SYNTHÈSE

STUDY

WORKING IN DIGITAL CREATION

Evolving employment in 2D and 3D graphics and related training challenges

NOVEMBER 2022
Abridged version

SYNÈRGIES

propelled by
SYNTHÈSE Pôle Image Québec

The platform dedicated to aligning training and employment in:

- VFX
- Animation
- Video games
- Digital experiences

Keep up to date with evolving expertise and jobs in digital creation by reading our:

Articles | Reports | Portraits & testimonials | Case studies | Scientific publications

View the full version of the study
WORKING IN DIGITAL CREATION on:

SYNTHESEsynergies.com

About SYNTHÈSE

SYNTHÈSE — Pôle Image Québec was founded in August 2018 by Ministère de l'Enseignement supérieur du Québec (the province's ministry of higher education).

Our mission is to develop promising and tangible initiatives to stimulate synergies between higher-education institutions and digital creation companies from a training and research standpoint throughout Québec.

About the Study

In 2021, in collaboration with the various players in Québec's digital creation ecosystem, SYNTHÈSE developed a 97-page study focusing on entry-level and junior job positions in 2D and 3D graphics.

This document is an abridged version of the study. It invites you to discover how 2D and 3D graphics jobs are evolving in response to technological and organizational changes. It also provides you with an opportunity to learn about the business models of companies active in the sectors targeted by the study.

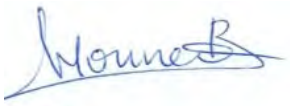
With a particular focus on the issues surrounding training and employment alignment, the study as a whole documents current and forthcoming transformations as well as the needs that educational programs must meet.

This investigative project is part of an ongoing monitoring process that aims to document the changes and needs of businesses and post-secondary institutions over the long term.

Message from the Executive Management

As in many other growth industries, the visual effects and animation, video game, and immersive digital experience sectors are facing a labour shortage that requires multifaceted responses. One of these responses is to ensure that the knowledge and skill sets of current and future professionals are always aligned with the needs of these inherently innovative and mutable sectors.

Solutions and actions, however, cannot be found without prior diagnostics. As the opening exchange in what SYNTHÈSE hopes will be a lasting dialogue between industry and education, this study presents an overview of the changes taking place in the digital entertainment industry. A few short- and medium-term solutions are put forward in an effort to foster alignment between training and employment in digital creation and enable Québec to maintain its leadership position in this industry.



Brigitte Monneau

SYNTHÈSE Executive Management

Read the long version of the study :

https://bit.ly/notre_enquete

SYNTHÈSE — Pôle Image Québec would like to thank all participants in the various stages of this study : professionals in the visual effects and animation, video game, and immersive digital experience industries in Québec as well as teachers in colleges and universities. Their collaboration has made it possible to paint a picture of the technological evolution of jobs in 2D and 3D graphics in the field of digital creation and of the issues involved in aligning training and employment.

SYNTHÈSE EXECUTIVE MANAGEMENT

Brigitte Monneau

PROJECT MANAGEMENT

Anne Le Bouyonnec

PROJECT MANAGER

Isabelle Lefebvre

RESEARCH, ANALYSIS, AND CONTENT PRODUCTION

Anne Le Bouyonnec

Isabelle Lefebvre

Andréane Morin-Simard

Magali Ouellet

INTERVIEWS

Anne Le Bouyonnec

Isabelle Lefebvre

EDITORIAL REVIEW

Alexia Boyer

Yuani Fragata

Albane Français

Brigitte Monneau

Antoinette Reyners

COORDINATION AND COMMUNICATIONS

Alexia Boyer

Albane Français

GRAPHIC DESIGN

Sabrina Bolduc

Alexandre Chocron

Hugo Nélis

La Workshop

ILLUSTRATIONS

Cyril Doisneau

LANGUAGE REVIEW

Joë Villaverde

DATA PROCESSING

Alexia Boyer

Isabelle Lefebvre

Sophie Lupien

Andréane Morin-Simard

Magali Ouellet

Jean-Charles Ray

Léa Roy-Beaudoin

SYNTHÈSE

1501 Bleury, 7th floor,
Montréal, QC, H3A 0H3
Phone : 438 476 0764 (# 100)
info@polesynthese.com
polesynthese.com

With collaboration from ministère de l'Enseignement supérieur

This study was originally conducted at the request of Ministère de l'Enseignement supérieur. The study does not represent the policies of the government departments and agencies that collaborated in the project. It represents the opinion of respondents, and its content is the sole responsibility of the authors of the study.

Preface by the sector associations

It is always more constructive to come together to face challenges in our industries. That is why our sector associations exist, namely, the Québec Film and Television Council, La Guilde du jeu vidéo du Québec, and Xn Québec. Coming together to support and defend the interests of our members – whether they are active in film and television, video game or immersive digital experience – is what we are all about.

This is precisely what we are doing under the SYNTHÈSE banner. As a result, we can take up – on behalf of the 700 Québec companies we represent – a major challenge : to address and resolve workforce issues in digital creation.

We represent industries whose know-how, inventiveness, and expertise are recognized all over the world, but which, for several years, have been facing a labour shortage that may ultimately hinder their growth and jeopardize their position as leaders.

At the same time, we know that Québec has a network of high-quality universities and colleges that can train future experts and teachers in digital creation. That is why, alongside SYNTHÈSE, we are engaged in a process of reflecting on training and employment in our sectors and implementing tangible action.

Several studies carried out between 2016 and 2018 in various digital creation sectors had already highlighted a lack of adequately qualified workers in each sector.

Today, the convergence of training, skills, and jobs within this ecosystem is increasingly evident, which calls for an overarching vision.

That is why SYNTHÈSE is addressing the workforce issue today by drawing up a wide-ranging portrait of the three sectors – the first of its kind. Resulting from hundreds of hours of consultation with experts and teachers in the sector, this report entitled Travailler en création numérique : évolution des métiers graphiques 2D et 3D et enjeux de formation (“Working in digital creation : evolving employment in 2D and 3D graphics and related training challenges”) paints a detailed picture of our industry’s needs. Based on study findings, the report puts forward a series of recommendations in which all stakeholders have a role to play.

As digital creation is an industry that is as fluid as it is dense and complex, its practices are constantly evolving, with new skills emerging all the time. Accordingly, this report is the starting point for an ongoing monitoring initiative based on SYNTHÈSE’s expertise in the area of aligning of training and employment. This monitoring initiative will make it possible to identify emerging professional trends and foster exchanges between training institutions and companies in the three sectors.

In an effort to provide solutions to workforce issues, our associations support SYNTHÈSE’s approach to aligning our members’ needs and the higher-education community’s expertise in a lasting manner. In this period of economic recovery, we are proud to support this initiative to ensure that Québec maintains its leadership in the digital arts.

Sophie Couture

Executive Director

Xn Québec

Valérie Daigneault

Director of the Secretariat of the Audiovisual Cluster

Québec Film and Television Council (QFTC)

Emilien Roscanu

Acting Executive Director

La Guilde du jeu vidéo du Québec

CONTENTS

INTRODUCTION

The purposes of this report

The purposes of this report

This report targets the following objectives:

Identify entry-level positions and hiring requirements for 2D and 3D graphics jobs in the three sectors covered by the study.

Identify current and future transformations that may impact employment in digital creation.

Document the effects of these changes on the practice of entry-level (less than one year's experience) and junior (between one and three years' experience) 2D and 3D graphics positions:

- On companies' workforce needs
- On the competencies[1] associated with targeted positions

Gather information on the needs to be met by the targeted initial training offer (see Table 1 and Table 2 below) leading to 2D and 3D graphics jobs in the three sectors of activity:

- Needs relating to skills and other training content to be developed for students in educational programs
- Needs relating to educational structures to be implemented
- Sticking points that currently limit ability to align training and employment

1. The term "competency" is used as understood by the industry professionals who took part in the study. The term's definition encompasses the tasks carried out by the various positions and related skill sets, without necessarily making a distinction between fields of knowledge, expertise, and interpersonal skills involved in carrying them out. The meaning of the term as used in this report may differ from its meaning in the field of education (in particular in comparison with the competency-based approach).

Table 1 – College programs (DCS)

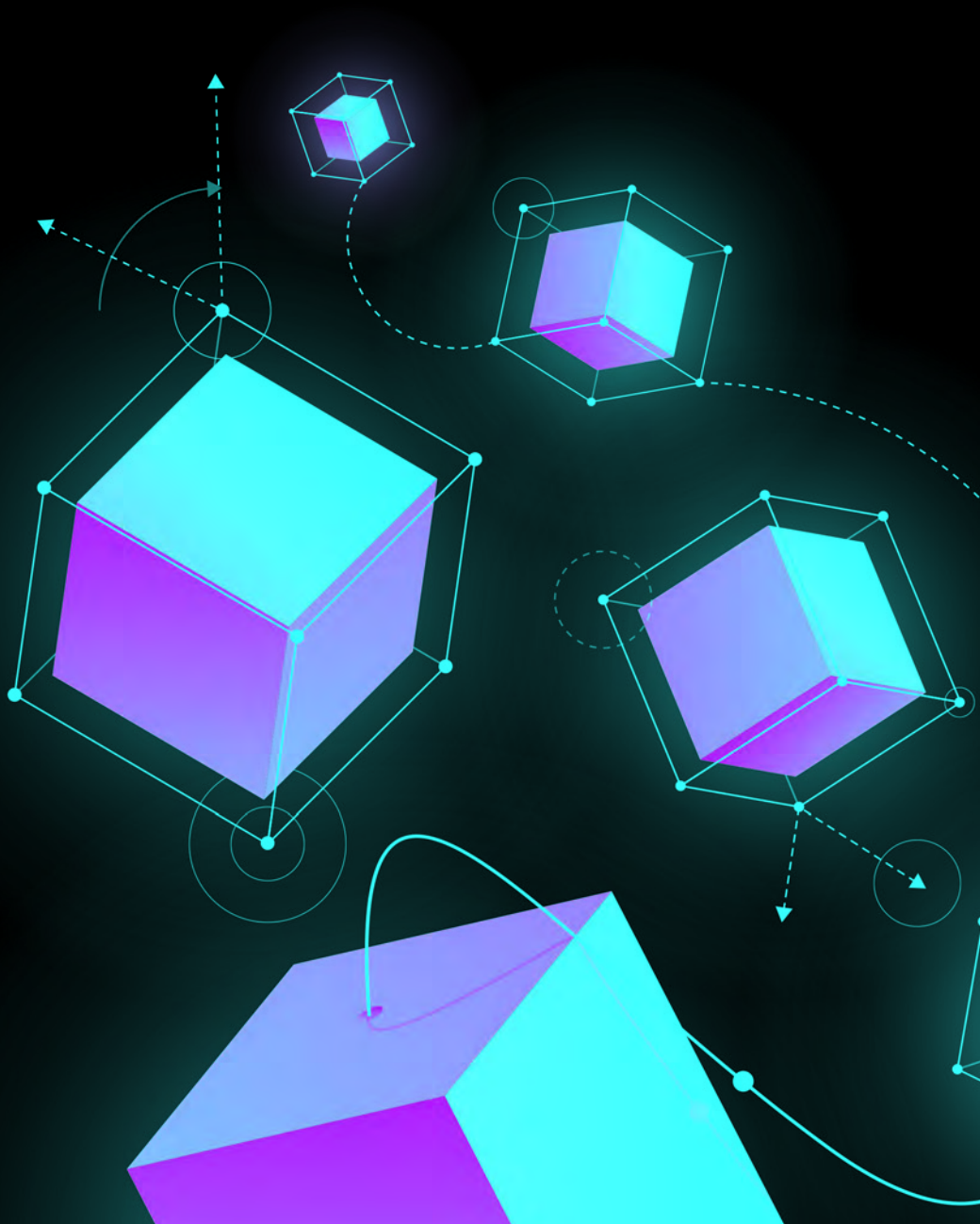
Programs	Teaching institutions
Illustration et dessin animé – voie de spécialisation : Dessin animé (574.AB) Illustration and animation (574.AO)	**Public :** Cégep du Vieux Montréal, Dawson College
Techniques d'animation 3D et de synthèse d'images (574.BO) 3D animation and computer generated imagery (574.BO)	**Public :** Cégep de Matane, Cégep du Vieux Montréal, Cégep Limoilou, Dawson College, Collège de Bois-de-Boulogne **Private :** Collège Bart, Collège LaSalle, Collège O'Sullivan de Québec, Institut Grasset
Techniques de production et postproduction télévisuelles – voie de spécialisation en postproduction télévisuelle (589.AO)	**Public :** Cégep de Jonquière **Private :** Collège Bart, Institut Grasset

Table 2 – Undergraduate and certificate programs

Programs	Types	Teaching institutions
Animation 3D et design numérique	Undergraduate, Certificate	Université du Québec à Chicoutimi – École des arts numériques, de l'animation et du design
Art et science de l'animation	Undergraduate, Certificate	Université Laval
Arts numériques	Certificate	Université du Québec à Chicoutimi
Fine arts – major in digital arts	Undergraduate	Concordia University
Communication – Concentration création médias : médias interactifs	Undergraduate	Université du Québec à Montréal
Création 3D	Certificate	Université du Québec en Abitibi-Témiscamingue
Création 3D – Concentration cinéma d'animation	Undergraduate	Université du Québec en Abitibi-Témiscamingue
Création 3D – Concentration exploration et expérimentation	Undergraduate	Université du Québec en Abitibi-Témiscamingue
Création de jeux vidéo – Concentration art	Undergraduate	Université du Québec en Abitibi-Témiscamingue
Création numérique – Concentration création 3D	Undergraduate	Université du Québec en Abitibi-Témiscamingue
Film animation (BFA)	Undergraduate	Concordia University
Effets visuels pour le cinéma et la télévision	Certificate	Université du Québec en Abitibi-Témiscamingue

Part I : Background

Part I of this report is designed to provide a general portrait of the industry targeted by the graduates of the college and university programs included in this study.



CHAPTER 1

Québec ecosystem encompassing the three targeted sectors : visual effects and animation, video game, and immersive digital experiences

Chapter 1 provides a general portrait of the three sectors within the Québec digital creation ecosystem covered by this study

Table 3 — The digital creation ecosystem*

* For this table as a whole, data that are not accompanied by documentary sources comes from documents obtained through private correspondence with sector associations.

Visual effects and animation sector
COMPANIES
37 companies are represented by the Québec Film and Television Council (QFTC)
The vast majority of companies in the visual effects and animation sector are service providers for large foreign studios
About 10 % of animation companies produce Québec- or Canadian-owned content
Many companies conduct a variety of operations
WORKFORCE
Visual effects : 2,770 jobs in 2020
Animation : 1560 jobs in 2020
Median annual salary : 82 500 $
Projected workforce requirements : 7250 jobs in 2023

Video game sector
COMPANIES
245 companies are represented by La Guilde du jeu vidéo du Québec
The video game industry is built on a service-based business model
Since 2015, independent studios that are able to develop, produce, and market their own intellectual property have emerged
WORKFORCE
13000 jobs in 2019
Projected workforce requirements : 2,000 jobs in the next two years
Average annual salary : 75 600 $

Table 3 — The digital creation ecosystem*

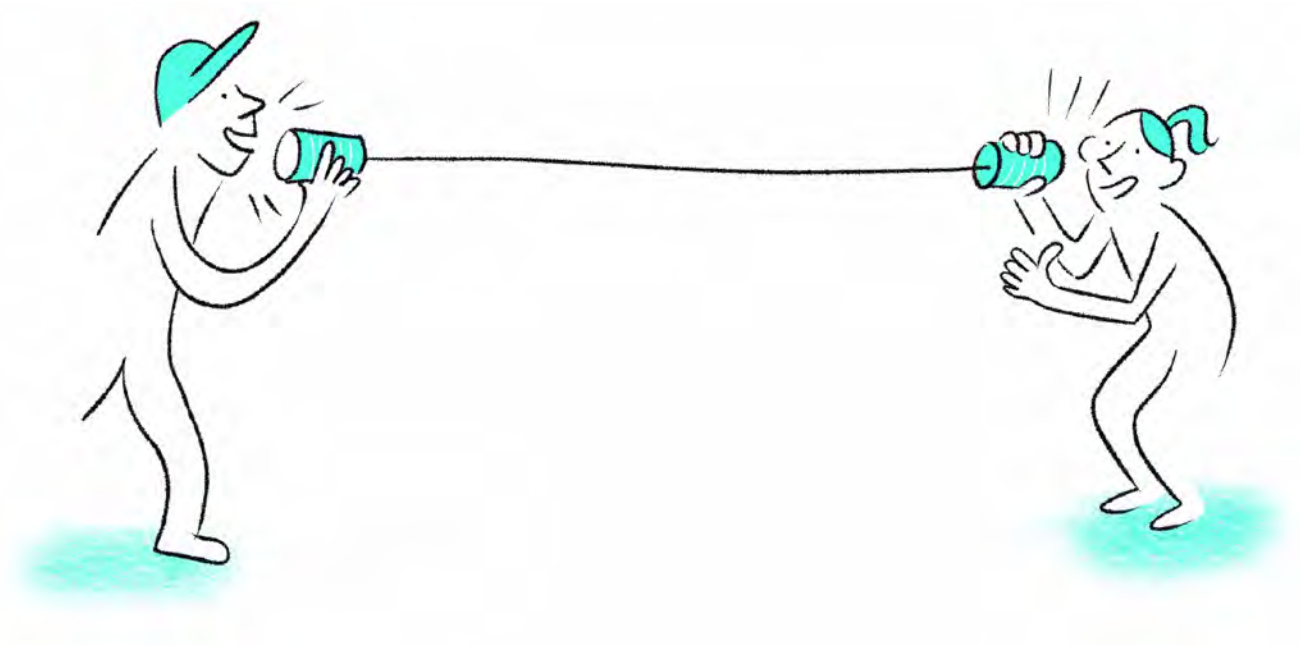
* For this table as a whole, data that are not accompanied by documentary sources comes from documents obtained through private correspondence with sector associations.

Immersive digital experience sector
COMPANIES
Approximately a hundred companies are represented by Xn Québec
The value chain borrows several models from the video game, entertainment, tourism, cinema, and theme-park industries
More than two-thirds of companies develop their own intellectual property (IP)
The majority of immersive digital experience companies are service providers
WORKFORCE
2300 jobs
Average annual salary : 55 000 $ in 2020
Companies hire freelancers rather than full-time employees

CHAPTER 2

Evolution and technological developments in the fields of visual effects and animation, video game, and immersive digital experiences

Chapter 2 presents the main themes for the three sectors according to the experts who were interviewed.



Trends in all three sectors :

Machine learning

This is a field of study in artificial intelligence that allows computers to “learn” from data. Machine learning is applied in tasks in accordance with the sectors, as outlined below :

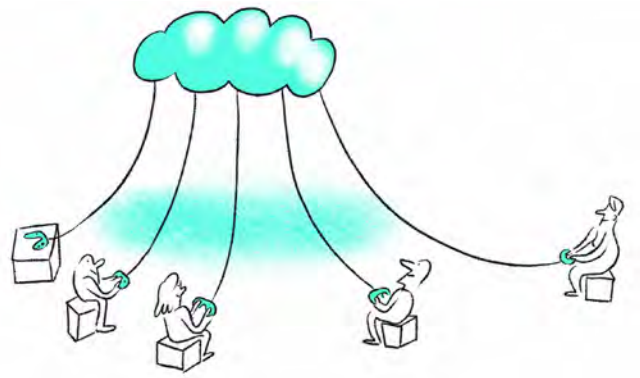
Visual effects and animation : used for animation, simulation (creatures, crowd), image composition, motion-tracking, rotoscoping, and rendering optimization.

Video game : enables generation of animation assets, poses, tracking, skeleton detection, robust gestures, motion anticipation, collisions, repetitive or predictable animation cycles.

Immersive digital experiences : for personalizing immersive digital experiences using everyday connected objects and automating in-place intelligent interactive installations.

Development of high-speed online networks and cloud services

These technologies allow for the continuous deployment of cultural content, broad sharing of data, and creation of massive databases.

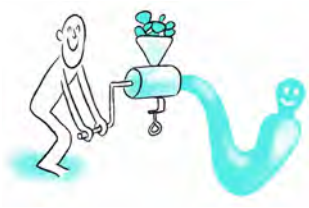


Video game : cloud gaming allows you to play streaming video games online and on any screen (desktop or laptop computers, tablets, smartphones or television sets). It can calculate geometries from decentralized servers, thereby boosting image-calculation capacity by a factor of ten.

Immersive digital experiences : enables the migration of computing power from public facilities to remote servers. It allows for a new form of interactive experience using lighter infrastructure.

Procedural generation tools

These tools allow you to create components by manipulating mathematical parameters as opposed to creating them pixel by pixel. Examples include Houdini, Substance Designer, Nuke, Modo, Unreal, and Unity.

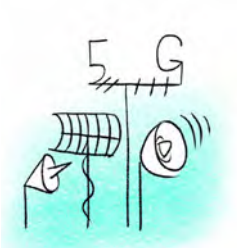


Visual effects and animation : used to accelerate the speed of image-rendering and creation of 3D environments. It also allows for continuous adjustments.

Video game : used for generation of game images or levels and production of larger game maps with small teams.

5G

5G is faster, more reliable, and more powerful, making it the new mobile network standard.



Video game : enhanced graphic quality, possibility of including better animations and more complex environments into games and designing games with more players in sync.

Immersive digital experiences : better distribution of MR, AR, VR and VM experiences to devices, via wireless networks. Opportunities for multiplayer-spectator interaction across the full range of attractions and immersive experiences.

Trends by type of sector :

Visual effects and animation

Use of real-time rendering engines :

Real-time rendering engines are mainly used in the 2D and 3D animation and visual effects industry, especially for scene previews

Virtual production :

Digital backgrounds generated by game engines are projected onto LED screens, which can be used to film actors in front of digital sets produced by a real-time rendering engine.

Diversity of specialized software :

Combining tools and different sets of expertise favours a cross-disciplinary approach to jobs and skills across the three sectors. With so much software on offer, the challenge lies in being able to understand and combine the various tools and work in parallel with others whatever the tools and tasks.

Universal Scene Description (USD) :

Implementation of the new universal scene description working format – introduced by Pixar – promises to solve several compatibility issues involving different software tools and data formats. This new standard fosters collaboration among various types of digital productions. It also allows for concurrent work involving multidisciplinary teams and provides a foundation for the development of the metaverse.

Video game

LiveOps :

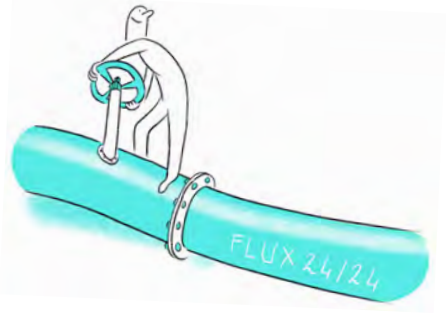
Games are no longer sold as a product, but as a service. This changes the way games are designed and produced and requires constant involvement from gaming-design, programming, and graphic-artist teams in an ongoing production mode. Today, mobile games must be designed for multi-year distribution so as to create and sustain a captive player base.

Physically based rendering :

Increases graphic quality and simplifies the work of lighting and texturing images. This technology has transformed the way lighting is produced in computer graphics, by more accurately simulating materials and light, allowing digital artists to focus on the image rather than the complexities of rendering. The principles of physical rendering techniques remain practical and simple for artists. They provide intuitive parameters based on values for each parameter (for example, reflection, albedo, roughness, texture, and so on).

Ray tracing :

A technological advancement that fosters visual quality in response to the physical laws of lighting as managed in game engines. As a result, games are much more realistic. This technology focuses on voxel-based lighting processes. Rather than lighting a scene with lights, the camera's rays define the provenance of lighting sources in a game and adjust them within the scene to create realistic moods in real time before the player's eyes.



Immersive digital experiences

Immersive extended reality experiences (augmented reality, virtual reality, mixed reality) :

These technologies have been developed in recent years; at the same time, content-creation techniques have taken advantage of video game techniques. These products create new narrative languages and generate new highly specialized jobs and expert skill sets.

Connected objects :

Objects are becoming communication vehicles : by being connected to the internet, they allow for the design of personalised experiences, including the use of intelligent devices that can be worn (wearables), such as smart clothes, smart bracelets, data gloves, and other items.

Large scale immersive digital experiences "in situ" :

These experiences can mix stage art and projections on several types of surfaces, including ice, water, and rocks and onto buildings, thereby allowing for a variety of immersive, cultural, and tourist-friendly shows.

CHAPTER 3

Entry-level and junior positions

Chapter 3 provides a brief overview of entry-level and junior positions in 2D and 3D graphics in the three sectors under study.

In the course of the interviews, the teachers who were consulted expressed the need to know more about the requirements for entry-level and junior positions for graduates from their programs. This chapter provides an initial response to this issue. To that end, six companies from the three sectors were consulted in August and September 2021.

In the tables below, entry-level and junior positions are listed (Table 4). Employment requirements are addressed (Table 5) as well as the artistic, technical, and behavioural skills required of those applying for these positions (Table 8).

Table 4 – Entry-level and junior positions in the three sectors

2D-3D artists specialities :	Visual effects and animation	Video game	immersive digital experiences
2D animator and motion designer	x	x	x
3D animator	x	x	
Artist – clean up	x		
Artist – compositing	x		
Artist – concept and illustration		x	x
Artist – lighting	x	x	
Artist – environment	x	x	
Artist – visual effects and simulation	x	x	
Artist – generalist			x
Artist – layout and tracking	x		
Artist – matte painting	x		
Artist – modeling	x	x	
Artist – rigging	x		
Artist – rotoscoping and preparation	x		
Artist – texturing and shading	x	x	

Table 5 – The factors considered most important when hiring (weighted scores)

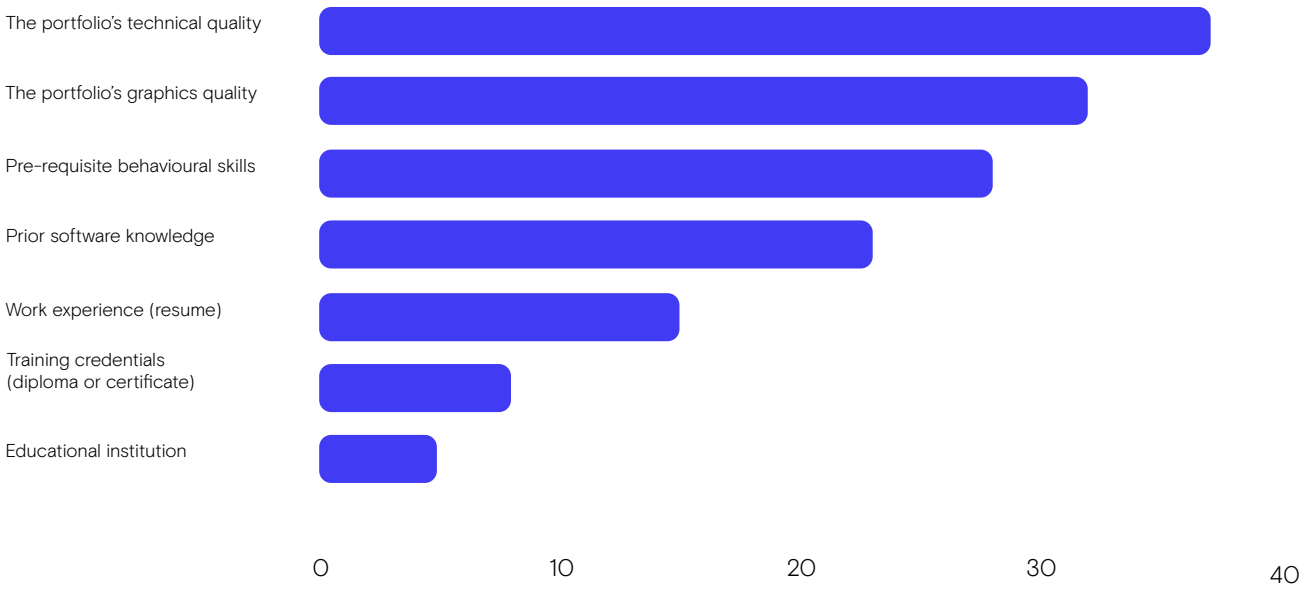


Table 6 – Preferred training credentials when hiring for entry-level and junior positions

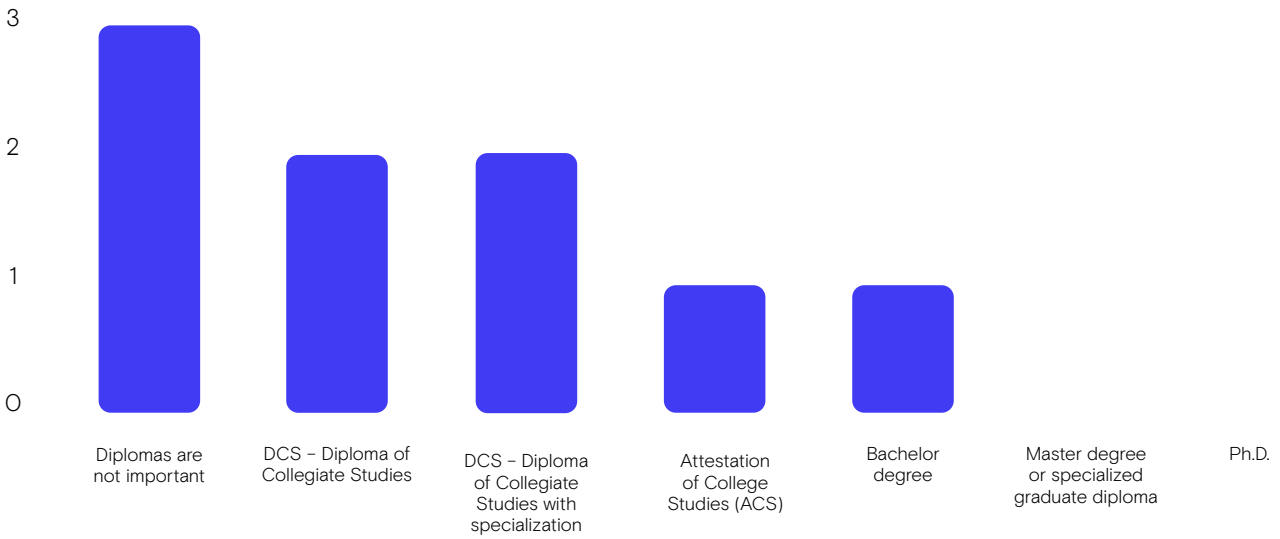
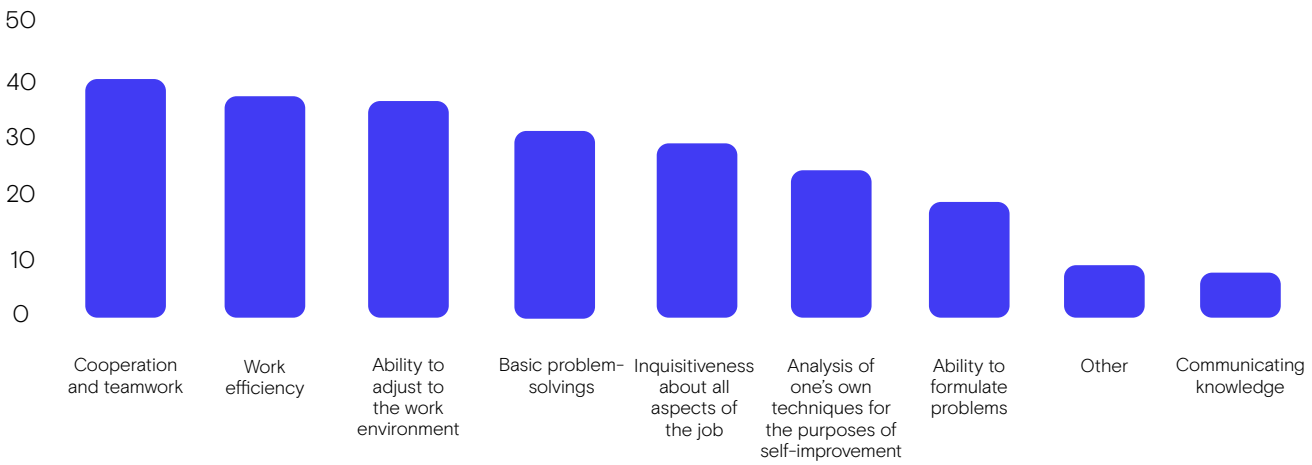


Table 7 – Favoured educational institutions

Écoles privilégiées
PUBLIC SCHOOLS
Cégep de Jonquière
Cégep de Matane
Cégep du Vieux Montréal
Université du Québec à Chicoutimi
Université Laval
PRIVATE SCHOOLS / BEYOND QUÉBEC
Algonquin College
Collège Bart
Sheridan College
École ArtFX
École Lost Boys
École supérieure des métiers artistiques (ESMA)
Breda University of Applied Sciences (BUAS in the Netherlands)

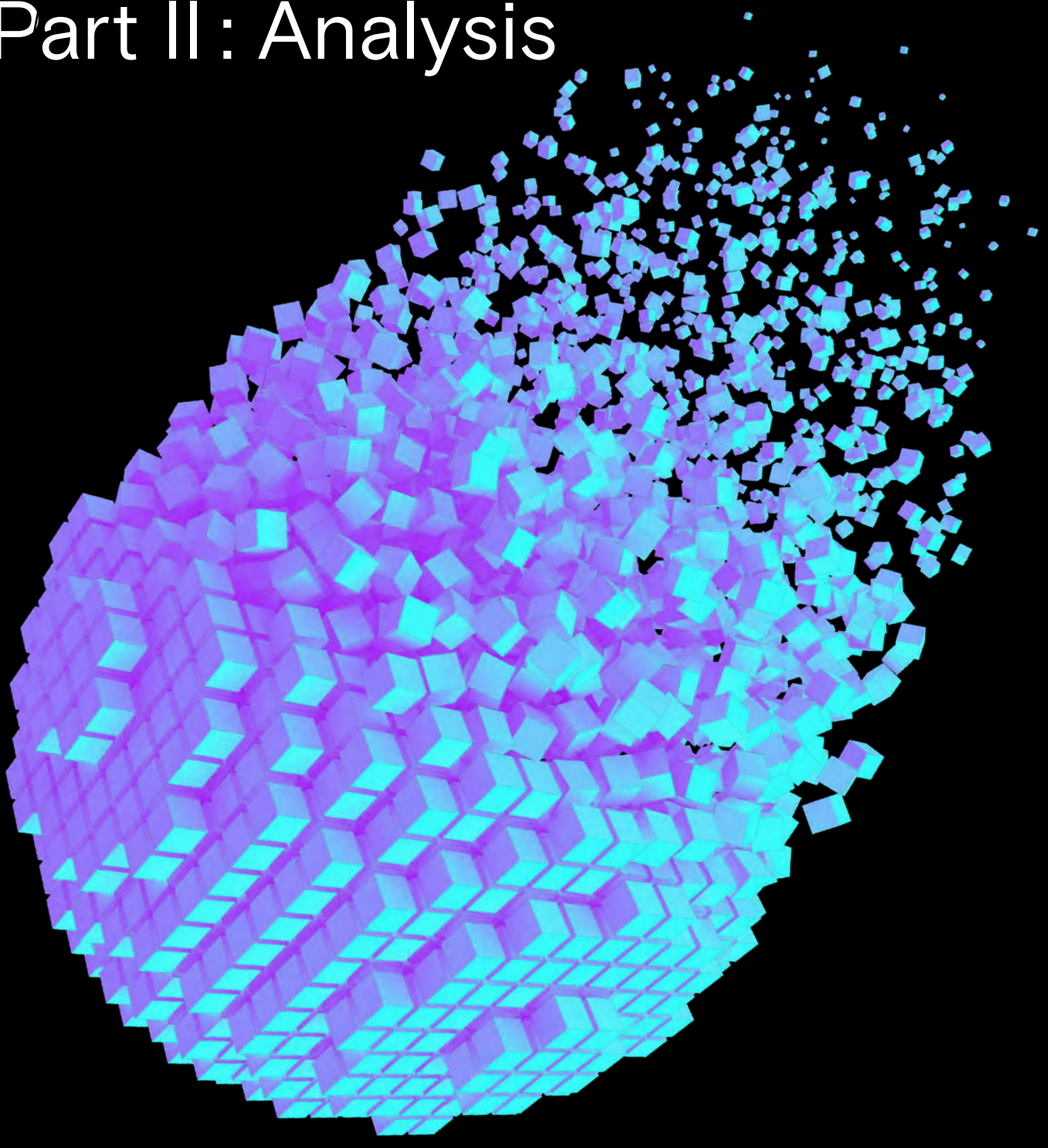
Table 8 – The most important behavioural skills when hiring for entry-level and junior positions (weighted scores)



Technical and artistic skills of entry-level and junior positions

Expertise is taken into account for entry-level and junior positions, especially in the video game and visual effects and animation sectors. Entry-level positions require the ability to perform a task in specific areas of activity such as modeling, texturing and shading, simple object animation, special effects creation, compositing, and so on with the appropriate software (see the long version of the report for more details).

Part II : Analysis



CHAPTER 4

Impact of technological changes on entry-level and junior employment positions in 2D and 3D graphics

Chapter 4 summarizes the technological changes that are impacting – or will impact in the years ahead – entry-level and junior employment in 2D and 3D graphics. This chapter also outlines the essential skills that future artists in all three sectors must be taught.

Technological developments to be taken into account when adjusting college and undergraduate programs

Automation : artificial intelligence and procedural software

Tools that enable automation of certain artistic processes are transforming the way 2D and 3D artists apply their skills. Rather than constructing and modeling graphic components as a whole, artists must increasingly direct their "artistic eye" to assembling objects and retouching images.

Artificial intelligence : machine learning and deep learning

While artificial intelligence tools such as machine learning and deep learning are not yet fully implemented in digital creation businesses, it is expected that they may eventually free artists from some repetitive and time-consuming tasks and accelerate the creative process by generating content that artists can rework. Future artists will need to have basic knowledge of the contributions and limitations of artificial intelligence as they pertain to creative activities so as to interact with teams of programmers and developers and make informed choices about the tools available to them.

Procedural generation tools

More respondents from the video game sector mentioned that companies in their sector seek artists with the technical skills to use the procedural generation tools (for example, Substance and Houdini) that are already well-established in the visual effects and animation sector. These software solutions allow artists to draw on pre-existing 3D object banks and mathematical parameters to create more content in less time; however, they require that artists have a good understanding of component-generation processes if they are to create and modify procedural content successfully.

Real-time rendering engines

Real-time rendering engines, originally developed for video games (for example, Unreal and Unity), are increasingly used in other areas of digital creation. In the visual effects and animation sector, these engines shake up production steps (compositing, previewing, and rendering may occur earlier in the process, especially with the onset of virtual production) and require increased collaboration among employees. In the field of immersive digital experiences, the use of gaming machines also influences the ways in which experiences are produced. Consequently, 2D and 3D artists who want to work in either of these sectors will need to master these tools.

Some more targeted changes

Artistic specialization in visual effects

Positions in 2D and 3D graphics in the field of visual effects and animation are becoming increasingly specialized; as a result, artists are required to master a broader range of tools. Several experts and teachers believe that in response to this reality, initial training programs need to become more specialized.

Video game LiveOps

While they do not change the nature of their work, online-gaming LiveOps require artists to create large amounts of content at a quicker pace. Preparing junior artists for the increased speed of execution and greater responsiveness that this new reality requires is crucial.

Extended reality in immersive digital experiences

Augmented reality (AR) and virtual reality (VR) technologies are among the most widely used by study respondents in this sector. These technologies raise particular challenges with respect to designing experiences; however, artists already working with 3D graphic design software can easily cope with them.

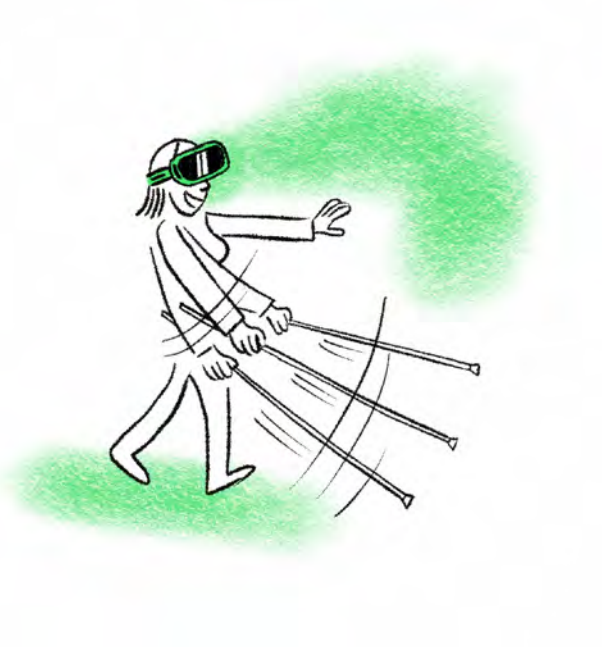


Table 9 – The digital creation tools used

This table was created by grouping together the tools mentioned by respondents to the study; it was subsequently completed using published references (Côté and Pilon 2016, 40).

Functions	Technical tools
2D ANIMATION	TVPaint Animation
	Harmony
	After Effects
3D ANIMATION	3ds Max
	Blender
	Flame
	Houdini
	Cinema 4D
	Maya
	Toolbag
	MotionBuilder
	Notch
	Cubic Motion
COMPOSITION AND INTEGRATION	Blender
	DigitalFusion
	Nuke
	After Effects
	Flame
	DaVinci Resolve

Tableau 9 – The digital creation tools used

Fonctions	Outils techniques
EFFECTS AND PARTICLES	Fume FX
	Houdini
	Maya
	Real Flow
	Massive
MODELING	Blender
	Maya
	ZBrush
	MeshLab
	SketchUp
	SpeedTree
	Substance Designer
	Mapping Matter
	Marvelous Designer
	R3DS Wrap
EDITING	Premiere
	Media Composer
	DaVinci Resolve
	Final Cut
ENGINES	Unreal
	Unity
	Mamoset
	Godot

Tableau 9 – The digital creation tools used

Fonctions	Outils techniques
PROGRAMMING	C++
	C#
	F#
	Python
	Visual Basic
	JavaScript
	Visual Studio
	TouchDesigner
RENDERING	Arnold
	V-Ray
	Guerilla
	Renderman
	Cycles
	Toolbag
	Houdini
	Unity
	Unreal
	Octane Render

Tableau 9 – The digital creation tools used

Fonctions	Outils techniques
TEXTURING AND LIGHTING	Mari
	3DCoat
	Marvelous Designer
	Quixel : Mixer
	Substance Painter
	Katana
	Clarisse
	Photoshop
TRACKING	3D Equalizer
	Nuke
	PFTrack
	SynthEyes

Skills to be developed, across all sectors, as a result of technological developments

Artistic skills

New artificial-intelligence tools, procedural software, and game engines for real-time rendering require artists to develop certain technical skills. Many industry professionals and educators, however, believe that artistic talent remains paramount for 2D and 3D graphics employment. For study participants, some technical tasks will be automated in the years ahead, but artistic vision will always be an essential feature for artists working in this field.

Cross-over skills

Flexibility and ability to adjust

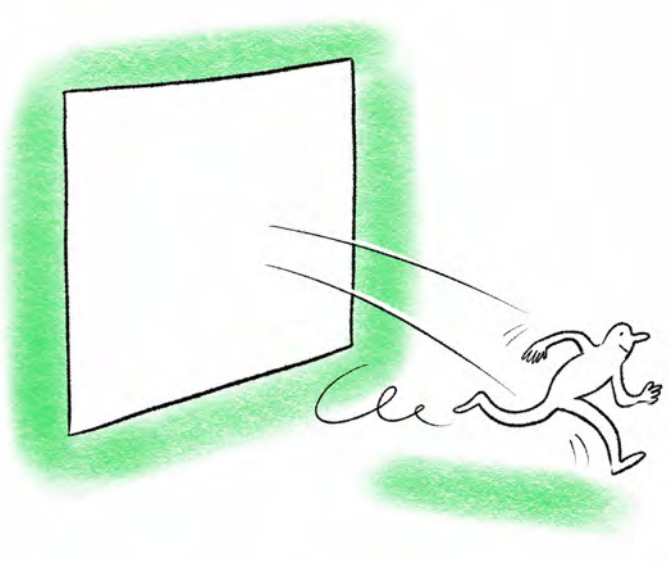
While each digital creative sector faces its own realities and is affected differently by technological change, they all have something in common : quickly evolving tools. To cope with the constant emergence of new work tools, many experts in all three sectors say that artists need to be flexible with respect to the technologies and tasks at hand.

Communication and collaboration

Some technological changes, such as virtual production and artificial intelligence, require increased collaboration among different job categories. The ability to interact with both technical and artistic profiles is a skill often mentioned by experts in the three digital creation sectors.

Critical thinking

The range of possibilities offered by technological developments – especially with regard to the automation of certain processes – requires artists to develop a critical mind. They need to be able to make informed decisions about the role of tools in their work : to know, for example, precisely what their objectives are and what processes are best suited to achieving them.



CHAPTER 5

Issues and challenges in aligning training and employment : workforce, skills, and initial training needs

Chapter 5 deals with workforce needs to be met by training. It also considers the sticking points between design studios and educational institutions that hinder the development and effectiveness of training-program upgrades..

Workforce needs that cannot be met by college and undergraduate programs

Recruitment needs are mainly for middle and senior positions that require many years of experience and management skills development (including project and team management). The jobs for which employers report hiring difficulties vary across the three sectors. The table below brings together the data collected from respondents and the literature.[2]

2. The workforce requirements shown in this table reflect the needs reported when the data were collected (from April 2020 to March 2021). Other workforce needs may not have been captured in this table and other needs may have arisen since.

Table 10 – Overview of workforce needs

Professionals and technicians	
VISUAL EFFECTS AND ANIMATION	2D animator (animation sector) 3D animator Compositing artist Lighting artist Visuals effects and simulation (VFX) artist Environments artist (matte painting) Texture artist Layout / tracking artist Modeling artist Other specialized artists : characters, storyboarding, rigging and armature, texture, animation design
VIDEO GAME	Rigging artist Animator with a strong command of movement Technical artist Technical animator UX designer Programmer (3D / Graphics, AI, Animation, Audio, Systems, Physics, Multiplayer, 3D, Ph.D.)
IMMERSIVE DIGITAL EXPERIENCES	Programmer Developer Animator 2D Animator 3D

Table 10 – Overview of workforce needs

Team leaders and supervisors	
VISUAL EFFECTS AND ANIMATION	Team leader – visuals effects and simulation (VFX) Team leader – lighting CG Supervisor – computer graphics Team leader – animation VFX Supervisor – visual effects 2D supervisor 3D supervisor Team leader – compositing Technical director – characters Technical director – production process Technical director – matte painting Technical director - environments
Supervisory and management staff	
VISUAL EFFECTS AND ANIMATION	Producer – visual effects (VFX) Production coordinator Department manager
VIDEO GAME	Technical artist Technical director
IMMERSIVE DIGITAL EXPERIENCES	Producer Project manager

Sources : Corbeil, Malouin and Khamassi 2016, 20; Côté and Pilon 2016, 69; KPMG 2017, 24; Xn Québec and Habo 2021, 49

Looking at the data in Table 10, we can see that the most sought-after talent profiles are not within the purview of graduates from the training programs targeted in the study, as they are not entry-level positions or require studies in other fields, such as computer engineering.

Needs to be met in initial training programs

The report distinguishes between two types of needs identified in the findings of the study: (i) needs relating to the knowledge and skills that must be taught; and (ii) needs relating to the educational structure of the programs.

Knowledge and skills to develop

The findings of the study point to gaps in student knowledge regarding companies' **organizational structures, including their production pipelines** and business models. Developing an **understanding of the different types of production in the three sectors** (including immersive digital experiences) and teaching students the basics of production budgeting were identified by some professionals as gaps to be bridged.

Interpersonal skills: professionals placed particular emphasis on skills relating to behavioural competencies when it came to identifying the essential skills needed to practise in the field of 2D and 3D graphic arts and identifying the needs to be met in initial training. The most frequently mentioned skills include: adaptability, collaboration, and teamwork; analytical skills; emotional intelligence and empathy; and communication skills, including the ability to receive and give feedback and manage stress.

Artistic skills: relating to the different work functions (drawing, anatomy, movement, and so on), artistic mastery of creative software (rather than just technical mastery), sense of observation ("artistic eye"), research and interpretation of reference images.

Technical skills: mastery of tools currently used in the various sectors of the industry. These include procedural software that requires mathematical knowledge to understand the nodal logic of these tools; programming languages (for example, Python, C#, C++). These technical skills allow artists to be more self-reliant (debugging) and help attract newcomers to job profiles that are in demand (such as technical artist).

Educational structures to implement

There is also a strong need to strengthen student specialization: the study's findings suggest that establishing specialization tracks or profiles of at least two years following a core year and extending the training program by one year (for a total of 4 years) would be the preferred options for developing expected skill levels for entering the job market.

Also noted was **the need for students to have more frequent contact with companies' reality**, which would reduce the gap between school training and workplace tasks. The solutions mentioned by the different players are: implementing traineeships throughout the training program; and setting up a mentoring or project-supervision system with studio professionals.

Sticking points to resolve

Several factors that hinder the ability of college and university undergraduate programs to meet the needs of businesses in the three sectors were mentioned :

Uneven networking between teachers and companies due to a lack of structured communication channels between the parties. This is especially the case in video game, where company secrets are jealously guarded.

CEGEPs lack the space and budget to renew their technological equipment and set up specialized laboratories in cutting-edge fields such as motion capture, photogrammetry, and virtual production.

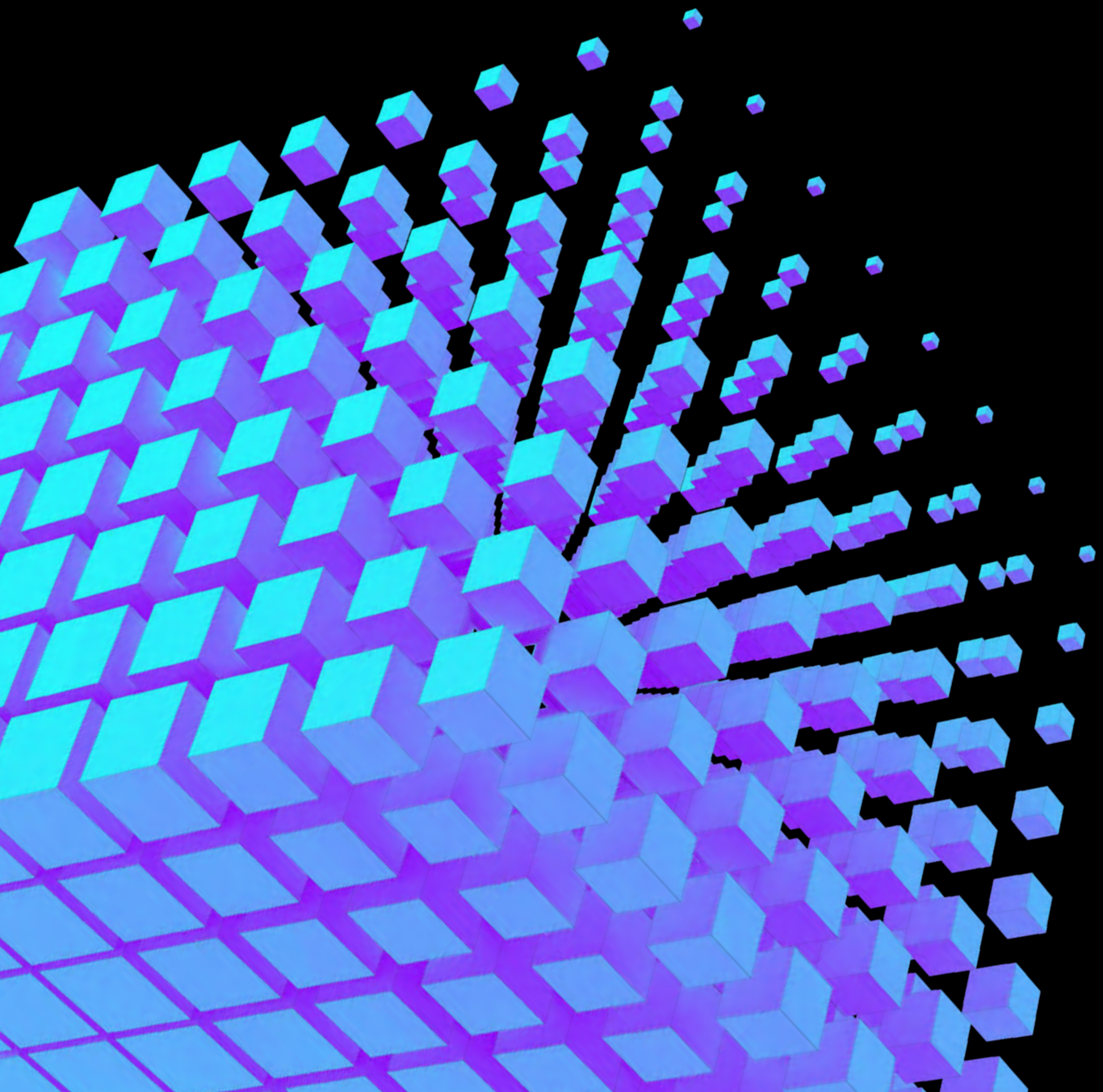
The salaries that colleges offer are not competitive enough to attract industry professionals. Also, the limited availability of specialized courses does not enable them to guarantee full-time teaching loads, which reduces their ability to attract qualified resources.

Some academic institutions have hiring rules for visiting professors and lecturers that limit their ability to hire professionals from the job market.

Some colleges and universities are confronted with administrative rigidity that undermines their effectiveness in approving program changes. As a result, lengthy change processes greatly reduce the ability of programs to adjust in a timely manner to rapidly evolving companies.

College professors lack the time to update their artistic and technical skills to keep pace with tools and software in current or emerging use in professional studios. Reducing teaching load by one day a week so as to permit teachers' ongoing involvement in professional productions was unanimously cited as a solution to be implemented to enable them to enhance their skills.

Part III : Conclusion



CHAPTER 6

Findings and avenues for discussion

Findings

Following the literature review and the interviews conducted with professionals in the three target sectors and teachers in college and university training programs in 2D and 3D graphic arts, this report highlights the following findings :

On workforce needs relating to the initial target training programs :

Entry-level and junior positions are not where the greatest recruitment difficulties lie; instead, they occur for the profiles listed below :

Visual effects and animation : mid-level and senior artists, mid-level management profiles (team leaders and supervisor positions for all artistic disciplines in the production pipeline).

Video game and immersive digital experiences : intermediate and senior artistic positions, artistic profiles with strong technical components (rigging, animation, lighting, simulation, image composition, rendering and programming).

The study has shown that companies of all sizes are hiring graduates of the programs targeted in the study for entry-level and junior positions. Other notable findings are as follows :

- A certain level of specialization is required for these positions.

- The constant and rapid technological and organizational changes in studios affect employer expectations regarding the level of mastery of artistic disciplines that applicants should possess.

- The technical and artistic quality of the portfolio and the behavioural skills of the candidates are the most important factors considered by recruiters.

On technological change and training the next generation

The technological and organizational changes that are taking place have – and will continue to have – **a direct influence on tasks and skills associated with entry-level** and junior level positions targeted by college and university programs.

The variety of specialized tools for each of the job categories requires junior artists to adjust to the software used in the studio that hires them and to possess cross-over knowledge of processes and production pipelines. To that end, artists need to acquire knowledge of operations and develop a command of the fundamental principles common to the families of software used for various tasks.

Procedural design software solutions (including Houdini, Substance Painter, Substance Designer, Unreal, and Unity) require novice artists to develop the following skill set : (i) understand the tasks assigned by the supervisor; (ii) analyze images produced by the software; (iii) develop an “artistic eye” so as to identify required alterations; and (iv) develop the artistic and technical competence needed to make required corrections.

Artificial intelligence (including machine learning and deep learning) automate non-repetitive artistic tasks in an effort to optimize artists’ work (rotoscoping, tracking, match moves, animation, composition, and more).

Implementing these new technologies will require enhanced cross-over collaborative skills to facilitate multidisciplinary teamwork. Ultimately the most sought-after skills will be artists’ ability to develop their artistic vision and analyze images and hone their sense of observation (“artistic eye”).

Real-time game engines : In visual effects, for example, the use of game engines (or other real-time rendering engines) requires artists to work with new tools and adjust to real-time production modes, which differ from pre-rendered production. In immersive digital experiences, especially in virtual reality, the use of game engines is becoming essential. Hence, learning to use these tools is becoming increasingly important, even for entry-level and junior positions, across all sectors.

Motion capture, photogrammetry, and volumetric scanning technologies : Artists need to know how to use them to perform tasks in, for example, pre-visualization, environment and character creation, animation, and more.

The emergence of new production modes such as virtual production in visual effects and animation, the LiveOps model in video game, and the production of extended reality experiences in immersive digital experiences all involve close collaboration and multidisciplinary teamwork. Speed and efficiency in performing creative tasks are also important skills for all job levels.

The needs to be met by college and university undergraduate training programs

Teach more about the various workplaces : operations and production pipelines, different types of production in the three sectors, production management.

Focus on the development of interpersonal skills : ability to adjust, collaboration and teamwork, analytical skills, emotional intelligence, empathy, problem-solving, stress management, effective communication.

Develop students' artistic skills : "artistic eye," image analysis, artistic mastery of creative software, artistic skills relating to various work functions, general knowledge of art history and world media.

Build more technical knowledge into training courses : mastery of the tools currently used in the three industry sectors, mathematical learning essential for the use of procedural design tools, programming languages [ex. Python, C#, C++].

Through student specialization, develop high levels of artistic and technical skills specific to particular fields of expertise (job functions) and a broad knowledge of the fundamental components found in the various specialized tools used by companies.

Familiarize students with the realities of the workplace to enable them to learn about various work processes (including production pipelines) and types of organization.

Other issues regarding training and job alignment : sticking points

Uneven channels of communication and networking among educational institutions, professors, and companies (varying degrees of openness of studios to sharing information).

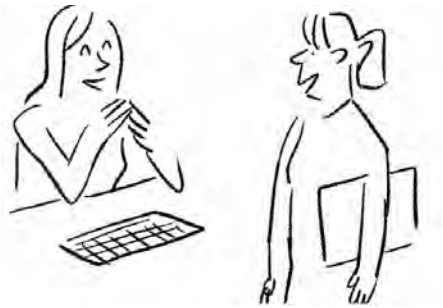
Insufficient budget and infrastructure in CEGEPs to set up laboratories with cutting-edge technologies (upgrading technology parks).

Deficiencies in colleges' power of attraction to recruit and retain teachers from the business sector (non-competitive salaries for faculty, too few courses in the specialties developed by sought-after professionals).

Limitations in some academic institutions relating to the recruitment of studio professionals due to inflexible hiring requirements for visiting professors and lecturers.

Insufficient administrative flexibility in some CEGEPs and universities prevents rapid adoption of educational changes in their training programs.

Difficulties for full-time college teachers to find the time to develop and update their knowledge of new business tools and practices and their artistic and technical skills.



Avenues for discussion

This report provides ideas for better aligning training programs in colleges and universities and employment requirements in companies in the three target sectors. Collaboration, consultation, and complementarity involving CEGEPs, universities, and SYNTHÈSE are encouraged to explore these ideas.

Consider the possibility of developing specialization profiles or concentrations specifically designed for the different job functions accessible to graduates of targeted college and university programs.

Foster workplace traineeships : training opportunities in the workplace would allow students, among other things, to become familiar with production processes and workflows and develop the soft skills inherent to their work and to being a team player in a genuine learning environment.

Address the body of knowledge and working methods of the three sectors (visual effects and animation, video game, and immersive digital experiences). Two possible solutions can be explored with educational institutions : (i) adjust the structure of existing programs to address 2D and 3D digital creation in a broad sense (including the three sectors' requirements); and (ii) create new specialized training programs for each of the sectors.

Develop structured communication channels and networking activities so as to homogenize access to business information from the three sectors for colleges and universities. Establishing continuous work placements and mentoring for teachers in higher-education institutions would lead to more sustained communication with businesses; as a result, this would help teachers update their skills with regard to studio tools and practices.

Develop an experimental technology centre that would be shared by educational institutions (CEGEPs and universities) and businesses so as to expand access to laboratories, equipment, and advanced technologies in a significant manner.

References

Corbeil, Vincent, Jean-François Malouin, and Refka Khamassi. 2016. « Profil de la main-d'œuvre dans l'industrie du jeu électronique au Québec en 2016 ». Rapport Technique. TECHNOCompétences. https://www.technocompetences.qc.ca/wp-content/uploads/2018/11/2016_Profil_MO_JeuVid%C3%A9o_TECHNOComp%C3%A9tences.pdf

Côté, Line, and Sylvianne Pilon. 2016. « Diagnostic des besoins de main-d'œuvre et d'adéquation formation-emploi : Secteur des effets visuels et animation ». Rapport Technique. Conseil emploi métropole, QFTC. https://numerique.banq.qc.ca/patrimoine/details/52327/2670478

KPMG. 2017. « Mise en place d'une grappe du jeu vidéo pour créer encore plus de valeur au Québec ». Rapport Technique. KPMG, Comité consultatif sur le développement de l'industrie québécoise du jeu vidéo.

Xn Québec and Habo. 2021. « Portrait de l'industrie et retombées économiques des secteurs ». Rapport Technique. Xn Québec. https://www.xnquebec.co/wp-content/uploads/2021/08/XN-Quebec-Portrait-des-membres-et-retombees-economiques-des-secteurs.pdf

Read the long version of the study and its references :

https://bit.ly/notre_enquete


SYNTHÈSE