

Course  
**CMP-5077-2**  
Introduction to 3D Animation

Computer Science





## INTRODUCTION

The goal of the *Introduction to 3D Animation* course is to provide adult learners with the means to express their creativity and to develop skills to produce 3D animated scenes.

In this course, adult learners deal with various learning situations that help them acquire theoretical and practical knowledge about 3D animation. They explore the environment of a 3D animation program and make sure they understand how its tools and commands work. They create scenes composed of several objects, lights and cameras by correctly using the tools and commands of the required program. They animate objects in the scene, using the most common techniques, and produce renders in accordance with instructions. At every step in their process, they evaluate their work by setting quality standards. They adopt ethical behaviour to communicate their ideas and respect intellectual property.

By the end of this course, adult learners will be able to animate scenes in a virtual 3D world containing modelled and textured objects, lights and cameras. They will be able to create an animation by using techniques for moving and transforming objects, applying lighting or camera techniques, and modifying object properties. They will demonstrate a sense of ethics in their communications and understand the importance of respecting intellectual property.

## SUBJECT-SPECIFIC COMPETENCIES

This course targets the following subject-specific competencies:

- *Interacts in a computer environment*
- *Produces computerized documents*
- *Adopts behaviours that reflect a concern for ethics, safety and critical thinking*

Thus, it is by activating and integrating all three subject-specific competencies and by using other resources that adults are able to effectively structure their learning.

During the learning situations, adult learners communicate using a human-machine interface and evaluate their efficiency in using a computer environment. They carefully plan their work and adapt their plan as they work. As they carry out a project and upon its completion, they evaluate their efficiency and make any necessary adjustments, while adopting ethical behaviour.

## PROCESSES AND STRATEGIES

As they learn about computers, adult learners are called upon to use various processes and strategies. These processes and strategies represent the way in which adults go about solving problems, meeting challenges and, in general, carrying out their learning activities.

For the *Introduction to 3D Animation* course, the suggested approach is the production process.

Production process	
<ul style="list-style-type: none"> <li>• This process consists of two steps: planning and production. Four values are associated with it: communicate clearly; validate the production on a regular basis; maintain ongoing feedback and collaboration; accept the change.</li> <li>• During the planning stage, adult learners must define the work to be done as precisely as possible. Planning must be flexible and allow adjustments throughout the project.</li> <li>• During the production stage, adult learners must complete the project according to the planning established; maintain ongoing feedback and collaboration; accept change, even at the end of the production stage, and respond to change rather than following the initial plan.</li> </ul>	
<b>Examples of strategies</b>	<ul style="list-style-type: none"> <li>- Comparing the current situation with the desired situation</li> <li>- Determining the steps involved in carrying out the work</li> <li>- Drawing up a work schedule</li> <li>- Choosing a work method</li> <li>- Making adjustments to the plan as they work</li> <li>- Analyzing their results</li> </ul>

To meet the requirements of the production process, the initial plan must be flexible enough to allow for adjustments throughout the project. Through discussions with the teacher or with their peers, adults learn to reflect on each step in their process and arrive at a result that will differ from their original plan. By applying the above process, they learn to cooperate with others and to accept changes during the course of a project.

## CROSS-CURRICULAR COMPETENCIES

The cross-curricular competencies are not developed in a vacuum; they are rooted in learning situations and contribute, to varying degrees, to the development of the subject-specific competencies, and vice versa.

Several cross-curricular competencies can be useful in dealing with the learning situations in the *Introduction to 3D Animation* course. Two are considered particularly relevant to this course: *Uses creativity* and *Adopts effective work methods*.

- **Intellectual Competency**

When adult learners work on a 3D animation project, they learn to *use creativity*. When they prepare a scene or animate 3D objects in it, they create a virtual world that reflects their vision of a real or imaginary world.

- **Methodological Competency**

Working on a 3D animation project requires sound planning. There are many steps involved, and adults must constantly reflect on their approach and make the necessary corrections before moving on to the next step. Thus, at each step in their project, they immerse themselves in a context or intention and engage in their work while adopting a flexible approach. This enables them to develop the competency *Adopts effective work methods*.

## SUBJECT-SPECIFIC CONTENT

The subject-specific content consists of knowledge and cultural references. The prescribed content for this course is outlined below. However, depending on the context (e.g. if certain tools or functions are not available in a given software program), other equivalent content may be substituted for that outlined below.

## KNOWLEDGE

- **3D environment**
  - Spatial representation on a coordinate system with three axes
  - Display modes (wireframe, solid, texture) and work modes (orthographic and perspective projections)
  - Texture mapping
  - Lights
  - Cameras
  - Renders
- **Object components (vertex, edge, polygon, texture)**
- **3D animation techniques**
- **Frame rates**
  - Web
  - PAL
  - NTSC

- **Storyboard**
- **Standard terminology associated with 3D animation**
- **Film terminology**
- **Importing objects**
- **Adding and modifying lights**
- **Adding and modifying cameras**
- **Object animation**
  - Creating movement using keyframes to create interpolations
  - Creating movement using motion curves
  - Creating movement along a path
  - Creating movement using constraints
  - Modifying the properties of an object (visible object, lights, cameras)
- **Producing renders of varying qualities**
  - Image
  - Video
  - Printing

## CULTURAL REFERENCES

The following cultural references will help adults understand some of the factors that influenced the development of computer science. These references give a cultural dimension to instruction, expand the adult learners' knowledge and make their learning meaningful. The teacher, with input from adult learners, may choose other references that are more appropriate to the task at hand.

- **Events and chronology**
  - Video games
  - Computer simulation
  - Films on virtual reality
  - Special effects in film productions
- **Heritage objects**
  - 3D cinema: from stereoscopy to polarizing filters
  - 3D animation peripheral
  - Claymation
  - Movie storyboard

- **Regional or national references**

- Video game designers, film producers, advertising and marketing firms
- Anecdotes
- School-related elements

## FAMILIES OF LEARNING SITUATIONS

The goal of the *Introduction to 3D Animation* course is to provide adult learners with the means to express their creativity and to develop their skills in the animation of 3D scenes. This course gives adult learners the opportunity to perform actions that will enable them to interact in a computer environment, and produce quality computerized documents and adopt ethical behaviours.

The shaded cells in the table below provide specifics about the contexts in which the prescribed families of learning situations are applied in this course.

Subject-specific competencies	Families of learning situations related to . . .		
	Information	Creation	Critical thinking
<b>Interacts in a computer environment</b>	Interacts by interpreting signals he/she receives and using input and output peripherals	Discovers what computers can do by consulting documentation and by experimenting	Critically examines computerized communication tools by applying evaluation criteria
<b>Produces computerized documents</b>	Communicates by using computerized services	Creates by correctly using the appropriate functions	Evaluates his/her work by setting quality standards
<b>Adopts behaviours that reflect a concern for ethics, safety and critical thinking</b>	Communicates respectfully, using the conventions of a given medium	Acts prudently by adopting safe behaviours	Validates information by using validation criteria

First, adult learners discover what computers can do by consulting documentation and by experimenting. For example, they may determine what is feasible or choose the right tool to carry out a project.

Then, adult learners create documents by correctly using the appropriate functions and thus work more efficiently. They evaluate their work on a regular basis by setting quality standards or by taking into account standards that have been set for them. Throughout their project, they communicate respectfully, using the conventions of a given medium.

## **BROAD AREAS OF LEARNING**

The broad areas of learning deal with major contemporary issues. Ideally, the situations to be studied should be selected in keeping with the educational aims of the broad areas of learning since these areas of learning provide a broader context for the learning situations and thus serve to make learning more meaningful. Two broad areas of learning are considered particularly relevant to this course: Health and Well-Being, and Career Planning and Entrepreneurship.

- **Health and Well-Being**

Helping adult learners understand the importance of healthy living habits is an essential aspect of the Computer Science program. Thus, a learning situation that helps make adult learners aware of how virtual reality affects health and well-being meets the educational aim of the BAL Health and Well-Being.

- **Career Planning and Entrepreneurship**

By developing computer competencies, adult learners increase their overall employability. A learning situation that introduces adult learners to the creation of three-dimensional scenes for the movie or video game industry meets the educational aim of the BAL Career Planning and Entrepreneurship.

## **EXAMPLE OF A LEARNING SITUATION**

All learning situations, no matter what broad area of learning is targeted, place adult learners at the heart of the action. Learning situations promote the development of subject-specific and cross-curricular competencies, the acquisition of computer knowledge and skills and the mobilization of various resources that are useful in carrying out the tasks at hand.



The table below shows the elements that need to be considered when developing a learning situation and highlights those selected for the learning activity described on the following page.

<b>ELEMENTS REQUIRED IN LEARNING SITUATIONS</b>	
<b>Broad area of learning</b> (targeted) - Contextualizes learning to make learning more meaningful	<ul style="list-style-type: none"> <li>• Career Planning and Entrepreneurship</li> </ul>
<b>Subject-specific competencies</b> (prescribed) - Are developed in action and require the active participation of adult learners	<ul style="list-style-type: none"> <li>• Interacts in a computer environment</li> <li>• Produces computerized documents</li> <li>• Adopts behaviours that reflect a concern for ethics, safety and critical thinking</li> </ul>
<b>Family of learning situations</b> (prescribed) - Group together situations appropriate to the course, based on issues drawn from reality - Promote the acquisition of computer knowledge and skills	<ul style="list-style-type: none"> <li>• <b>Information</b> <ul style="list-style-type: none"> <li>○ Communicates respectfully, using the conventions of a given medium</li> </ul> </li> <li>• <b>Creation</b> <ul style="list-style-type: none"> <li>○ Discovers what computers can do by consulting documentation and by experimenting</li> <li>○ Creates by correctly using the appropriate functions</li> </ul> </li> <li>• <b>Critical thinking</b> <ul style="list-style-type: none"> <li>○ Evaluates his/her work by setting quality standards</li> </ul> </li> </ul>
<b>Cross-curricular competencies</b> (targeted) - Are developed in context together with the subject-specific competencies	<ul style="list-style-type: none"> <li>• Uses creativity</li> <li>• Adopts effective work methods</li> </ul>
<b>Knowledge</b> (prescribed) - Includes computer knowledge and skills that adult learners must acquire in the course	<ul style="list-style-type: none"> <li>• 3D environment</li> <li>• Terminology associated with 3D animation</li> <li>• Object animation techniques</li> <li>• Creating a 3D scene with textured objects, cameras and lighting</li> <li>• Creating a 3D animation</li> </ul>

This section provides an example of a learning activity. It includes a context that serves as a common thread throughout the activity; however, it is not formally spelled out. Although they may not be explicit, the learning situation includes the elements identified in the table above: the broad area of learning, the subject-specific competencies, the families of learning situations, the cross-curricular competencies and the prescribed knowledge. To promote learning, these elements must be structured in a coherent and meaningful way.

Teachers can target any element as a focus of learning, be it actions related to the subject-specific or the cross-curricular competencies or the prescribed knowledge that adults must acquire.

## EXAMPLE OF A LEARNING SITUATION

### A soccer ball

**Task:** Create a 3D animation of a soccer ball.

The teacher asks adult learners to create a 3D animation of a soccer ball for their child's soccer team. The animation could then be used for advertising purposes for the team and incorporated into a Web site, an advertising video or a souvenir video.

In preparation for the task, the teacher asks the adult learners to design a storyboard and plan the steps in their project.

Using three-dimensional objects they have already modelled or found on the Web, adult learners compose the scene for their animation. To make the scene more realistic, they can use an image of a soccer field in the background, add text or sound effects and a music track. Once the project is completed, the adult learners present it in a medium of their choice.

To carry out the activity, adult learners draw on common animation techniques: using keyframes to create interpolations, using paths or objects deformation. They are not expected to master all of the course content before they start their project; rather, they will construct their knowledge as they work, using the means at their disposal: the documentation provided, planning, communication with peers (when the situation permits), and reflection and review. They will plan their work in advance and, in collaboration with the teacher or their peers, will analyze their results at each step, regulating their approach based on their needs.

## END-OF-COURSE OUTCOMES

We perceive the world around us in terms of three dimensions: length, width and depth. The *Introduction to 3D Animation* course gives adult learners the opportunity to better understand this representation of the universe through the use of 3D animation techniques.

When adult learners *discover what computers can do*, they consult available software documentation, tutorials and guides. They search the Internet for information that may help them. They look for inspiration in available creations in order to design an original product.

When adult learners *create* an animation, they consider all aspects of the task at hand and plan their work using a sketch or storyboard to establish the desired result. They determine the resources to use, break the work down into steps and draw up a work schedule. They choose a work method that is appropriate for their project. At each step in the project, they analyze their results in order to determine the improvements to be made and the means of doing so.

When adult learners *design* a scene, they arrange objects in a harmonious manner and respect the rules of spatial perception. They add lighting to bring light and shadow into the scene, and integrate cameras to produce various points of view. If necessary, they use layers to distribute the objects in the scene and make it easier to animate them.

When adult learners *animate* objects in 3D, they create movement by using keyframes, motion curves or paths. They modify object, light and camera attributes. They add keyframes on the timeline and create interpolations. They produce renderings and export their animation in an appropriate format.

When adult learners *evaluate their work*, they note their observations and establish quality standards that they will be able to apply in subsequent projects.

When adult learners *communicate*, they demonstrate a sense of ethics and act responsibly by respecting the copyright of the digital material they use.

Throughout the learning process, adult learners develop competence in the following computer knowledge and skills: they position 3D objects in a scene using the most common animation techniques and produce renderings in accordance with instructions. In addition, they do not hesitate to consult various resources to obtain help when difficulties arise.

## EVALUATION CRITERIA

### ***Interacts in a computer environment***

- Use of appropriate strategies to interact and to troubleshoot

### ***Produces computerized documents***

- Thorough planning of the work
- Appropriate formatting based on document type
- Application of appropriate tools and functions
- Rigorous compliance with the constraints identified

### ***Adopts behaviours that reflect a concern for ethics, safety and critical thinking***

- Adequate communication using the conventions of a given medium