

Course  
**CMP-5082-2**  
Introduction to Programming

Computer Science





## INTRODUCTION

The goal of the *Introduction to Programming* course is to provide adult learners with the means to solve problems using a structured programming language. It is designed to introduce adult learners to the development of computer algorithms and the logic of structured programming.

In this course, adult learners deal with various learning situations that help them acquire practical knowledge about programming. By translating an algorithm or correcting a computer program, adult learners interact by interpreting the codes they are given, and critically examine the tools they use by choosing and applying the necessary solutions. Thus, they communicate in a specific language, use computer resources and respect the codes and conventions of the language. They evaluate their work on a regular basis to make sure it meets the standards that have been set. Throughout the entire process, adult learners discover what computers can do.

By the end of this course, adult learners will be able to translate a predefined algorithm into a structured language, produce the visual design of the application, correct syntax errors, and compile and execute the program. They will understand algorithms, programming syntax and the structures and functions of a structured programming language.

## SUBJECT-SPECIFIC COMPETENCIES

This course targets the following subject-specific competencies:

- *Interacts in a computer environment*
- *Produces computerized documents*

Thus, it is by activating and integrating these two 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. 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 to their approach.

## 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 Programming* 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 Programming* course. Two are considered particularly relevant to this course: *Solves problems* and *Adopts effective work methods*.

### ▪ Intellectual Competency

Programming is essentially a problem-solving activity. Designing an algorithm, writing code or looking for actual or potential errors requires the ability to *solve problems* in a formal manner, i.e. to rigorously analyze each element of the situation, test possible solutions and adopt a critical approach.

### ▪ Methodological Competency

When programming, adult learners are encouraged to *adopt effective work methods*. They use these methods when they plan their work and adhere to their plan, among other things. They

demonstrate rigour when they translate algorithms and write code, and when they program, they analyze their approach and results regularly in order to make the necessary corrections.

## 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

- ***Introduction to the concept of algorithms***
  - Definition
  - Flowchart
    - Symbols
    - Flow direction
  - Pseudo code
- ***Structures and functions***
  - Variables
    - Types (whole, real and Boolean, characters, character string)
    - Allocation
    - Scope
  - Mathematical operators
  - Logical operators
  - Elements of simple alternative structures
  - Elements of repetitive structures
  - Functions integrated in different classes of objects
    - Syntax
    - Arguments
    - Function return
- ***Programming syntax***
  - Instructions
  - Reserved words
  - Input and output

- **Controls**
  - Button
  - Checkbox, option button
  - Image
  - Label, text box
  - Listbox
  - Frame
- **Types of programming**
  - Event-driven
  - Sequential
- **Main programming languages**
  - C, C++
  - Java, JavaScript
  - Visual Basic
  - PHP
  - ActionScript
- **Interface ergonomics**
  - ISO 9241-210
  - Architecture
- **Standard terminology associated with the programming language selected**
- **Reading an algorithm**
- **Developing an algorithm to meet a need**
- **Translating an algorithm into a structured programming language**
  - Interpreting an algorithm
  - Designing the program's user interface
  - Applying ergonomic standards to the interface
  - Writing code using indentation
  - Following the programming syntax
  - Adding comments to the source code
- **Troubleshooting**
  - Making the algorithm more efficient

- Identifying possible inaccuracies in the program code
- Solving the inaccuracies identified
- **Compilation**
  - Generating the executable version of the program
  - Executing and validating the definitive version of the program using test data

## 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**
  - History of computers
  - Y2K bug
- **Heritage objects**
  - Perforated cards or tape
  - First adding machines
  - Vacuum tube computers
  - Integrated circuits
  - Program in linear programming language
- **Regional or national references**
  - Québec software publishers, Web application developers
  - Anecdotes
  - School-related elements

## FAMILIES OF LEARNING SITUATIONS

The goal of the *Introduction to Programming* course is to provide adult learners with the means to solve problems using a structured programming language. 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.

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 interact by interpreting the signals they receive and by using input and output peripherals, in particular to take action. Thus, they 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. They critically examine computerized communication tools by applying evaluation criteria to configure their environment appropriately, among other things.

Then, they communicate using computerized services, in order to share their experiences and ideas and to express themselves. They take the time to evaluate their work by setting quality standards, or by taking into account standards that have been set for them, in order to get an accurate sense of the results of their efforts.

## 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: Career Planning and Entrepreneurship, and Citizenship and Community Life.



- **Career Planning and Entrepreneurship**

By developing computer competencies, adult learners increase their overall employability. Thus, a learning situation that makes adult learners aware of the creative potential of programming as it applies to entrepreneurship meets the educational aim of the BAL Career Planning and Entrepreneurship.

- **Citizenship and Community Life**

The Computer Science program gives adult learners the opportunity to experience the principles that are the basis of equal rights in our society. A learning situation that helps adult learners become aware of security problems related to computer programs meets the educational aim of the BAL Citizenship and Community Life.

### **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 learning situations and highlights those used in the learning activity described on the following page.

| <b>ELEMENTS REQUIRED IN LEARNING SITUATIONS</b>                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Broad area of learning</b> (targeted)<br>- 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)<br>- 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> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Families of learning situations</b> (prescribed)<br>- Group together situations appropriate to the course, based on issues drawn from reality<br>- 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>○ Interacts by interpreting signals he/she receives and using input and output peripherals</li> <li>○ Communicates by using computerized services</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> </ul> </li> <li>• <b>Critical thinking</b> <ul style="list-style-type: none"> <li>○ Critically examines computerized communication tools by applying evaluation criteria</li> <li>○ Evaluates his/her work by setting quality standards</li> </ul> </li> </ul> |
| <b>Cross-curricular competencies</b> (targeted)<br>- Are developed in context together with the subject-specific competencies                                                                                  | <ul style="list-style-type: none"> <li>• Solves problems</li> <li>• Adopts effective work methods</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Knowledge</b> (prescribed)<br>- Includes computer knowledge and skills that adult learners must acquire in the course                                                                                       | <ul style="list-style-type: none"> <li>• Standard terminology associated with the programming language selected</li> <li>• Correcting and compiling an existing computer program</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

### Password generator

**Task:** Modify a password generator that takes into account certain parameters (number and type of characters) in order to manage access to certain sections of the adult education centre's Web site more efficiently.

To start off the activity, the teacher provides an overview of the desired improvements to the password generator and gives adult learners an uncompiled version of the program.

To carry out the activity, adult learners plan their work by familiarizing themselves with the lines of code and testing the existing version of the program. They note the changes they wish to make to the program and validate their plan with the teacher. They then proceed with the second part of the task, which is to make the desired changes, test the program, correct potential errors and compile the program in order to have the students at the adult education centre use it.

At the end of the activity, students use the password generator in a real situation, in the presence of the adult learners and the teacher, who observe the effectiveness of the improvements made as well as any remaining errors.

## END-OF-COURSE OUTCOMES

To deal with situations related to programming, adult learners prepare an algorithm, validate it and translate it into a structured programming language. To do this, they use the following subject-specific competencies: *Interacts in a computer environment* and *Produces computerized documents*.

When adult learners *discover what computers can do*, they consult the documentation provided in order to define the context and experiment to analyze the current situation. This allows them to determine the step involved in the work and to draw up a work schedule.

When adult learners *interact* or *communicate using computerized services*, they interpret the codes, rules and conventions of the programming language and respond by correctly using the appropriate commands, functions and syntax.

When adult learners *critically examine computerized communication tools*, they analyze the task to be carried out and select and mobilize the necessary computer resources.

When adult learners *evaluate their work*, they check whether they have attained their objective, as well as the quality standards that have been set, by going over the steps they followed and testing their program. They make the necessary corrections and identify other contexts in which their approach could be applied.

Throughout the learning process, adult learners develop competence in the following computer knowledge and skills: they solve problems requiring the use of a computer program by writing an algorithm which they validate and translate into a structured programming language. In addition, they do not hesitate to consult various resources to obtain help when difficulties arise.

## **EVALUATION CRITERIA**

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

- Accurate interpretation of messages and signals
- Use of appropriate strategies to interact and to troubleshoot
- Judicious application of evaluation criteria

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

- Proper presentation of the information based on the context
- Rigorous compliance with the constraints identified