

Course
Sense of Space and Time
MTH-P102-3
Presecondary



“Time and space are infinite, yet we never seem to have enough of them.”

C. Thomson

Presentation of the Course *Sense of Space and Time*

The course *Sense of Space and Time* is designed to help adult learners deal competently with real-life situations that involve problems associated with orientation in space and time.

Adults will therefore learn to use basic arithmetic and their knowledge of the dimensions of time and space in their daily lives.

The course continues to build on what adults have learned in the Literacy level courses or in their daily lives. Reading time on a digital timepiece and various units of time (e.g. second, minute, week, year) have already been covered in previous courses. Learners already have the basic knowledge required to situate themselves or an object in space (e.g. on top, to the right, inside, above) and they are familiar with certain units of length. The *Sense of Space and*

Time course builds on this learning in addition to making connections between concepts related to time and space in the real-life situations that require it. This course allows adults to consolidate what they have learned in *Arithmetic and Personal Finances* and introduces the four operations on negative numbers.

By the end of the course, learners will be able to interpret and produce simple information with respect to time and space and to measure time and length. They will make rigorous use of arithmetic language and use deductive and inductive reasoning to manage time, get around and understand the meaning of arithmetic operations.

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: *Orienting oneself in space and time*.

The ability to orient oneself in time and space is required in many real-life situations. Adults must be able to manage their time, determine what is involved in getting from one place to another, situate themselves or objects in their surroundings, situate an event anywhere in the world, etc. The situations in this class affect the daily lives of adults in very concrete ways and may be related to their training, work or personal life. However, some of the situations may involve social or international issues that will be examined in the course, such as analyzing a historical event, understanding a current event, etc.

Some of the real-life situations in this class refer to the concept of time, which must be understood in order to be able to adhere to a schedule, tell time or situate an event in time. Other situations involve exclusively orientation in space, such as locating an object, a place or an event, describing a route, etc. Lastly, when the situation involves planning a trip or a move or understanding historical, national or international events, the concepts of time and space are considered in the same situation.

Class of Situations	Examples of Real-Life Situations
Orienting oneself in space and time	<ul style="list-style-type: none">▪ Planning a schedule▪ Planning an itinerary▪ Moving▪ Travel▪ Relocating for work reasons▪ Understanding historical events▪ Situating local or international events▪ Planning the layout of a room

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
<ul style="list-style-type: none"> ▪ Interpreting information related to time and space 	<ul style="list-style-type: none"> ▪ Determines the location of a city based on its geographic coordinates ▪ Follows the direction indicated on a road map ▪ Follows instructions in order to get to a specific place ▪ Interprets information about a bus route ▪ Reads time on a timepiece that uses hour and minute hands (analogue) ▪ Interprets a schedule or day planner ▪ Places historical events in chronological order
<ul style="list-style-type: none"> ▪ Producing information related to time and space 	<ul style="list-style-type: none"> ▪ Explains an itinerary orally ▪ Describes an itinerary using a diagram ▪ Describes where a country is located ▪ Describes the location of objects in a descriptive text ▪ Indicates major conquests on a timeline ▪ Produces a work schedule ▪ Explains a travel route

Categories of Actions	Examples of Actions
<ul style="list-style-type: none"> ▪ Determining measures of time and length 	<ul style="list-style-type: none"> ▪ Estimates the duration of an activity ▪ Determines the time required to cover a given distance on the basis of the average speed ▪ Determines what time it is in another country ▪ Calculates the time elapsed between two events ▪ Times the duration of an event ▪ Determines the difference in altitude between any two land points ▪ Determines the distance between two cities using a road map ▪ Uses an odometer to measure distance ▪ Measures the distance between two objects

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

Orienting oneself in space and time

Categories of Actions

- Interpreting information related to time and space
- Producing information related to time and space
- Determining measures of time and length

Operational Competencies

Thinks logically

- Infers the operations for converting one unit of measure into another
- Selects information on time and space and the appropriate arithmetic operations
- Establishes priorities to organize time and outings
- Uses proportional reasoning
- Checks that his/her conclusions are realistic and coherent

Communicates

- Accurately decodes the symbols, notations and terms associated with arithmetic, space and time
- Identifies information that gives him/her a sense of space and time
- Checks his/her interpretation with other people
- Forms a mental image of itineraries, travel routes and the positioning of objects
- Properly organizes the message using mathematical models
- Accurately uses the symbols, notations and terms associated with arithmetic, space and time
- Makes sure his/her message is clear

Essential Knowledge

- Space
- Time
- Relationship between space and time
- Decimals and ratios
- Proportional relationships

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 dealing with the situations in the class *Orienting oneself in space and time*, adults interpret and produce information related to time and space, determine the measures that allow them to orient themselves and establish a plan that takes both time and space into account.

Adults interpret information related to time and space that is provided in a day planner, a calendar, an analogue clock, a timetable or a road map, or that is provided orally. To do this, they accurately decode the symbols, notations and terms associated with arithmetic, space and time such as whole and decimal numbers, units of measure, coordinates, etc. Adults identify information that enables them to orient themselves in space and time and determine which information is appropriate for the real-life situation. This allows them to form an accurate mental image of their itinerary and outings and then select the best travel route. They can also determine the position of an object, a location or an event using a system of coordinates and everyday vocabulary related to position in space. In cases where the information has been provided, they check their interpretation of the message with others and make sure that their conclusions are coherent.

Adults produce information related to time and space in order to draw up a personal schedule, sketch an itinerary, describe a trip, etc. They accurately use the symbols, notations and terms associated with arithmetic, space and time such as the time of day, units of measure, geographic coordinates or whole numbers. Planning a schedule or an outing requires adults to establish priorities by making connections between time- and space-related measurements and concepts. Their message is based on mathematical models (e.g. diagrams, timelines). They select the spatial and temporal information that is appropriate to their message, and make sure that their messages are clear and coherent. In situations that involve positioning in space, itineraries or travel, they take the time to form a mental representation of the information to be illustrated or described.

Adults determine measures of time and length accurately when interpreting or producing spatial and temporal information or when attempting to better understand the real-life situation at hand. They clearly identify the appropriate units by making rigorous use of the symbols in the International System of Units. They are required to infer operations in order to convert a unit of time and length in situations that deal with these dimensions. Adults select the relevant information and the appropriate arithmetic operations for the real-life situation being examined. The results of their calculations are correct. They take the time to estimate a dimension or a duration and compare the results of their calculations or their measurements with their initial estimates. For example, adults use proportional reasoning when they deduce that distance covered is directly proportional to the time elapsed (when the average speed is constant). This allows them to anticipate the effect of changing one of these quantities. Adults check that their conclusions are plausible and coherent.

Evaluation Criteria

- Interprets information related to time and space correctly
- Produces clear and appropriate information related to time and space
- Accurately determines a measure of time or length

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* makes it possible for adults to make connections, draw conclusions and organize their representations of space and time in the real-life situations in the class *Orienting oneself in space and time*. This competency consists in using deductive and inductive reasoning with respect to the concepts of time, space and arithmetic.

Adults who think logically are able to infer the arithmetic operations needed to deal with time- and space-related factors in certain situations. For example, they infer the number by which a unit of time or length must be multiplied in order to convert it into another unit or the calculation required to convert time expressed according to the 24-hour clock into time expressed according to the 12-hour clock. They look for examples to check their conjectures made with respect to their choice of operations or give counterexamples in order to clarify, adjust or refute it.

Adults can therefore deduce the required calculations and select the arithmetic operations appropriate to a given real-life situation. They check that their calculations are plausible and coherent by making connections between their results, initial estimates and the various spatial and temporal aspects to be considered. Furthermore, planning a schedule or a trip requires that adults be able to prioritize their choices by making connections between the measures and concepts of time and space. For instance, they deduce that the distance covered is directly proportional to the amount of time elapsed (if the average speed is constant), which allows them to anticipate how changing one of these quantities will affect the other. Thus, by taking into account various possible routes to get to a given location, they can select the best one. Adults are concerned with ensuring that their conclusions are plausible and coherent (e.g. estimates, choices, expectations).

Contribution of the Operational Competency *Communicates*

The operational competency *Communicates* makes it possible for adults to interpret and produce simple messages involving spatial and temporal information when they deal with the real-life situations in the class *Orienting oneself in space and time*. This competency involves decoding and accurately using arithmetic language and terms related to space and time.

Adults who interpret a message correctly decode the notations and symbols related to time, units of measure, geographic and alphanumeric coordinates, timelines, whole numbers, etc. They understand the meaning of basic vocabulary associated with arithmetic operations and that of terms related to time and space, such as time zones, century, altitude, etc. They are able to interpret a timetable, an itinerary, a day planner, a map or any other simple document by recognizing information that enables them to orient themselves in space and time. When in doubt, they check their interpretation with someone else. Learners form a specific mental image of the given itineraries and travel routes.

Adults produce a message by correctly using arithmetic language and the terms related to space and time to formulate explanations, describe a geographic location, draw up a schedule or tell time. They organize their message appropriately by using specific mathematical models (e.g. diagrams, timelines). They take the time to form a mental representation of what they want to describe, for instance, an itinerary, a trip or the position of an object in relation to another. They make sure their message is clear and appropriate to the situation and audience.

Essential Knowledge

All of the knowledge shown in the following table is compulsory since it is essential for dealing with many of the situations in the class *Orienting oneself in space and time*.

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 previously acquired knowledge is also needed to deal with the situations examined in this course, adult learners must deepen their understanding of this knowledge by adapting it to situations that involve orienting themselves in space and time. In some cases, the knowledge outlined in this column is included with more general knowledge in the left-hand column. It is nonetheless listed to make it easier to identify adult learners' previously acquired knowledge.

Since essential knowledge in arithmetic is dealt with only in a context involving orientation in space and time, this material is 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
<p>Space</p> <ul style="list-style-type: none"> • Cardinal points • Alphanumeric coordinate system (on road and geographic maps) • Geographic coordinate system (latitude and longitude in degrees and altitude in metres) • Scale • Legend • Everyday vocabulary related to positioning in space (e.g. towards the northwest, to the south, parallel, transversal) • Significant segments (secants) • Converting one unit of length to another within the international system (mm, cm, m and km) • Reading road and geographic maps • Determining actual distance using a map 	<p>Space</p> <ul style="list-style-type: none"> • <i>Everyday vocabulary related to positioning in space (e.g. above, below, to the right, to the left, inside, outside, on top)</i> • Significant segments (parallels and perpendiculars) • <i>Units for measuring length (mm, cm, m and km)</i> • Measuring and estimating length

New compulsory knowledge	Compulsory knowledge acquired in previous courses
<p>Time</p> <ul style="list-style-type: none"> • Units of time (e.g. trimester, semester, decade, century, millennium) • Everyday vocabulary describing the frequency of an event (daily, weekly, monthly, annual) • Standard time and daylight savings time • Reading time on an analogue timepiece (watch with hands) • Reading and writing time according to the 24-hour clock (e.g. 19:30) • Equivalence between time on the 24-hour clock and time on the 12-hour clock (e.g. 19:30 and 7:30 p.m.) • Estimating duration • Converting a measurement of time into another <p>Decimals</p> <ul style="list-style-type: none"> • Decimals (up to three places) • Positioning decimals on the number line (including negative numbers) • Rounding off positive decimal numbers to the nearest hundredth • Calculations involving the four operations on decimals (e.g. the operations involving negative numbers are performed using visual aids only: timeline, illustrations) 	<p>Time</p> <ul style="list-style-type: none"> • <i>Units of time (e.g. second, minute, hour, day, week, month, year)</i> • <i>Reading a digital timepiece (e.g. 07:30 PM)</i> • <i>Timing</i> <p>Decimals</p> <ul style="list-style-type: none"> • <i>Decimals (up to two places)</i> • <i>Whole numbers</i> • <i>Comparing decimals (including negative numbers)</i> • <i>Rounding off positive decimals to the nearest whole number and to the nearest tenth</i> • <i>Sense of the four arithmetic operations</i> • <i>Calculations involving the four operations on positive decimals (using a calculator, mental calculation techniques and written calculation algorithms)</i> • <i>Solving sequences of arithmetic operations on positive decimal numbers (with at most one set of parentheses and four operations)</i> • <i>Mental estimate of the results of operations or sequences of operations on positive decimal numbers</i>

New compulsory knowledge	Compulsory knowledge acquired in previous courses
<p>Relationship between space and time</p> <ul style="list-style-type: none"> • Time zones • Average speed • Relationship between distance and average speed and time • Determining the time of day in various geographic locations 	<p>Decimals (cont'd)</p> <ul style="list-style-type: none"> • <i>Expressing relations using arithmetic models that involve positive decimal numbers</i> <p>Ratios (these concepts are examined in the context of reading an analogue timepiece)</p> <ul style="list-style-type: none"> • <i>Representing mixed numbers (e.g. using the base 10 number system and visual aids such as blocks, illustrations)</i> • <i>Calculating a fraction of a natural number</i> • <i>Determining the fraction that corresponds to a part of a whole</i> <p>Proportional relationships</p> <ul style="list-style-type: none"> • <i>Directly proportional relationships</i> • <i>Unit-rate method</i>

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.

Rigour	Openness
This attitude allows adults to be precise when measuring time or length and when producing descriptions; it also helps them perform precise calculations and check their plausibility.	This attitude enables adults to take an interest in various geographic locations and different events likely to occur in these places.

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
<ul style="list-style-type: none">▪ Travel agencies▪ Airline companies, moving companies, car rental companies, bus transportation companies, etc.	<ul style="list-style-type: none">▪ Calculator▪ Geometry instruments▪ Compass▪ Odometer▪ Stopwatch▪ Clock▪ Ruler▪ Tape measure▪ Globe▪ Road and geographic maps▪ Calendar▪ Day planner▪ Mapping software

Contribution of the Subject Areas

The contribution of certain subject areas, in particular the Social Sciences, Working Life, Languages and Mathematics, Science and Technology is also useful for dealing with the real-life situations in this course. The elements identified for each subject area are not compulsory and do not constitute prerequisites.

Subject Area: Social Sciences

Programs of Study: *Social and Political Life and Community and Culture*

- Learners who are required to plan a trip or situate a current event as part of the *Sense of Space and Time* course may use their knowledge of social and political events, geography, history, etc.

Subject Area: Working Life

Programs of Study: *Introduction to the World of Work and Career Choice*

- Some of the real-life situations examined in this course may involve planning work-related travel and schedules. Adults therefore use their knowledge of holidays, deadlines, organizational behaviour, etc.

Subject Area: Languages

Program of Study: *English, Language of Instruction*

- Adult learners will likely be required to communicate orally or in writing in all of the situations examined in this course. Consequently, the language of instruction will be used throughout the course.

Program of Study: *French as a Second Language*

- A number of the real-life situations in this course require the use of a second language. Adults may have to use a second language when they travel, ask for directions or the time, etc.

Subject Area: Mathematics, Science and Technology

Program of Study: *Computer Science*

- Some of the real-life situations in this course could involve the use of computer resources. For example, learners may use spreadsheets or word processing software to produce a timetable or the Internet to find a geographic map or a road map.

Program of Study: *Relationship With the Environment*

- When orienting themselves in space and time, adults must situate themselves in their environment. The knowledge related to this program can therefore be used to deal with the real-life situations in this course. Learners may also use their knowledge of astronomy if they wish to situate themselves on a larger scale or better understand units of time (e.g. days, months, years) that are based on astronomical phenomena.

Program of Study: *Mathematics*

- In addition to the compulsory knowledge for this course, working with some of the real-life situations examined in this course may require knowledge of mathematical content covered in other common core education courses. For example, this applies to situations that involve drawing up or reading plans and using geometric shapes to describe one's surroundings.

Andragogical Context

The *Sense of Space and Time* course will provide the teacher with an opportunity to remind learners that they must take account of the space and time considerations that affect their daily lives. By developing their knowledge of these two dimensions, they can deal with different situations more efficiently.

Although the focus of this course is on space and time, learners continue to build on the arithmetic knowledge they began to acquire in the *Arithmetic and Personal Finances* course. If the learners have not yet mastered certain concepts (shown in the right-hand column of the table of essential knowledge), the teacher will have to allow time and suggest simpler learning situations so that learners may acquire this knowledge.

Geographic coordinates are part of a three-dimensional system and a fairly strong capacity for abstract thinking is required to represent them. Therefore, the teacher may find it useful to use such concrete materials as a globe in order to support learning. This is also why the concept of altitude will be studied separately from the concepts of longitude and latitude. Road maps and geographic maps are also fairly complex for the Presecondary level. For this reason, it would

be preferable to refer to an environment with which learners are already familiar. Internet sites or mapping software will no doubt make it easier for learners to understand maps since they provide the option of viewing a given location either from a global or a very detailed perspective and to move from one place to another on the map.

The teacher draws on the real-life experiences of learners in order to present them with realistic learning situations. The closer the learning situations are to actual everyday situations, the more meaningful they are and the more knowledge the students will retain. Furthermore, this course provides a good opportunity to help adults develop punctuality and a sense of organization. It may be a good idea to plan for several short learning situations rather than work with complex situations over a long period. Learners at this level will find it easier to assimilate mathematical knowledge if they can use this knowledge in a number of different real-life situations and if these situations are not encumbered by too many non-mathematical details.

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

Planning a Schedule

The real-life situation in the class *Orienting oneself in space and time* involves planning a schedule. As part of the learning situation, the adults are asked to draw up a one-week timetable, to make sure they can adhere to the timetable and to familiarize themselves with using a day planner.

In a class discussion, the learners talk about their ability to adhere to a schedule, remember an appointment, show up on time, etc. The teaching staff points out that they might find time management useful and presents some examples of schedules that are relevant to them, such as a school schedule. The teacher then presents the conventions associated with reading and writing time on the 24-hour clock as well as equivalences between the 24-hour clock and the 12-hour clock. These concepts may be explored in relation to those already examined in other learning situations such as units of time and reading time on an analogue or a digital timepiece. To help the adults consolidate what they have learned, the teacher asks them a few questions, orally or in writing, using the examples of schedules presented earlier. The teacher provides individual learners with feedback on how well they have mastered these concepts.

In order to help the learners to draw up their own schedules, the teacher suggests a review of the algorithms for the four operations and demonstrates each operation through examples involving minutes. If some adults are still not comfortable with these techniques, the teacher may provide other examples and exercises to be completed either individually or in pairs. To explain the conversion of units for measuring time, the teacher provides the

adult learners with a text together with a few examples and exercises. They complete the exercises on their own and check their comprehension in teams of two or three. The teacher provides support, as needed. After they have noted, for instance, that 90 minutes are equivalent to 1 hour and 30 minutes, they may perform calculations involving units of time to determine the duration of a number of activities or the time at which they are expected to end.

The teacher can now help the adults produce their own personal schedules using an eight-column table, that is, one column for the hours and the other seven columns for the days of the week. The adult learners list their activities during the week and indicate the day and time of the activities on the table. An estimate of how long the activities will last will help them determine the time at which the activities should end. Following the instructions provided and working alone, they divide their tables into the number of rows they deem necessary. The length of time indicated in each row will not necessarily be the same for everyone, since the adult learners may consider that certain periods of the day are busier for them and will therefore have more rows in their tables. They make sure their schedules are realistic and comprehensible by having it checked by a classmate.

The teacher makes sure that the schedules are clear and accurate. The times and durations indicated must be plausible and written according to mathematical conventions. The adults may also be asked to transfer their schedule to a day planner and be

encouraged to use their school planner to better manage their time and increase their ability to meet deadlines.

The teacher may review the learning situation by asking questions aimed at getting the adult learners to make connections between what they have learned and the operational competency *Communicates*. They see that the various schedules and planners studied are all consistent with the symbols and notations of mathematical language. They too must observe these conventions to make sure that others will understand them.

Elements of the Course Addressed by the Learning Situation

Class of Situations	
Orienting oneself in time and space	
Learning Situation	
Planning a Schedule	
Categories of Actions	
<ul style="list-style-type: none"> Interpreting information related to time and space Producing information related to time and space Determining measures of time and length 	
Operational Competencies	Essential Knowledge
<ul style="list-style-type: none"> Thinks logically Communicates 	<ul style="list-style-type: none"> Units of time Reading time on an analogue timepiece Reading time on a digital timepiece Reading and writing time on the 24-hour clock Equivalence between time on the 24-hour clock and time on the 12-hour clock Estimating duration Converting a measurement of time into another Performing calculations using the four operations on decimals
Complementary Resources	
<ul style="list-style-type: none"> Calculator Ruler Digital or analogue watch 	<ul style="list-style-type: none"> Day planner Examples of schedules

