Course

Basic Geometric Representations

MTH-B214-3

Literacy

“All that geometry teaches is true only for the learner.”

Joseph Joubert

Presentation of the Course *Basic Geometric Representations*

The course *Basic Geometric Representations* is designed to help adult learners deal competently with real-life situations that involve representing their immediate physical environment.

This course prepares adults to use basic concepts related to geometry, measurements and ratios to represent and describe their environment.

By the end of the course, adult learners will be able to interpret and convey information concerning the positioning of objects in space. They will be able to use simple geometric models (squares, rectangles, circles, triangles), representations of simple fractions and the relationships between quantities of objects and units of measurement (metres, litres, degrees Celsius) to represent and describe the characteristics of their immediate physical environment.

Dealing With the Real-Life Situations

Dealing effectively with real-life situations is based on actions. These actions are grouped into categories and make use of a set of resources that include operational competencies and essential knowledge. During the learning process, adults are expected to construct knowledge related to these resources in order to be able to deal appropriately with their real-life situations.

The class of situations, categories of actions, operational competencies and essential knowledge constitute the compulsory elements of the course. These elements are explained in detail under their respective headings.

Class of Situations Addressed by the Course

This course addresses a single class of situations: *Representing one's immediate physical environment*.

This class consists of real-life situations (e.g. getting around in an unfamiliar place, preparing a meal or decorating one's home) in which adults are required to represent elements in their physical environment by using basic concepts related to geometry, measurements and ratios. Whether determining how much of a cleaning product should be used, making a note of the dimensions of a window, following road signs, measuring the ingredients for a recipe or describing the position of a piece of furniture with respect to another, adults use basic concepts related to geometry, measurements and ratios.

These real-life situations address the needs expressed by adults and take their interests into account. The situations can involve the personal, professional, social or cultural aspects of their lives.

Class of Situations	Examples of Real-Life Situations
Representing one's immediate physical environment	▪ Getting around in an unfamiliar place ▪ Decorating one's home ▪ Doing household chores ▪ Purchasing a consumer product ▪ Preparing a meal ▪ Carrying out work-related tasks ▪ Practising recreational activities ▪ Following health-related instructions

Categories of Actions

The *categories of actions* are groups of actions that are appropriate for dealing with the real-life situations addressed in the course. *Examples of actions* are provided to illustrate the scope of the category in a variety of contexts.

Categories of Actions	Examples of Actions
▪ Reading information involving geometry, measurements or ratios	▪ Understands the meaning of geometric shapes on clothing labels and road signs ▪ Reads the quantities of ingredients needed to prepare a recipe ▪ Reads the measurements indicated on the packaging for a tablecloth ▪ Reads the required quantity of a cleaning product ▪ Reads the distance to be covered on a bicycle path
▪ Writing information involving geometry, measurements or ratios	▪ Makes a note of the dimensions of a window ▪ Makes a note of the quantities of ingredients needed for a recipe ▪ Draws a diagram of a house using geometric shapes ▪ Makes a note of the correct dose of a medication ▪ Makes a note of the length of the pieces of wood needed to refurbish a piece a furniture
▪ Orally interacting in cases involving a description of the physical environment	▪ Situates a street with respect to another ▪ Locates a community service in his/her environment ▪ Describes an everyday object by referring to its shape ▪ Describes the position of a piece of furniture with respect to another ▪ Indicates the location of the closest convenience store ▪ Follows road signs ▪ Explains where his/her apartment is located ▪ Indicates the approximate quantity of a liquid remaining in a container (one half, one quarter)

Categories of Actions	Examples of Actions
▪ Determining measurements and ratios	▪ Measures the ingredients for a recipe ▪ Measures a dose of medication ▪ Estimates the distance between his/her house and the closest CLSC ▪ Orders a given amount of wine in a restaurant ▪ Fills a container with water to half its capacity ▪ Checks the temperature on a cooking thermometer ▪ Measures the length of a plank of wood ▪ Estimates the snowfall for one day

Compulsory Elements and End-of-Course Outcomes

The compulsory elements are those that the teacher must absolutely take into account when designing learning situations.

Class of Situations

Representing one's immediate physical environment

Categories of Actions

- Reading information involving geometry, measurements or ratios
- Writing information involving geometry, measurements or ratios
- Orally interacting in cases involving a description of the physical environment
- Determining measurements and ratios

Operational Competencies

Thinks logically

- Selects information
- Distinguishes between written or oral information about the physical environment
- Deduces information
- Uses pertinent examples

Communicates

- Listens attentively
- Decodes symbols, terms and notations about the immediate physical environment
- Asks for clarifications
- Repeats information to check comprehension
- Uses the appropriate symbols, terms and notations
- Makes sure that measurements expressed in writing are accurate
- Asks for help, if necessary

Essential Knowledge

- Ratios
- Geometry
- Measurement
- Natural numbers
- Arithmetic operations

The end-of-course outcomes describe how adults make use of the compulsory elements to deal with the real-life situations addressed in the course.

End-of-Course Outcomes
In order to deal with the real-life situations in the class *Representing one's immediate physical environment*, adult learners use basic concepts of geometry, measurements and ratios. When adults read, write or interact with others in an attempt to understand or describe the physical characteristics of their surroundings, they must distinguish between information expressed orally and in writing that refer to concepts of geometry, measurements and ratios. Learners decode symbols, terms and notations related to their immediate physical environment and recognize certain segments, simple fractions and simple geometric shapes as well as units of length, capacity and temperature. In written or spoken language, they identify the information that allows them to situate themselves and to represent the position of objects in space or to recognize the shape of these objects. In interactions that involve representing their physical environment, adults are concerned with communicating effectively. This is why they listen attentively to information that is useful for representing the physical characteristics of their environment. If necessary, they ask for clarifications and repeat the information to make sure they have understood it correctly. After selecting the relevant information, adults form a mental representation of their physical environment and describe it by using concepts of geometry, measurements and ratios. They specify their position or that of objects in space and use the properties of a geometric figure to deduce certain items of information such as the length of a segment. In certain situations, ratios are useful for indicating the relationships between different quantities of objects. In other situations, ratios are useful for representing a part of a whole. Learners use units of measure and the appropriate instruments to estimate or determine length, capacity or temperature. If necessary, they use examples to validate their work. Throughout the process, adult learners must make sure they are representing their physical environment in a plausible manner. They describe their environment by using the appropriate symbols, terms and notations and are concerned with conveying measurements and ratios that are as precise as possible. They do not hesitate to ask for help if they encounter difficulties.

Evaluation Criteria

- Interprets information involving geometry, measurements or ratios correctly
- Writes information involving geometry, measurements or ratios correctly and legibly
- Provides an appropriate verbal description of the physical environment
- Correctly determines measurements and ratios

Operational Competencies

The contribution of each operational competency is described in terms of the actions that are appropriate for dealing with the real-life situations in this course. These operational competencies are addressed in other courses and therefore all of the courses taken together contribute to their development.

In this course, only the following operational competencies are addressed: *Thinks logically and Communicates.*

Contribution of the Operational Competency *Thinks logically*	
The operational competency *Thinks logically* helps adult learners to organize their thinking and guides them in taking action to deal with real-life situations that involve *Representing one's immediate physical environment*.	In order to describe elements in their immediate physical environment, adult learners select the information they need to construct an accurate representation of the real-life situation examined in the course. When they use concepts of geometry, measurements and ratios, this operational competency allows them to distinguish between pieces of information about these concepts, which are expressed orally or in writing. They also use the properties of a geometric figure to deduce certain information such as the length of a segment. If necessary, when determining a length or a ratio, adult learners use relevant examples to validate their work.

Contribution of the Operational Competency *Communicates*	
The operational competency *Communicates* promotes meaningful exchanges in the daily lives of adults. It is essential to the effective interpretation and transmission of messages in various real-life situations that involve *Representing one's immediate physical environment*.	When attempting to represent their physical environment in their daily interactions, adults ensure that they can understand others and make themselves understood. They therefore listen attentively to information so that they can understand their surroundings. They decode symbols, terms and notations pertaining to their immediate physical environment. If necessary, they ask for clarifications and repeat information they have received in order to check its accuracy. In order to describe the elements in their physical environment, they express themselves by correctly using mathematical language pertaining to the position of people and objects in space, geometric shapes, simple fractions and units of measure. Adults make sure that they accurately convey measurements and ratios in writing. If necessary, they do not hesitate to ask for help from someone close to them, a peer or a resource person in order to overcome a difficulty.

Essential Knowledge

All of the knowledge shown in the following table is compulsory since it is essential for dealing with a number of situations in the class *Representing one's immediate physical environment*.

The left-hand column shows the essential knowledge that was not covered in previous courses. Where necessary, its scope is shown in parentheses. The right-hand column shows the essential knowledge that was covered in previous courses. Since it is also required to deal with the situations in this course, adult learners must deepen their understanding of this knowledge by adapting it to situations that involve representing one's immediate environment.

Ratios (ratios of quantities of objects and simple fractions) are covered only as they pertain to the representation of the physical environment, and therefore are covered only partially. In order to present all the aspects of this essential knowledge in a greater range of contexts, it has been made compulsory in other mathematics courses that examine other types of situations.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Ratios • Ratios of two natural numbers • Simple fractions (with denominator smaller than or equal to 10) • Numerator and denominator • Representing fractions and ratios between quantities of objects (using the base 10 number system and concrete materials such as blocks and illustrations) • Everyday vocabulary related to fractions (e.g. half, one half, one quarter, one third, two thirds)	**Natural numbers** • Natural numbers • Even and odd numbers • Arranging natural numbers in increasing and decreasing order • Comparing natural numbers • Counting • Counting by multiples • Everyday vocabulary associated with comparing quantities (e.g. as many, equal, the same, similar, more, less, greater than, less than, the largest, the smallest)
Geometry • Everyday vocabulary related to the positioning of objects in space (e.g. above, below, to the right, to the left, inside, outside, on top) • Simple geometric figures (circles, squares, rectangles and triangles)	**Arithmetic operations** • Understanding of the four arithmetic operations (addition, subtraction, multiplication, division)

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Geometry (cont'd) • Line segments and curves • Constructing simple geometric figures: squares, rectangles, triangles and circles (using no specific technique) • Constructing acute, obtuse and right angles (using no specific technique) • Properties of squares and rectangles (parallel sides, congruent sides, right angles) • Significant segments (width, height, parallel and perpendicular sides) **Measurement** • Units of measure: milligrams, kilograms, grams, millimetres, centimetres, metres, kilometres, millilitres, litres and degrees Celsius • Measuring and estimating length, mass, capacity (volume) and temperature	**Arithmetic operations (cont'd)** • Vocabulary related to the four arithmetic operations (e.g. add, total, take away, difference, multiply by, times, how much in all, separate, divide, how much for each one) • Calculations involving the four operations on the natural numbers (using a calculator, concrete means and written calculation algorithms) • Mental estimate of the result of an operation involving natural numbers

Attitudes

The following attitudes are provided as suggestions only. The development of these attitudes can help adults to become more competent in dealing with the real-life situations in this course.

Confidence in Their Abilities	Perseverance
If they are confident in their abilities, adults spring into action more readily when required by the situation and learn from their mistakes.	Persistent adults make a sustained effort and look for solutions to their difficulties. When needed, they ask for help from a resource person or seek support from a peer.

Complementary Resources

The following resources are provided as suggestions only and consist of references that may be consulted in learning situations.

Social Resources	Material Resources
▪ Public, parapublic and private organizations ▪ Community organizations ▪ Services provided by the training centre ▪ Commercial establishments (e.g. grocery stores, drugstores)	▪ Bank of images of road signs ▪ Cookbooks ▪ Various labels (e.g. cleaning products, medications) ▪ Instruments for measuring capacity ▪ Thermometer ▪ Measuring instruments ▪ Maps of bicycle paths ▪ Geometry instruments ▪ Calculator, etc.

Contribution of the Subject Areas

The contribution of all the subject areas is also useful for dealing with the real-life situations in this course. In the Literacy level courses, the examples of real-life situations are similar in some ways and complement the essential knowledge covered in the *Computer Science* program, which also belongs to the subject area of Mathematics, Science and Technology, and in the *English, Language of Instruction* program, which belongs to the Languages subject area. This makes it possible to deal with different aspects of a real-life situation and to create cross-curricular learning situations. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

Andragogical Context

In different real-life situations, adults are required to describe and represent elements in their immediate physical environment. To help them deal with a range of situations, the *Basic Geometric Representations* course helps them construct this representation through the use of basic concepts related to geometry, measurements and ratios. More specifically, this course helps adults to orient themselves in their physical environment, to read, write and interact in different situations that involve applying their knowledge. In this regard, this course is essential to helping adults become more autonomous.

Adults are encouraged to play an active role in constructing their knowledge of mathematics. However, given the degree of autonomy needed to read task-related information or instructions, the teacher provides constant support in learning activities. Oral and team work is preferred when the context permits. The concrete materials made available to adults facilitate learning and the construction of knowledge. Frequent reflection on what has been learned allows adults to gauge their progress and to make the necessary adjustments. The teacher is concerned with creating an atmosphere of confidence that makes learning enjoyable and fuels the adult learners' determination to persevere. The teacher makes sure adult learners have the necessary resources to explore, understand and organize the data they need in order to plan and take action.

The Literacy level courses are designed to allow for the flexibility needed to adjust to the practical needs of adults. To enable adults to deal competently with real-life situations, the examples examined in the different courses are in some ways similar and involve using what was learned in English, Language of Instruction, Mathematics and Computer Science.

This is how the different facets of a real-life situation can be explored, thereby making it possible to create cross-curricular learning situations. The courses are adapted to adults' level of autonomy with respect to their ability to use written materials.

Learning Situation

The learning situation that follows is provided as an example to show teachers how the principles of the education reform can be applied in the classroom.

It is authentic in the sense that it addresses a real-life situation (taken from the class of situations in the course) that adults may find themselves in. It is sufficiently open and comprehensive to allow adult learners to explore several important aspects related to dealing with this real-life situation.

The examples of actions presented in the course help the teacher to identify those actions that an adult would take to deal with the real-life situation. The teacher can then refer to these examples in order to develop pertinent learning activities.

The learning situation is organized in terms of the three steps of the teaching-learning process, which are as follows:

- planning learning
- actual learning
- integrating and reinvesting learning

These steps highlight the principles of the education reform insofar as they encourage adults to be active, to reflect on their learning and to interact with their peers when the learning context is suitable. They include learning activities and may also include evaluation activities intended to support adults in the learning process.

These activities help learners to construct knowledge related to the compulsory elements of the course that are targeted by the learning situation concerned: one or more categories of actions, essential knowledge and the actions of the operational competencies associated with the categories of actions.

The example provided also refers to certain teaching strategies—pedagogical methods and techniques—that can be selected according to the learners, the context and the learning environment. Certain learning strategies may also be suggested, as well as a variety of material and social resources.

Example of a Learning Situation

Getting Ready for a Bicycle Trip

Getting Ready for a Bicycle Trip is an example of a learning situation that can be used in this course. It belongs to the class *Representing one's immediate physical environment* and, more specifically, to the real-life situation *Getting around in an unfamiliar place*. Throughout this learning situation, adults use the operational competencies *Thinks logically* and *Communicates*.

In order to provide a context for this learning situation, the teacher prepares a scenario that requires the adults to determine the route for a one-day bicycle trip. The situation is fictitious, but realistic. To carry out this activity, adult learners will have to become familiar with units of length.

After presenting the scenario, the teacher listens to the adults' reactions and provides more clarifications by answering their questions. The teacher then leads a class discussion on the knowledge needed to carry out this type of project and on the challenges involved, and begins by handing out a questionnaire on what they know about the different units of length. Using this information, the teacher has the class carry out an initial learning activity aimed at providing points of comparison for the smaller units of measure such as metre, centimetre and millimetre. Examples of points of comparison are given for each unit of measure (e.g. a door handle is usually about one metre above the floor). These examples are written on the board. The teacher then names various objects and asks the adult learners to choose what would seem to be the most appropriate unit of measure to represent the object's length. The teacher gives the class a few minutes to come up with objects that can be measured in metres, centimetres and millimetres. An example must be given for each unit of measure. The adult learners then pool all of their examples so that they may be verified. A variety of examples will ensure that these measurements are better represented. If necessary, the teacher provides clarifications and repeats the exercise.

The learning activity continues with an examination of the kilometre, a unit of measure that will be especially useful in preparing for a bike trip. In order to help the adults represent the distance that corresponds to one kilometre, the teacher begins by presenting a point of comparison that is familiar to the adults by telling them the number of kilometres between the training centre and the city pool. The teacher then names a few places with which the adult learners are familiar and asks them whether the distance between those places can be measured in kilometres. In the ensuing discussion, each person gives new examples and the rest of the class comments on how realistic these examples are.

When the teacher feels that the points of comparison are sufficiently clear for illustrating the concept of kilometre, the class can begin planning the bike trip. Each learner is given a map of the bike path in the area where the centre is located. This map contains little information and it is very simply sketched. If necessary, the map can be reproduced by only keeping the minimum amount of information needed for the task at hand. The teacher introduces the learning activity and points out useful symbols such as rest stops or parking areas. The teacher asks the adults to describe the shape of these

symbols by drawing on their knowledge of geometric figures. Each person clearly marks the start and the end of the path and identifies known places. This is a good time to get the adult learners to locate these places with respect to one another and to use concepts they have already learned about positioning in space.

The adults continue the learning activity by working in teams of two or three. Before they sketch out their route, the teacher has them calculate the total length of the bike path and determine the length of the different segments in kilometres. By taking these distances into account, the adults arrange these segments, from the shortest to the longest. They help each other find the required information by adding and comparing numbers. Each team then presents its results and explains the method used to obtain them. The teacher comments on the work and makes corrections, if necessary. The adults are asked to work in teams to determine a realistic bike route by taking into account what they observed when they were examining the map and the amount of time they have for the trip. They use a highlighter to mark out the route, perform calculations and make a note of the total distance to be covered.

To conclude the learning situation, the teacher reviews the activity with the class. The adults comment on how realistic their route is and what they have learned through the activity. The adults are asked to identify the units of length they studied and to name other real-life situations in which these units of measure could be useful.

Elements of the Course Addressed by the Learning Situation

Class of Situations	
Representing one's immediate physical environment	
Learning Situation	
Getting Ready for a Bicycle Trip	
Categories of Actions	
▪ Reading information involving geometry, measurements or ratios ▪ Writing information involving geometry, measurements or ratios ▪ Orally interacting in cases involving a description of the physical environment ▪ Determining measurements and ratios	
Operational Competencies	**Essential Knowledge**
▪ Thinks logically ▪ Communicates	Measurement ▪ Units of measure ▪ Estimating a length Geometry ▪ Simple geometric figures ▪ Positioning objects in space Natural numbers ▪ Classifying and comparing natural numbers Arithmetic operations ▪ Adding natural numbers
Complementary Resources	
▪ Map of bicycle paths