

Careers Behind the Camera

Amazon MGM Studios

Key Student Learnings

Overarching Content Questions

How do people use math and technology to turn a TV show or movie idea into a reality?

What careers exist at the intersection of technology and entertainment?

How are people in these careers using AI in their daily work?



Vocabulary

Stop 0: Intro

Artificial Intelligence

Computer systems that can perform tasks typically done by humans by learning from data.

System

A group of parts that work together to accomplish a task

Stop 1: Previsualization

Previsualization

An animated version of movie scenes used to explore ideas and creative concepts before filming begins

Mood

The feeling or emotion you want the audience to have when they're watching

Stop 2: Virtual Production

Hardware

The physical parts of a computer system.

Software

The instructions given to a computer.

Game Engine

A computer program used to build and run 3D interactive environments

Network Traffic

The number of user accessing the data at one time.

Stop 3: Post Production

Timecode

A digital clock that tracks hours, minutes, seconds, and frames in a video.

Frame

A single image in a video. In movies, 24 frames play every second.



Vocabulary

Stop 4: Marketing

Data Analytics

The process of examining numbers to find patterns that help to make better decisions.

Ratio

Comparing numbers to show their relative values.

Stop 5: Innovation

Cloud Computing

Securely storing and sharing data over the internet instead of using physical drives.

Generative AI

Artificial Intelligence that can create new content and ideas based on user prompts.



Intro

Careers Behind the Camera with Amazon MGM Studios



Watch this Tour Stop in: [Video 1](#)

How has technology shaped the way movies and TV shows are made, from the earliest films to today's virtual productions?

For as long as movies have existed, technology has been at the heart of bringing stories to life. The very first films were short, silent clips recorded on hand-cranked cameras. In the 1920s, sound was introduced, creating "talkies" that forever changed the movie experience. Later, color films, computer-generated imagery (CGI), and digital editing each revolutionized how stories could be told on screen. Today, **Artificial Intelligence (AI)** is the newest tool added to that long history of innovation. **Artificial Intelligence** is computer systems that can perform tasks typically done by humans by learning from data.

Filmmaking is fundamentally a **system**—a group of parts that work together to accomplish a task - working seamlessly to transform ideas into reality. Movie production depends on countless interconnected parts working in sync. At Amazon MGM Studios, this system includes everything from the LED panels on their virtual production stage to the network engineers ensuring data flows without interruption to the creative minds directing the action. If any single component fails—whether human, technical, or digital—the entire production can stall. This systems-based approach is why modern filmmakers must understand both the artistic and technical sides of production.



Intro

Careers Behind the Camera with Amazon MGM Studios

Watch this Tour Stop in: [Video 1](#)

On this tour behind the scenes at Amazon Studios, we'll see how professionals work with cutting-edge technology to produce TV shows and movies that are watched by millions. From the earliest days of Culver City Studios' history to Amazon's current virtual production facilities, the goal has always been the same: telling stories that captivate, move, and inspire audiences.



Vocabulary Review Question

A system is a group of parts that work together. Which of these parts must work together to successfully create a movie?

- A. Hardware (like physical cameras and microphones)
- B. People (like directors, actors, and camera operators)
- C. Software (like digital video editing programs)
- D. All of the choices are correct!**



Stop 0 Standards

CS Standards

1B-IC-18: Discuss computing technologies that have changed the world, and express how those technologies influence, and are influenced by, cultural practices.

2-IC-20: Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options.

Next Generation Science Standards (NGSS) Standards

Cross Cutting Concepts:

Systems and system models

Common Core ELA Standards

CCSS.ELA-LITERACY.SL.6-8.1: Engage in collaborative discussions about how technology shapes culture and careers.

ISTE Standards

ISTE 1.1.d - Empowered Learner

Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies.



Stop 1

Previsualization

Watch this Tour Stop in: [Video 2](#)



How do directors, animators, and special effects artists use pre-visualization to bring big ideas to life?

Before a movie is filmed, directors and artists need to imagine what the story will look like on screen. They don't just grab a camera and hope for the best — they begin with pre-visualization, or previs.

Previsualization is like a 3D, animated rough draft of a movie. Instead of writing paragraphs, filmmakers “draft” with sketches, models, and animations to test ideas before filming begins. It helps them plan camera angles, lighting, stunts, and even how characters will move through a scene. It's the movie version of writing a first draft of an essay in English class in that you get to explore and revise before creating the final version.

Previs usually begins with storyboards, which are like comic strips that map out each shot. These storyboards can be turned into short animated scenes that show timing, pacing, and emotion. Artists also use color, texture, and shading to help create the **mood** (how the audience should feel). This makes the world of the story feel real and intentional, whether it's bright and funny or dark and suspenseful.



Stop 1

Previsualization

Watch this Tour Stop in: [Video 2](#)



Pre-visualization saves both time and money by helping everyone prepare before filming begins. In school, that's like running a simulation in science class — a model you can test, observe, and improve before doing the real experiment. In filmmaking, previsualization (previs) lets directors experiment and learn from mistakes in a digital world, so everything runs smoothly when cameras finally roll.

No matter what kind of project you're working on — a movie, an app, or even a science experiment — planning is key. Pre-visualization shows how creativity and preparation come together to make big ideas real.

Vocabulary Review Question

When a filmmaker creates a specific mood for a movie scene, what are they trying to do?

- A. Make the audience feel an emotion, like happy or sad.
- B. Figure out exactly how much the movie will cost.
- C. Test out the physical cameras and microphones.
- D. Decide what the actors are going to eat for lunch.



Stop 1 Standards

CS Standards

2-AP-13: Decompose problems and subproblems into parts to facilitate the design, implementation, and review of complex programs.

Next Generation Science Standards (NGSS) Standards

Cross Cutting Concepts:

Systems and system models

Cause and effect



Common Core ELA Standards

CCSS.ELA-LITERACY.RI.6-8.7: Integrate information presented in different media or formats.

CCSS.ELA-LITERACY.W.6.5 With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.

ISTE Standards

Standards 1.4.c - Innovative Designer

Students develop, test and refine prototypes as part of a cyclical design process.



Stop 2

Virtual Production

Watch this Tour Stop in: [Video 3](#)



How do software, hardware, and people work together to create virtual worlds for film?

For decades, the film industry relied on building massive physical sets or shooting against blank green screens, a process where visual effects were added weeks or months later. This traditional approach was slow, costly, and required actors and directors to merely imagine what the final scene would look like. Virtual Production represents a monumental shift in filmmaking, allowing creators to film in locations that are incredibly difficult or expensive to travel to, or environments that do not exist at all, like a post-apocalyptic Tokyo.

At the center of this innovation is the LED volume (a massive wall composed of thousands of tiny lights, or pixels). Because the digital world is displayed live on these screens, actors can physically react to their environment, and directors can capture the final shot directly on set without the limitations of a green screen. This process requires a complex, integrated system: a combination of **hardware** (the physical equipment), **software** (the digital instructions), and people working together to create movie magic in real time.



Stop 2

Virtual Production

Watch this Tour Stop in: [Video 3](#)

How do software, hardware, and people work together to create virtual worlds for film?

The foundation of this system is the software, specifically a tool known as a **game engine**. Originally designed to power video games, this type of computer program creates highly interactive, 3D environments. Digital designers use game engines to build everything from alien planets to everyday objects, with precise control over scale, weather, and lighting. This software sends specific instructions to the hardware—the LED walls—telling each individual pixel exactly what color to display and how bright to shine.

Virtual production is revolutionary because a network of sensors and powerful servers instantly tracks the physical camera, rendering a photorealistic digital background that shifts in real time to perfectly match the camera's perspective. To create a seamless illusion, film crews blend these dynamic digital environments with physical sets and real props, allowing them to safely capture highly complex or dangerous scenes. Ultimately, bringing this world to life relies on human expertise, requiring engineers and cinematographers to perfectly balance art and technology by matching physical stage lighting to the digital screens.



Stop 2

Virtual Production

Watch this Tour Stop in: [Video 3](#)



Vocabulary Review Question

In virtual production, the physical LED screen is the ____, while the code telling it what colors to display is the ____.

- A. software / hardware
- B. **hardware / software**
- C. input / output
- D. camera / TV

Vocabulary Review Question

In virtual production, what is the main purpose of a game engine?

- A. It is the motor inside a camera that makes it spin.
- B. It is a machine that creates physical props out of foam.
- C. It automatically writes the script for the actors.
- D. **It is the software used to build and run interactive 3D virtual movie sets.**



Stop 2 Standards

CS Standards

2-IC-20: Compare tradeoffs in computing technologies that affect everyday activities and career options

2-CS-02: Design projects that combine hardware and software components to collect and exchange data.

2-DA-07: Represent data using multiple encoding schemes

Next Generation Science Standards (NGSS) Standards

MS-ETS1-2: Evaluate competing design solutions using a systematic process (choosing between traditional location filming and virtual production for efficiency).

Cross Cutting Concepts:

Cause and effect

Systems and system models



Stop 3

Post-Production

Watch this Tour Stop in: [Video 4](#)

How does math and science help get a movie ready for release after filming ends?

When the director yells “Cut!” on set, the filming may be done, but the movie is far from finished. The project enters post-production, the critical stage where editors, sound designers, and colorists transform hundreds of disconnected clips into a cohesive story. While the concept is similar to recording a video for social media and adding stickers, music, or captions, professional post-production operates on a massively complex scale. Editors use advanced software to trim scenes, manipulate audio, fix color, and add visual effects to ensure every moment looks and sounds perfect.

Every step of this process depends on relentless precision, measured using a system called timecode. **Timecode** acts as a digital address for video, breaking footage down into hours, minutes, seconds, and frames (represented as HH:MM:SS:FF). Calculating timecode requires editors to step away from standard base-10 math and utilize base-60 math (since there are 60 seconds in a minute and 60 minutes in an hour), combined with fractional math to pinpoint exact moments in time.



Stop 3

Post-Production

Watch this Tour Stop in: [Video 4](#)

The smallest unit of a timecode is the **frame**—a single still picture. When played in rapid succession, these frames create the illusion of motion. The industry standard for feature films is 24 frames per second (fps). This means every second of screen time contains 24 pictures, making a single frame equal to exactly $\frac{1}{24}$ th of a second. This specific mathematical rate gives movies their signature, slightly dream-like "cinematic" feel. In contrast, live sports broadcasts and smartphone cameras often encode video at 30 or 60 fps. These higher frame rates capture motion much more smoothly and sharply, which is ideal for fast-paced action or reality, but lacks the traditional "larger-than-life" aesthetic of a movie.

Behind the scenes, editors use math and computer science to convert between these frame rates, calculate total frame counts, and sync sound perfectly to the action. If a door slams on screen, the sound effect must hit the exact $\frac{1}{24}$ th of a second that the door closes visually. Being misaligned by even a single frame breaks the illusion for the audience. Post-production proves that filmmaking isn't just an art form—it's an act of engineering, where math is used to turn everyday footage into cinematic magic.



Vocabulary Review Question

What happens if an editor's timecode math is off by just a tiny fraction of a second?

- A. **The actor's lips won't match the words you hear.**
- B. The camera can overheat and break.
- C. Nothing at all - being off by a few frames doesn't affect the final movie.
- D. The movie will play in reverse.



Stop 3 Standards

CS Standards

2-DA-07: Represent data using multiple encoding schemes.

Next Generation Science Standards (NGSS) Standards

Cross Cutting Concepts:

Systems and system models

Common Core Math (CCSS) Standards

7.RP.A.2: Recognize and represent proportional relationships between quantities.

CCSS.MATH.PRACTICE.MP6: Attend to precision. Mathematically proficient students try to communicate precisely to others. They calculate accurately and efficiently, and express numerical answers with a degree of precision appropriate for the problem context.



Stop 4

Social Media Marketing

Watch this Tour Stop in: [Video 5](#)

How do social media marketers use data analysis and mathematics to connect movies with audiences?

Making a movie is only half the job—people need to know it exists. That's the job of **marketing**: creating messages and activities that help products, services, or ideas get attention and grow. Marketers plan every campaign around connecting a story to its target audience. To build excitement for an upcoming TV show or movie, social media marketers share clips, trailers, and behind-the-scenes videos on social media platforms.

Once a video is posted, marketing shifts from pure creativity to a mathematical discipline known as **data analytics**. Marketers track interaction metrics, looking at numbers like how many people watched a video, how many hit the like button, and how many shared it. However, they don't just look at isolated numbers; they use math to compare them by calculating ratios.



Stop 4

Social Media Marketing

Watch this Tour Stop in: [Video 5](#)

Ratios compare numbers to show their relative values. For example, if a movie clip gets 100,000 views and 50,000 likes, a marketer calculates that as 50 likes for every 100 views, or a 50% engagement rate. That ratio proves the content was highly successful, especially compared to a video with 100,000 views and only 5,000 likes, which yields just a 5% engagement rate.

By calculating these ratios and percentages, marketers can identify patterns to see which content audiences connect with the most. They use these mathematical patterns to make future decisions: if a funny blooper reel gets a higher engagement ratio than a serious trailer, the team knows they should create and post more funny content. The secret to successful marketing is mixing numbers with stories—allowing math to guide creativity so the right audience sees the right content.



Vocabulary Review Question

How do social media marketers use data analytics to make decisions?

- A. They ask the actors to choose the pictures they think make them look best.
- B. They flip a coin every morning.
- C. **They look for patterns in data to see what fans enjoy.**
- D. They post the same video every single day.



Stop 4 Standards

CS Standards

1B-IC-18: Discuss computing technologies that have changed the world.

2-DA-08: Collect data using computational tools and transform the data to make it more useful and reliable.

Common Core Math (CCSS) Standards

CCSS.MATH.CONTENT.6.SP.B.4: Display numerical data using plots (bar graphs of likes, comments).

CCSS.MATH.CONTENT.7.RP.A.2: Recognize and represent proportional relationships (e.g., likes per 1,000 views).

CCSS.MATH.CONTENT.6.SP.B.5: Summarize numerical data sets in relation to the context.

CCSS.MATH.CONTENT.HSS.IC.B.6: Evaluate reports based on data (marketing campaign analysis).

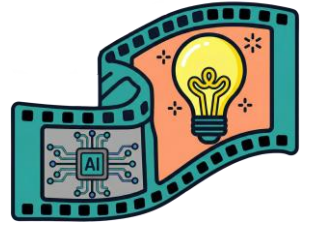
CCSS.MATH.CONTENT.6.RP.A.3.C: Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.



Stop 5

Innovation

Watch this Tour Stop in: [Video 6](#)



How are innovations in cloud computing, AI, and virtual production shaping the future of filmmaking?

The Media, Entertainment & Innovation (ME&I) Lab at Amazon Studios operates as a technology incubator—a testing ground where computer engineering meets storytelling. Unlike traditional research departments focused on distant, theoretical concepts, the ME&I Lab focuses on immediate, practical solutions. Their core philosophy is that technology should never be used simply for the sake of being "new"; it must solve real logistical or creative problems that filmmakers face on set.

One major logistical problem is data management. Historically, cameras recorded footage onto physical media cards that had to be manually collected, securely shipped, and downloaded onto local hard drives before editors could even see the film. The ME&I Lab solves this using "Studio in the Cloud" computing. In this modern workflow, digital cameras upload massive, high-resolution video files directly to secure, internet-based servers in real time.

This shift to **cloud computing** completely eliminates geographical barriers. A director in Los Angeles, an editor in New York, and a visual effects artist in London can all access, review, and manipulate the exact same footage simultaneously. By bringing the media directly to the creatives through the internet, studios drastically reduce production time and open up new opportunities for global collaboration.



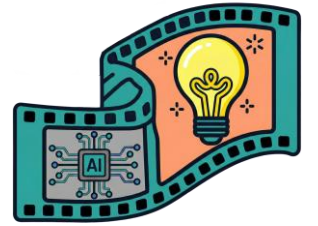
Stop 5

Innovation

Watch this Tour Stop in: [Video 6](#)

On the creative side, the lab utilizes Artificial Intelligence (AI)—specifically Generative AI—to revolutionize how movies are pitched and planned. **Generative AI** allows computer systems to create new, original content based on human instructions. When a filmmaker has an idea, they can now use AI to generate complete concept trailers to explore different visual styles before spending money on a physical production. To manage this powerful tool, a new career path has emerged: the Technical Artist.

Ultimately, innovations like cloud networks and AI do not replace human filmmakers; rather, they eliminate technical barriers and enhance human creativity, allowing artists to focus entirely on what matters most: telling a compelling story.



Vocabulary Review Question

_____ allows filmmakers to safely share and store files over the Internet instead of needing to hand off physical media.

- A. timecode
- B. **cloud computing**
- C. Generative AI
- D. game engines



Stop 5 Standards

CS Standards

2-IC-20: Compare tradeoffs of computing technologies

2-NI-04: Model the role of protocols in transmitting data across networks and the Internet.

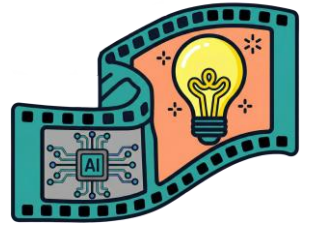
Next Generation Science Standards (NGSS)

MS-ETS1-1: Define the criteria and constraints of a design problem, accounting for relevant scientific principles.

MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process.

Crosscutting Concepts

Systems and System Models



Polls

Poll

Overall, rate your tour experience on a scale of 1-5

- 1 - Extremely Unsatisfactory
- 2 - Unsatisfactory
- 3 - Neither Unsatisfactory or Satisfactory
- 4 - Satisfactory
- 5 - Extremely Satisfactory

How did this tour affect your interest in pursuing careers in technology?

- 1 - Decreased
- 2 - No change
- 3 - Increased

True or False: This tour introduced me to a new career path I had not previously considered.

- 1 - True
- 2- False



Stop 6

Conclusion

Watch this Tour Stop in: [Video 7](#)

How can you prepare for a career at the intersection of technology and entertainment?

Throughout the tour of Amazon Studios, we've seen filmmaking evolve into a massively complex system where engineering and creativity operate hand in hand. While innovations like virtual production and cloud computing provide storytellers with powerful new tools, the fundamental importance of human creativity remains constant. This technological shift has created an explosion of "hybrid roles"—such as Technical Artists and Visualization Supervisors—who serve as the crucial bridge between these traditionally separate worlds. Modern filmmaking relies on a highly collaborative system where computer scientists, mathematicians, network engineers, and visual artists come together to translate creative visions into precise technical reality.

For students interested in these future-proof careers, preparation begins by embracing a balanced education that values both STEM and the humanities. Mathematics and computer science provide the technical foundation for data analytics and digital environments, while art and English classes develop vital visual literacy and narrative skills. Outside the classroom, students can start building their portfolios immediately using accessible tools like smartphone cameras or free software like Unreal Engine. By collaborating with peers on creative projects, students can mirror professional studio environments and take the first steps toward a career of lifelong learning and storytelling.



Rapid Fire Review



Review

An animated 'draft' used by filmmakers to plan out complex scenes before the cameras even start rolling is called _____.

- A. post-production
- B. ratio
- C. previsualization**
- D. Artificial Intelligence

A single image that represents a tiny fraction of a second in a movie or video is known as a _____.

- A. frame**
- B. clip
- C. scene
- D. mood

A comparison of two numbers, like comparing how many people shared a post versus how many people saw it, is a _____.

- A. metaphor
- B. sum
- C. product
- D. ratio**

A type of Artificial Intelligence called _____ AI, allows people to create and test new content based on prompts.

- A. Virtual
- B. Voice
- C. Generative**
- D. Robotic

