

Direction for Designing a 3D Animation Curriculum Utilizing AI Technology

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Abstract

In the field of animation, as technology advances, production technology, production methods, and production culture are also steadily developing. The demand for content is increasing rapidly around the OTT platform, and the demand for animation content and diversity is increasing. With these market changes, animation creation ability is becoming a more important animation education goal. There is also a need to innovate educational methods to provide students with the skills and knowledge required in the modern animation business. This paper investigated the composition of the educational curriculum of domestic and foreign animation universities education. It examines artificial intelligence (AI) technology that can be used in animation creation and explores the design and direction of the university animation curriculum using it. AI technology has already proven its potential in various areas, and it is integrated into the animation curriculum to present various development potentials. Using AI technology, students can focus on practical and essential animation education by preventing technical difficulties in animation creation, increase their experience in animation production, and experiment with planning and producing various contents. It is proposed to design an educational curriculum that further strengthens animation creation and production capabilities by forming smart animation classes to foster talents who can lead the future animation industry in a new direction.

Keywords : Artificial Intelligence, 3D Animation Curriculum, 3D Animation Education

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1. Introduction

1.1 Background of the Study

Until recently, arts education of university predominantly evolved from 'Design' and 'Fine Arts' such as painting, sculpture, and crafts. The establishment of 'Visual Content' as a major in universities has not been around for long. However, for the MZ generation, who consume more video content than texts and pictures, such content has become a critical means of communication and self-expression. Consequently, there is a growing demand for film, broadcasting, and various media-based video content production education. Numerous public and private educational institutions are offering related courses. A few years ago, producing video content was an area limited to a few trained specialists due to the specificity of the equipment and software used. However, with the advent of smartphones, tablets, and the rapid development of smartphone apps, user-friendly production software has been developed, making it accessible to anyone. Thus, the difference between outputs produced by those educated in institutions and others, and what additional capabilities a graduate should possess, is becoming a pressing question.

Among these video contents, animation stands out as a creative field that combines technology and art to convey stories. The themes and subjects of these stories are diverse. The significance and differentiation of animation education in universities lie in this creative activity. Students should be able to deeply explore their desired topics and subjects and have the freedom to experiment and research the methods of expressing them. By

encouraging out-of-the-box thinking, universities can foster a culture of creativity and innovation.

With the growth of the content industry, significant investments are being made in video content production technology, which is rapidly evolving. Technologies like AI (Artificial Intelligence), real-time rendering engines, virtual reality, and augmented reality are being actively introduced and utilized in the field. While universities have been refining and developing their curriculums every year to stay competitive, the reality is that university education is the slowest to adapt to rapid technological advancements and changing cultures and perceptions.

Now is the time to examine the current industry and technological changes, and the education market, and to contemplate where the focus of education should be shifted. As we enter the era of the 4th Industrial Revolution, we need to recognize the educational needs of the new era that extends from traditional animation works. It is time to pay attention to this trend. A new era and generation require a new educational program.

1.2 Research Objective

This study aims to explore the potential and benefits of introducing Artificial Intelligence (AI) and advanced technologies into the animation production process to innovate animation education in the era of the 4th Industrial Revolution. By doing so, the goal is to provide animation major students the opportunity to focus more profoundly on intrinsic values, ensuring they face no hindrance in expressing their stories about the world. AI-based software has the capacity to automate specific

tasks in the animation creation process, allowing a higher focus on creativity. Generative AI algorithms can create new designs, extending creative possibilities and broadening the boundaries of animation creation. This offers significant potential for universities that encourage diverse experimentations and challenges.

New technologies can not only refresh the creative process but also have the power to guide planning and creation in a direction that diverges from conventional norms and structures. It is vital to enable students to discover their voice regarding society and the world around them, develop their unique artistic worlds, and contribute new ideas to the industry, thus leading the animation industry with a competitive edge. The purpose of this paper is to seek innovation in animation education in university using AI and advanced technologies, and the content is as follows.

Firstly, it studies the need for change in animation education. It explores the current status and challenges of animation education and emphasizes the necessity to advance university education to produce excellent animation works by introducing advanced technologies that keep pace with rapidly evolving technology and industry realities.

Secondly, it proposes directions for designing university animation education utilizing AI technology. With AI technology growing at an incredibly rapid pace and poised to bring significant changes to various industries and cultures, exploring AI-based applications for animation creation and pro-actively introducing them into the animation curriculum could potentially unlock future possibilities for animation education in university.

2. Main Body

2.1 Animation Major Curriculum in Domestic Universities

Animation education in university is akin to a condensed real animation production pipeline. <Table 1> shows each element that constitutes the animation production stages. While there are differences between universities, courses are generally designed to teach the elements for Pre-Production, Main-Production, and Post-Production. There are also project courses where students integrate and apply what they have learned from each subject to produce actual animation films. Animation projects typically start in earnest in the latter of the 4-year program, starting from the third year. However, it is primarily in the final graduation project that a fully-fledged animation in its proper format is produced.

<Table 1> Animation Production Configuration

Pre-Production element	
Planning, Concept Design (Background, character, props), Script, Storyboard	
Main-Production element	
2D Animation	3D Animation
Background art, Layout, Animation, Clean-up, Coloring,	3D Layout, Modeling, Rigging, Animation, Texturing, Look Dev., Lighting, Rendering, FX
Post-Production element	
Compositing, Editing, Sound	

There has been much research and positive outcomes regarding the value of project-based education. Given the nature of the animation major, a project-centered curriculum is essential. Through executing animation projects, students get to apply the knowledge and

〈Table 2〉 Animation Education Curriculum in Domestic Universities

Hoseo University				
Year	Planning/ Story/ Direction	Art/ Design	Main Production	Project
1	Film Analysis, Comic & Animation Research, Web-based Platform Research	Character Concept Drawing, Painting Techniques, Costume Drawing, Digital Imaging	Basic Digital Animation, Animation Drawing 1, 3D Graphics Basics 1,2, Video Editing	
2	Animation Planning, Direction, Visual Development	Expression Techniques Research 1,2, Expression Techniques Research 1,2, Animation Drawing, Background & Prop Art	3D Animation 1,2, Drawing 2, Stop-motion 1, Visual Motion & Effects 1,2, 3D Animation 1,2, Drawing 2, Stop-motion 1, Visual Motion & Effects 1,2	
3	Scenario Practice, AI 3D Advanced Animation 1,2, Advanced Production	Matte Painting, 3D Sculpting & Painting, Character Study	2D Animation 1,2, Stop-motion 2, AI 3D Lighting & Rendering, VFX Character Animation, Virtual Reality Simulation	Short Animation Creation 1,2
4	Video Analysis Graduation Film Research	Web Content Production	Computer Animation, 3D Special Effects and Compositing	Creative Animation 1,2, Animation Seminar, Portfolio 1,2
Sangmyung University				
Year	Planning/ Story/ Direction	Art/ Design	Main Production	Project
1		Character Design	Animation Basics, Digital Graphics Basics, Basic Modeling, Lighting & Rendering, Animation Techniques, 3D Character Modeling & Rigging, Video Editing Design	
2	Animation Storytelling, Content Planning & Narrative Direction Animation Planning & Non-linear Storytelling		Match-moving, CGI, Animation Production using Game Engine 1,2, Animation Asset CGI	Experimental Studio 1
3	Interactive Content Analysis & Planning, Animation History		Game/VR Animation, Interactive CGI Basics, Realistic Animation, 3D Effects, Interactive CGI Capstone	Experimental Studio 2
4	Story Workshop		CGI Production, Animation Workshop	Digital Character Studio 1,2, CGI Portfolio
Korea National University of Arts				
Year	Planning/ Story/ Direction	Art/ Design	Main Production	Project
1	Storyboard Basics 1,2, Image Direction 1,2 Idea & Expression 1,2	Figure Drawing 1,2	Character Animation 1,2, Comic & Multimedia 1,2, Acting Practice 1,2	
2	Storytelling Practice 1,2, Storyboard Workshop 1,2		Convergence Content Production Workshop 1,2 Animation Workshop 1,2, 3D Animation Production 1,2 Character Animation 3,4, 3D Character Creation 1,2, Animation Software Practice 1,2, Webtoon & Comics Practice 1,2	
3	Comic & Animation Seminar 1,2, Preproduction Practice 1,2, Comic & Animation Aesthetics 1,2		Engine-based XR Animation 1,2, Webtoon & Comics Practical Skills 3,4, 3D Animation Production 3,4 Animation Digital Photography	
4				Graduation Film Workshop 1,2, Comic & Animation Workshop 1,2, Independent Project 3,4, Production Focus Workshop, Stop-motion Workshop

skills they have learned in class in a practical context. They explore the interrelationships of each field and integrate them, gaining a comprehensive understanding of animation production and its concepts. Unlike passive lecture-based classes, they actively apply what they have learned, research, find solutions to problems, collaborate with peers, and make decisions to complete projects. These activities enhance various skills, including technical development, communication, collaboration, critical thinking, problem-solving, and decision-making.

⟨Table 2⟩ provides an overview of the curricula of college of animation in leading domestic universities.

2.1.1 Limitations of the Traditional Educational Approach

As previously discussed, animation education is structured around project-based courses supplemented with various job-specific training sessions. To produce a single animation film, no step from ⟨Table 1⟩ can be overlooked. Acquiring foundational skills in each job-specific area requires several years of study, making it feasible to create animation film only in the senior years. Before graduation, at best, students might produce two films, but on average, they complete just one as their graduation project. As a result, the number of genuine animation project experiences is quite limited.

However, with the current focus on the OTT (Over-the-top) media service market and the surge in investments for IP acquisition, there is an increasing demand for creative content. With a growing market for content in various formats, it is now crucial to emphasize a project-based curriculum to provide substantial,

practical, and field-centered animation education. Engaging actively with the public and developing a sense for creating marketable content has never been more critical. Presently, the video content industry is actively researching production techniques using more advanced technology, primarily centered around AI. The advancements in 3D animation and VFX technology have reached a point where distinguishing between reality and virtuality is challenging due to their realism and precision. AI utilization has enabled automation of tasks that demand vast amounts of data and time, leading to efficient and advanced technology-based production. Given this industrial backdrop, a shift in the focus of animation education is even more essential.

2.2 Utilization of Artificial Intelligence in the Animation Field

2.1 Overview of AI Technology

Artificial Intelligence (AI) was first conceptualized by Professor John McCarthy at the 1956 Dartmouth Conference in the USA. It refers to an algorithm that allows computers to mimic the way the human brain recognizes patterns from vast amounts of data, differentiates objects, and processes information [Lee, 2021].

AI technology can generally be classified into three main categories: Narrow AI, General AI, and Superintelligent AI.

AI technology is rapidly growing, leading the fourth industrial revolution. According to Goldman Sachs Research, the groundbreaking advances of AI have the potential to bring about extensive changes to the global economy. As tools leveraging the advance-

ment of natural language processing are applied to business and society, they project a global GDP increase of 7% (or nearly \$7 trillion) and a productivity growth rate increase of 1.5 percentage points over the next decade [Goldmansachs, 2023].

3D animation and VFX, given the growing value of their industry, have seen substantial investment in technology. Hence, AI technology is also actively researched in those field and is leading innovation. AI brings high efficiency to animation tasks by automating time-consuming tasks or repetitive actions that require processing substantial amounts of data. Furthermore, there is advanced technology that recognizes prompt-based natural language text and automatically generates key frame animation data and 3D modelling sources.

2.2 Generative AI

Generative AI refers to deep learning models that can produce high-quality texts, images, and other content based on the data they have learned. This means that these models can “learn” statistically possible outputs when presented with raw data (e.g., all of Wikipedia or the collected works of Rembrandt) and, through deep learning models, encode a simplified representation of the training data, then produce new work similar to, but not identical to, the original data [Kim, 2023].

Such Generative Artificial Intelligence (GenAI) can produce various data types like images, 3D models, videos, audio, text, and 3D animations. GenAI, having learned from images from around the world, possesses human creativity and can produce very realistic and intricate content, making it a valuable tool in numerous industries, including gam-

ing, entertainment, and product design. Recent innovations like GPT (Generative Pre-trained Transformer) and Midjourney have significantly enhanced the capabilities of GenAI.

Below, we will explore programs based on these generative AI technologies that can be beneficial for animation production.

2.2.1 Motion Capture Animation Based on AI Technology

The new motion capture technology developed with AI no longer requires expensive equipment and special facilities. It recognizes the movements from captured videos instantly, applying them to the rigged characters in the program, generating keyframe animations. Additionally, facial motion capture can also be extracted from videos. Without attaching tracking points to the face, it can recognize expressions and mouth shapes, extracting detailed facial animation data. The extracted data is freely compatible with 3D animation production platforms. The generated animation data can be edited within the program for more natural movements.

⟨Table 3⟩ AI-based motion-capture tool

Tool	Plask ai
Features	AI-based motion capture 3D animation tool Web Browser Based
Overview	<ul style="list-style-type: none"> - Plask ai is a Web Browser Based tool that enables AI-driven 3D motion capture and editing simultaneously. - There is no need for suits or any additional equipment: filming is simply done with a camera connected to a device like a phone or tablet. - The AI-driven engine used by Plask can accurately identify the bodily movements and expressions of multiple actors at once, and with just a few button clicks, users can edit and convert it into realistic and lifelike animations. - Plask ai also has an automatic image

	generation feature. Using its built-in 3D character pose system, when a pose and camera are set, it produces character images based on the style desired by the user. - https://plask.ai/
Tool	Deepmotion
Features	AI-based video motion capture 3D animation tool
	Web Browser Based
Overview	<ul style="list-style-type: none"> - Deepmotion is a program that captures full-body movements, including facial and hand tracking from video footage, and reconstructs them into 3D animations. - AI automatically re-targets the animation onto custom characters. - Through the animation preview, users can instantly view the 3D animation results and use the Rotoscope Pose Editor tool to edit animations frame by frame, achieving more accurate 3D animation outcomes. - https://deepmotion.com/
Tool	Radical Motion
Features	AI-Based Video Motion Capture 3D Animation Tool
	Web Browser, Cloud
Overview	<ul style="list-style-type: none"> - Radical is a program that offers motion capture solutions without the need for AI-based suits or specialized equipment. Using computer vision and deep learning algorithms, it analyzes 2D video footage to generate 3D animation data.
Tool	Rokoko
Features	Motion Capture Smart Suit
	Hardware/Software for Windows/Mac
Overview	<ul style="list-style-type: none"> - Through Rokoko is software platform, Roko Studio, users can gather and transmit motion capture data from Smartsuit Pro (a full-body motion capture suit) and Smartglove (a glove for capturing hand and finger motion). - Motion capture data can be streamed in real-time to rendering programs like Unity, Unreal Engine, etc. - Compatible with Maya, Blender, Cinema 4D, Unreal, Unity, iClone, and more. - https://www.rokoko.com/
Tool	Cubic Motion
Features	Motion Capture, Facial Recognition
	Hardware/Software
Overview	<ul style="list-style-type: none"> - Cubic Motion is proprietary technology and pipeline accommodate various capture types, including single/stereo camera HMC, 4D

	data, and video inputs from depth cameras. They provide sophisticated facial animations for a broad range of applications, including games, films, broadcasts, virtual reality (VR), and augmented reality (AR). - https://cubicmotion.com/
Tool	Elize
Features	3D Character Animation Creation
	Web Browser Based
Overview	<ul style="list-style-type: none"> - Elize captures motions from video footage and applies them to user-uploaded 3D characters in real-time rendering, implementing realistic facial and lip-sync animations. - With the use of deep learning technology, it very realistically portrays the habits and behaviors of conversational characters. - https://www.elize.ai/

2.2.2 AI-Based Automated Animation Tool

3D animations are typically produced at 24 to 29 frames per second. The principle involves inputting the movement of animated objects for each frame. Animators, artists responsible for creating motions, need to design and input poses for characters or objects frame by frame using 3D animation software. While traditional 2D animations required drawing and filming every single frame, 3D animation software automates the process by interpolating movements between certain frames. However, since this interpolation calculates the mid-values of the input frames' positions, animators still must adjust every frame. Now, this entire process can be streamlined using AI technology. After learning from vast datasets of animation data and motion references, AI can create realistic and natural motions based on simple input gestures. Lip-sync animation can be entirely replaced by AI technology. Users can input dialogue into the program, adjust the tone and speed, and instantly generate a lip-sync animation. References

<Table 4> AI-based 3D Animation Creation Tool

Tool	Cascadeur
Features	3D Animation Automatic Creation
	Web Browser Based
Overview	<ul style="list-style-type: none"> - A 3D character animation program based on AI technology that allows for easy and quick creation of realistic animations, eliminating the need for repetitive or complex tasks. - The rigging system for character skeletal structure can be applied very simply and easily. A unique intelligent device powered by neural networks helps to create postures more easily and quickly. - By just moving the primary control points of the character, AI automatically positions the rest of the body. Based on simple animation movements created by the artist, AI produces more realistic and superior results. This can be applied at the user's convenience. A dedicated tool can be used to easily add secondary motions (auxiliary movements added between primary actions). - https://cascadeur.com/
Tool	Creative Reality Studio (D-ID)
Features	Face Recognition & Animation Creation
	Hardware/Software
Overview	<ul style="list-style-type: none"> - Creative Reality Studio (D-ID) is the world's first platform combining GPT-3, Stable-Diffusion, and D-ID is unique facial animation technology. - Interfaced with Stable-Diffusion, it can create characters, and with GPT text generation technology, it assists in scriptwriting. - When text dialog is entered for an uploaded character, Creative Reality Studio provides an animation of the specified character with accurate facial expressions speaking the entered text. - You can enhance the character's vitality by selecting an appropriate voice, tone, and language to match the script. The produced video shows very realistic and natural expressions and motions. - https://www.d-id.com/creative-reality-studio/
Tool	Squiglit
Features	Animation Creation
	Web Browser-Based
Overview	<ul style="list-style-type: none"> - Squiglit requires only basic user inputs (scripts or storyboard outlines) and uses AI

	<ul style="list-style-type: none"> to automatically create an entire animation video with captivating visuals such as motion graphics, images, text, and music tailored to the content. - HTTP://squiglit.com/
Tool	Omniverse Audio2Face
Features	3D Character Animation Creation
	Web Browser Based
Overview	<ul style="list-style-type: none"> - Omniverse™ Audio2Face Beta is a program that simply creates 3D character animation in real-time to match the voice recognition track of the input audio. - The results are executed in real time or baked to be used in combination with other applications. - NVIDIA's reference application simplifies the process of creating animation from audio input, enabling creators to easily and quickly implement ideas. At its core, Audio2Face uses Generative Adversarial Networks (GAN), which are two neural networks competing against each other, to create realistic facial expressions from audio input. - https://www.nvidia.com/en-us/omniverse/apps/audio2face/

2.2.3 AI Technology-Based Automatic 3D Modeling Tool

Using AI technology, 3D modelling sources can be created from text inputs. Of course, the artistic and aesthetic sensibilities of an artist are still required, and it is currently impossible to produce modelling data at a complex level with many details. AI algorithms can convert text prompts or 2D images into 3D models, reducing the time and effort required to create intricate 3D scenes. Currently, it is still in the technology development phase and may not provide refined and high-quality modelling data. However, it can be used for base modelling to achieve a desired shape or for creating simple 3D animations. Typically, when such AI tools are used as an auxiliary in the creative process, the copyright for the resulting work belongs to the creator themselves.

<Table 5> AI-based 3D modeling creation tool

Tool	Spline AI
Features	3DModeling Generator
	Web Browser Based
Overview	<ul style="list-style-type: none"> - A platform that creates 3D modeling, textures, and animation keys based on text. Real-time rendering is also possible. - https://spline.design/ai
Tool	3dfy
Features	3DModeling Generator
	Web Browser Based
Overview	<ul style="list-style-type: none"> - A platform that converts text prompts and 2D digital images into 3D modeling and texture sources. - https://3dfy.ai/
Tool	Masterpiecestudio
Features	3DModeling/Animation Generator
	Software connected to VR gear
Overview	<ul style="list-style-type: none"> - Generates 3D assets (including 3D modeling, rigging, and textures) from text prompts, 2D digital images, and videos. - Editing is possible at each stage for superior results. It aims to produce assets that can be directly used for games or animations. - https://masterpiecestudio.com/
Tool	Meshcapade
Features	3D Character Generator
	Web Browser Based
Overview	<ul style="list-style-type: none"> - Creates 3D characters based on input images. - https://meshcapade.com/

2.2.4 AI Technology-Based Digital Image Creation Tool

Currently, it is the most talked-about and actively used field among AI generators. Starting with the commercial application of the GAN (Generative Adversarial Networks) model developed in 2014, the initial outputs were blurry and lacked accuracy. However, with continuous development, the generated images are now highly realistic and detailed. Users can guide the desired image using text prompts, and the program generates the image based on these prompts. Depending on how the text prompts are used, the guidance accuracy and detail of the image can vary. By

repeatedly editing the generated image with text prompts, users can derive an image that is closest to the desired result. Moreover, using deep learning and machine learning technologies, users can apply specific artistic styles or the styles of famous artists by training the program on those styles and then applying them to the images.

<Table 6> AI-based Digital Image Creation Tool

Tool	Runway
Features	Overall Image and Video Creation, Transformation, and Editing
	Web Browser Based
Overview	<ul style="list-style-type: none"> - Utilizing AI technology, it is possible to style, transform, and edit text prompts, images, and video sources into 2D animations, 3D animations, live-action videos, image transformations, composites, and more. - Video creation using text prompts, images, or a combination of both. - Styling and transforming videos or images through text prompts or images. - Rendering storyboards into completed videos in various styles. - Separating specific elements from videos and editing or transforming them using simple text prompts. - Completing 3D low-polygon preview videos into realistic rendered results. - Transforming video sources into stylized 2D/3D animations. - https://runwayml.com/
Tool	Studio Artist 5.5
Features	Image/Animation Creation
	Software for Windows/Mac
Overview	<ul style="list-style-type: none"> - Synthetik is Studio Artist 5.5, based on deep learning, allows users to automatically paint input photos in various styles. - Videos can be produced by automatically generating each frame as an animation. - Capabilities include transforming photos into instant vector art, creating abstract and generative art, and rotoscoping animations from videos. - https://synthetik.com/
Tool	DALL-E 2
Features	Text-Based Image Creation
	Web Browser Based

Overview	<ul style="list-style-type: none"> - A platform by OpenAI, initially launched in 2021, it has contributed to advancements in AI-based art techniques. DALL·E 2 was released on April 6, 2022. - It can create realistic or creative art images based on input text prompts. - Users can also transform and edit their images as intended by the text. - https://openai.com/product/dall-e-2
Tool	Midjourney
Features	Text-Based Image Creation
	Web Browser Based
Overview	<ul style="list-style-type: none"> - By inputting a text prompt, users can produce high-quality images as desired. - Users can modify uploaded images by adding text prompts, altering their content and style, and adding transformations to created images. - It is advantageous for creating images tailored to a user is artistic preferences, rather than just photorealistic images. - https://docs.midjourney.com/
Tool	Stable Diffusion
Features	Text-Based Image Creation
	Web Browser Based
Overview	<ul style="list-style-type: none"> - Users can create high-quality images in any way they want without any limitations on text prompt input. - No registration is required, and the license is free for commercial use. - Users can access an image text prompt database along with created images. - https://stablediffusionweb.com/
Tool	Jasper
Features	Text-Based Image Creation
	Web Browser Based
Overview	<ul style="list-style-type: none"> - Images are created based on text prompts. - It has a user-friendly menu setting and allows users to create desired images quickly and easily. - https://www.jasper.ai/

2.2.5 AI-based Story Creation Tool

“Sun spring” is a short film scripted by the first artificial intelligence screenwriter ‘Benjamin’ in 2016. Benjamin learned from science fiction movie scripts of the 1980s and 1990s available online to craft the screenplay [Lee, 2021]. In this way, AI, like digital image creation tools, is capable of autonomously pro-

ducing complete writings. Using AI writing tools, creators can quickly verify their planning ideas, identify issues, and explore potential improvements.

<Table 7> AI-based Idea and Story Writing Tool

Tool	ChatGPT
Features	Text-based Content Creation
	Web Browser Based
Overview	<ul style="list-style-type: none"> - ChatGPT is a leading text-based artificial intelligence program. - A modification of the GPT (Generative Pretrained Transformer) architecture, it is specifically designed and finely-tuned for interaction with users, generating human-like text based on the given user input. - It can receive and process various information and provide summaries. Through consistent updates and development, creative and collaborative work becomes possible. - Creative and technical writing tasks, like song composition, screenplay writing, or learning the user is writing style are feasible. - https://openai.com/product/chatgpt
Tool	Jasper
Features	Text-based Content Creation
	Web Browser Based
Overview	<ul style="list-style-type: none"> - Jasper is an AI story generator. - It uses neural networks and natural language processing to write stories, evolving through deep learning to better generate new ideas. - Main features include plot generation, character development, and an idea bank, among other functions that assist in brainstorming unique ideas. - Jasper AI offers over 50 templates for writing. - https://www.jasper.ai/
Tool	SudoWrite
Features	Text-based Story Creation
	Web Browser Based
Overview	<ul style="list-style-type: none"> - Sudo Write is an AI-based writing program that simplifies the story-writing process. - Based on GPT-3 and GPT-4, with over 175 billion parameters in its Transformer model, it learns general concepts from training data. - Powered by a variation of the Chat-gpt algorithm and an exclusive descriptive processor, it provides automated keyword suggestions and insights into reader responses, allowing writers to tailor stories

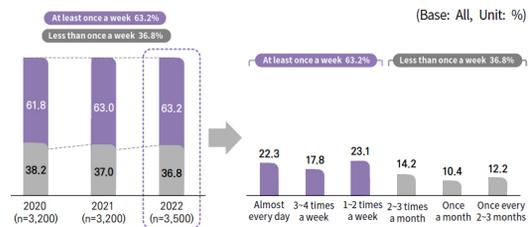
	<p>to their desired audience.</p> <ul style="list-style-type: none"> - It also features a comprehensive resource library for leveraging all languages. (https://neilchasefilm.com/best-ai-story-generator/) - In the AI canvas, it provides plot points, character arcs, and themes while generating alternate plot points, character secrets, and plot twists. - https://www.sudowrite.com/
Tool	Rytr
Features	Text-based Story Creation Web Browser Based
Overview	<ul style="list-style-type: none"> - Rytr creates AI stories that assist in brainstorming ideas and storylines. - It is based on a neural network trained on over 500,000 stories. - With Rytr, the more the deep learning technology is used, the more it learns, thus further developing stories and ideas. - Users can specify the genre, style, length, and other parameters of the story they want Rytr to generate, and it can produce multiple versions of the story. Additionally, Rytr has a built-in plagiarism checker (Neil Chase, 2023). - https://rytr.me/

2.3 Direction of Animation Talent Training in Response to Changes in the Industrial Environment

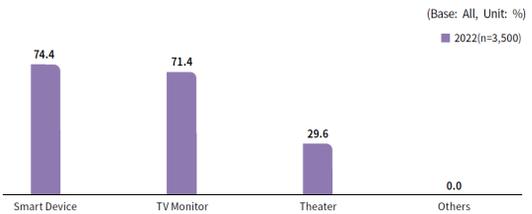
To understand the demand for future animation content creation and the required capabilities, it is necessary to examine the changes in demand and requirements of the content industry and market. Recent data from the 2022 Animation Industry White Paper on the media and frequency of animation usage is as follows:

Firstly, the frequency of animation usage is shown to be “at least once a week” at 63.2%, and this has been on a continuous rise since 2020. Additionally, when it comes to the medium used to view animations, “smart devices (74.4%)” and “TV monitors (71.4%)” had a rela-

tively high usage rate, whereas “theaters” were at 29.6% [Korea Creative Content Agency, 2022].



<Figure 1> Frequency of Watching Animation



<Figure 2> Used Media when Watching Animation

Following the onset of the COVID-19 pandemic, the video content industry has undergone significant transformations. The demand for video content has skyrocketed, especially on OTT platforms. With the rise in demand for animation content, there is an increased call for content diversity due to a broader range of viewing genres and audience age groups. As Korean content (K-content) gains traction globally, there is an imperative for qualitative and quantitative growth in Korean animation content.

Given the evolving demands and needs of new animation content consumers, the skills and capabilities of those creating future animations must also adapt. Animation education must not only stay abreast with current industry trends but also look ahead, preparing students for their transition from a four-year educational journey to the professional industry landscape.

2.3.1 Planning Capability

According to the 2022 Animation Industry White Paper, 61.1% (including multiple responses) of viewers indicated that they choose animations based on the story, with the second most popular reason being the characters they love, at 42.0%. The crux of content consumption lies in compelling stories and well-designed characters. As the demand for animation content grows, it is imperative to adopt efficient production methods that save time and cost. In doing so, it will satisfy the rising demand for content, represent the voices of various societal layers and generations, and convey comprehensive narratives that respect cultural diversity and values.

2.3.2 Creativity and Artistic Sensibility

The 2022 Animation Industry White Paper revealed that 38.0% (including multiple responses) of the respondents chose animations because they liked the artwork, marking a 5.4% increase from the previous year. Animations, by their genre, allow for unique and artistic expressions. With the rise of platforms like YouTube and Netflix, there is an increasing demand for original animations. As the supply of animations expands, audiences will seek even more diverse and original works. Advancements in AI technology have made image creation easier and faster, paving the way for a production environment where one can invest in elevating the artistic quality of animations. Thus, students must hone their creative ideas and artistic sensibilities.

2.3.3 Production Techniques and Application Skills

In line with the theme of this paper, the level of technical expertise and its applicative

ability in animation production is paramount. Referring to Table 2, which showcases the curriculum of leading animation-major universities domestically and internationally, it is evident that a significant focus is on production techniques. The 2D and 3D graphic production platforms are numerous and varied. Every year, new technologies are developed, and production software is updated. While the design, style, and degree of completion vary, the production time and necessary workforce are substantial. Especially in universities, students' works require more time and human resources as learning and production occur simultaneously. By leveraging appropriate AI technologies, it is possible to reduce animation production time and concentrate on enhancing the necessary capabilities.

2.3.4 Problem-solving Capability

One of the primary competencies that students should focus on developing during their college education is problem-solving capability. Animation production culminates from a fusion of knowledge across various disciplines. Students delve deeply into several specialized fields of study and, through projects, apply that knowledge to actual creations. During the animation creation process, they are given opportunities to directly utilize and implement the skills and knowledge acquired from individual courses. However, not all learned content is immediately and seamlessly applicable. The real production process often involves trial and error. Animation production proceeds with techniques from various sectors and multiple programs. Thus, abilities to harness software, integrate different fields, and merge the work of team members become in-

dispensable, as challenges arise in these areas. Through multiple projects, students encounter these trials and errors, gradually enhancing their problem-solving capabilities.

2.3.5 Collaboration and Communication Skills

When producing an animation as a team, collaboration and communication skills are essential. According to an industry satisfaction survey report released by Chungkang College of Cultural Industries in 2022, the most valued foundational skills by industry employers are problem-solving (89.6%) and communication (89.3%). Companies in the animation sector particularly rated 'communication skills' higher. In team projects, obtaining commendable results is not always achievable through individual technical prowess alone. Animation production requires experts from various fields to work responsibly towards a collective goal at each stage. The outcomes of these stages come together, much like pieces of a puzzle, to form a complete artwork. Merely excelling in one area does not guarantee favorable outcomes. If there is a lack of communication among team members, even a group of highly skilled individuals might fail to produce substantial results. For these reasons, universities are emphasizing project-centered education to fortify students' collaboration and communication abilities.

2.4 Structuring Smart Learning with the Introduction of Artificial Intelligence (AI) Technology

2.4.1 Benefits of Smart Learning Through AI Integration

(1) By integrating AI technology, tasks can

be executed rapidly and efficiently, leading to quicker completion of animations. This efficiency allows for the planning and realization of multiple projects.

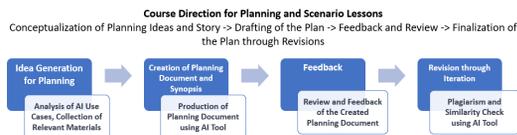
- (2) Repetitive tasks that typically consume a substantial amount of time can now be replaced.
- (3) Projects that focus on creating individual animations can leverage AI technology to save both time and production costs. This results in a deeper focus on the core or primary objectives of the project. It enables the design of projects centered around each student's area of concentration, such as planning, storytelling, design, direction, advanced technical skills, branding, etc.
- (4) AI can compensate for areas with a shortage of manpower or insufficient training, broadening the scope of project planning.

2.4.2 Classes on Planning and Scenario Development

AI platforms are incorporated into classes centered on planning, ideation, and storyline formulation. For students without any experience in conceptualizing story ideas or plans, even after theoretical lessons, drafting a plan remains a challenging endeavor. While the acquisition of theoretical knowledge is essential in learning about planning and scenarios, hands-on experience is of paramount importance. Through the process of converting an idea into a formal plan and refining it, students can identify crucial elements and potential pitfalls. By utilizing AI programs in the ideation and refinement stages, the process becomes more efficient, allowing students to

gain more practical experience.

Furthermore, for students more inclined towards production majors than planning and storytelling, AI programs can streamline the planning process for animation projects. This efficiency ensures that they can dedicate more time to their primary field of study.

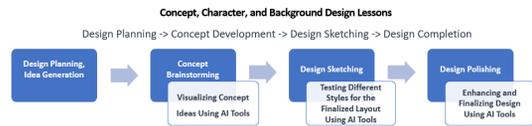


〈Figure 3〉 Planning and Scenario Class

2.4.3 Concept, Character, and Background Design Lessons

For designers, drawing skills are of paramount importance. However, during the learning process, students with less advanced drawing techniques may find it challenging to produce concept designs without investing considerable time, making it hard to experiment with diverse ideas. During the animation design phase, as concepts are fleshed out and detailed backgrounds or character designs are conceptualized, utilizing AI tools can facilitate rapid visualization of brainstormed ideas. This allows for the analysis of the strengths and weaknesses of the outcomes and accumulates experience in discerning good designs. Once a specific design idea is settled upon, experimenting with various styles to express it is essential. Here again, AI tools can be employed to produce test images of the conceived design by applying different styles sourced from extensive data. Furthermore, towards the final stages, AI tools can be used to enhance the image or add realistic details. By selectively using AI technology during the design process, students studying design can produce a plethora of designs in a short span,

analyze the outcomes, refine them through feedback, and ultimately achieve a higher level of design proficiency.

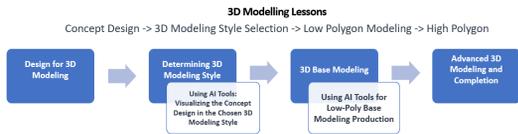


〈Figure 4〉 Animation Design Class

2.4.4 3D Modelling Lessons

Producing 3D animation works requires a substantial amount of time and process to create 3D modelling assets such as backgrounds, characters, and props. 3D modelling demands a combination of sculpting, design sense, and 3D graphics skills. It is an area where differences in quality and completeness are visually apparent early in the animation production process. Currently, Photogrammetry software, which extracts 3D modelling data and textures from outdoor backgrounds, close-up objects, characters, etc., by inputting 3D scans or panoramic photo sources, is well-developed, allowing for swift and precise conversion of specific people or objects into 3D assets. While Photogrammetry tools convert existing entities into 3D models, generative AI creates 3D objects instantaneously based on text, without the need for 3D graphics software.

Presently, AI-based 3D modelling technology is still in its infancy but is expected to grow rapidly soon. Instead of starting modeling from scratch, artists can use AI to craft a basic form and then refine it with their design sensibility to finalize it. Furthermore, when used to produce assets that aren't primary backgrounds or main characters and don't require artist modifications, AI can significantly reduce animation production costs.



〈Figure 5〉 3D Modeling Class

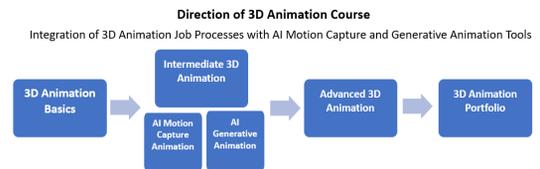
2.4.5 3D Animation and Rigging

Animating a character according to physical laws to imbue it with lifelike vibrancy requires a lengthy period of expertise. Particularly for realistic characters, precise and detailed movements are essential. Any awkward or physically inaccurate depiction of a realistic humanoid character is movements can easily become noticeable, posing challenges in narrative delivery. When students majoring in animation are tasked with producing an animation project without achieving a proficient level of key animation capabilities, or when there is a shortage of artists capable of handling extensive key animation tasks, the utilization of AI technology can be beneficial.

To enhance professional competency as an animator, it might be beneficial to establish courses on beginner, intermediate, and advanced levels, coupled with programs utilizing AI-based motion capture and generative animation techniques. The standard animation professional curriculum should primarily focus on physically accurate movements and delve into intricate animated motions that can not be captured in motion-capture, stylized animation, and unique character portrayals.

Rigging can be described as one of the most technically demanding areas. While rigging is an indispensable phase for animating created characters, successful rigging techniques that render the character is motions natural-looking also demand a period of expertise. For students not majoring in rigging, automated systems could significantly save

time and considerably enhance the efficiency of learning key character animation.



〈Figure 6〉 3D Animation Class

2.4.6 Miscellaneous

In addition to rotoscoping, AI technology can be utilized in the synthesis and editing stages. Software platforms like Adobe are already extensively integrating AI, designed to allow artists to work more efficiently and quickly.

3. Conclusion

Rapid advancements in technology and science are influencing all areas of modern civilization. The progress of artificial intelligence, big data, and digital technology is driving the Fourth Industrial Revolution and significantly altering the cultural and arts industry. The growth of internet network technologies has led to the rise of new OTT video content platforms like Netflix, Disney Channel, and YouTube. The increasing demand for video content and shifts in consumption patterns are having a significant impact on the growth of the South Korean animation industry. With the expanding viewer base, not just limited to children but also adults, there is a growing demand for diverse and high-quality content.

In this era, universities need to swiftly adapt to technological developments and shifts in societal perceptions. Compared to the past is OEM-focused production environ-

ment, the contemporary trans-media era requires a different direction in nurturing talents. The skills required include planning, directing, creativity, artistic sensibility, technical knowledge, application skills, problem-solving, collaboration, and communication. Animation educational institutions must aim to enhance these capacities.

Presently, the animation curriculum in domestic universities is broadly divided into planning (story) and direction, design and art, primary production technology, and post-production technology. To produce a complete animation work, understanding and skills spanning all these domains are essential, demanding more than just foundational knowledge for producing refined works. Knowledge and skills acquired through the animation curriculum can be applied in practical project-based lessons, offering an integrative learning experience. If AI technologies tailored for each domain are introduced, it could increase production efficiency and allow a deeper focus on the project is fundamental aspects.

To foster creativity, innovation, and application, there is a need for curriculum design that actively incorporates AI into the university animation education process. The potential of AI in automating specific tasks is immense, allowing students to set more ambitious educational objectives focusing on the creative aspects of animation and developing their unique artistic perspectives. Integrating AI into the animation curriculum encourages students to experiment with and explore new creative possibilities. They should be motivated to develop unique artistic viewpoints, contributing fresh ideas to the industry, and ensuring competitiveness.

Platforms based on existing or under-devel-

opment AI technologies can be applied in courses related to planning and scenario development, concept design, 3D modelling, animation, and rigging. Whether utilizing 100% of the entire process for learning or leveraging parts of the program, it can enhance production efficiency, accelerate the pace, or supplement specific skills or production capabilities lacking in certain learning domains, ensuring more profound and fundamental learning.

Institutions of higher education often have complex procedures for designing and implementing curricula, and it takes a significant amount of time for students to graduate and enter the workforce. Thus, swiftly adapting to industrial trends and technological shifts is not easy. While the essence of university educational objectives goes beyond just acquiring skills, we are in an age of rapid changes where innovation in acquiring required capacities for the present and future is crucial. By incorporating AI through smart class structures, the efficiency, effectiveness, and creativity of animation education can be enhanced. We conclude this research with the expectation that this will help nurture future animation talents and further develop the animation industry.

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