to work with others. You need both soft and hard skills to design, build, and iterate game content.”

— Jose Villeta, director of software engineering

“Our programmers make sure the code written achieves the feeling of our design team’s goals. If you’re a programmer, you need to know how to write code. And you need to make sure you can write code in the language of the engine, whether it’s C#, C++, JavaScript or Python. The more aware all game developers are of how the technology works the harder you can



push that technology to achieve your creative vision.”

— Genese Davis, narrative designer

“Some of the skills required for a job like this is an understanding of anatomy and how the body moves. Having an eye for those things translates to realistic animations and movements. On top of that, being able to communicate well with people is a huge deal since we work so closely with actors in making their mocap (full-body motion tracking) gear work well. Helping people feel comfortable in the mocap gear means they are comfortable in their acting, resulting in better animations.”

— Brady Campbell, motion capture technician



## WHAT ARE SOME SUGGESTIONS YOU HAVE FOR STUDENTS AS THEY LOOK INTO CAREER OPTIONS IN THE FIELD OF GAME DEVELOPMENT? WHAT WERE THE HARDEST SKILLS TO LEARN?

“My suggestion is the same suggestion that was given to me when I first started looking into becoming a game developer: You have to actually make games. Even now, I am still working through being willing to learn something new when I have become comfortable with what I already know. This happens to me continuously — I find myself uncertain about learning a new process or program that might really benefit my ability to contribute to my team. But usually, spending even a

little bit of time learning pays off huge dividends in the end.”

— Jennifer Egan, mission implementer

“Whenever I get asked this question, I always ask a follow up: What do you love doing in life? Art, programming, designing, animating, writing, etc. Pinpointing not only something you love about the process, but also something you feel comfortable and



have a natural talent in, are large strides in the right direction. If you have no idea, then start anywhere. Download a free game engine, do some tutorials, take a course in any aspect of the game making process and get going. If you have a propensity for 3D art, then learn an art package and use them as quickly and as often as possible, but you must first make sure you’re a good artist. You should understand the general principles of your art.”

— Genese Davis, narrative designer

“Build out a portfolio of your personal or team-based work. A computer-science

or engineering- related program can provide a solid foundation for software development. Whereas for art development, learning the industry digital content creation tools like Autodesk Maya, Photoshop, ZBrush, or Houdini among others, is key for a strong skill set. Independent of discipline, the hardest skills to learn are dedication to the craft, eye for quality, and focused efforts to iterate on the game until its completion. Since video games are interactive software applications, the production of them is a never-ending process for fun factor, visual quality and, more importantly, a defect-free experience.”

— Jose Villeta, director of software engineering

**Avalanche Software was founded in 1995. They were a part of Disney Interactive for 11 years and since 2017 have been a part of Warner Bros. Games. [Learn more: AvalancheSoftware.com](https://www.avalanche-software.com)**



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