Course

Geometric Representations and Transformations

MTH-2102-3

Secondary Cycle One

"As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality."

Einstein

Presentation of the Course *Geometric Representations and Transformations*

The course *Geometric Representations and Transformations* course is designed to help adults deal competently with real-life situations in which they must solve problems involving representations of the physical environment and its transformations.

In this way, they will learn to use plans, the geometry of transformations and measurements to better understand and represent the world around them and the transformations that occur in it.

This course builds on the knowledge acquired in previous courses. For example, adult learners are already able to convert from one measurement to another within the international system, and to use both the law of proportions (rule of three) and the unit-rate method. They are also familiar with fractional notation in certain contexts and with the representation of geometric shapes. In this course, they will explore different measurement systems, conversion of units from one system into units from another, and scale plans. They will also consolidate their understanding of fractions by using them to represent the scale of a plan, a scale factor or a portion of an object, and will continue their study of geometry by examining solids broken down into simple solids, geometric transformations and the properties of congruent figures and similar figures in everyday situations

By the end of the course, learners will be able to make appropriate use of geometric and arithmetic language. They will also be able to make inferences and deductions pertaining to geometric representations and transformations. They will have a better perception of their physical environment and its transformations, and will be better able to produce appropriate descriptions and illustrations in this regard. Lastly, they will also be able to identify the measures and ratios needed to deal with real-life situations.

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 the physical environment and its transformations*.

The ability to represent the physical environment and its transformations is required for many real-life situations. Adult learners form perceptions of the physical environment and its transformations through direct observation or by interpreting verbal descriptions or illustrations. In both cases, the pictures they form in their minds are based on geometric models. In addition, adult learners are often required to produce representations of the physical environment and its transformations, which may take the form of an oral or written description or an illustration. Representations may pertain to the physical environment itself (e.g. an object, a place) or to a transformation that takes place in it (e.g. movement, displacement, alteration). However, this class includes only situations involving physical realities that adult learners can easily understand as well as basic geometric concepts.

Many of the real-life situations in this class pertain to representations of the physical environment (e.g. producing a mechanical component shown in a diagram, identifying a location in a building using an evacuation plan, travelling using a map, describing an object or a portion of an object to a third person). Other situations relate more to transformations of the physical environment and their representations. For example, adult learners who organize or renovate a room use plans and units of measure. Learners who adapt a recipe to feed a certain number of people must perform calculations to adjust the ingredient quantities. Isometries and dilatations must also be used to illustrate transformations that occur on a manufacturing production line, the operation of an optical device or the movement of objects during the rearrangement of a room. Adult learners may also refer to descriptions or illustrations of movements when appreciating works art or learning how to use a tool (e.g. lever, hammer).

Class of Situations	Examples of Real-Life Situations
Representing the physical environment and its transformations	▪ Learning about the mechanics of a tool ▪ Renovating an apartment ▪ Rearranging a room ▪ Assembling a piece of furniture ▪ Producing technical drawings ▪ Learning how to use optical equipment ▪ Manipulating a digital image

Class of Situations	Examples of Real-Life Situations
	▪ Building a shed ▪ Sewing ▪ Landscaping ▪ Studying motion in a production line ▪ Travelling ▪ Describing movement during a physical activity ▪ Finding a location in a building ▪ Planning meals ▪ Enjoying works of art

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
▪ Forming perceptions of the physical environment and its transformations	▪ Visualizes the movements required to use a tool ▪ Determines the movement applicable to a section of a piece of furniture during its assembly ▪ Identifies pattern repetition in a painting ▪ Follows a plan when building a shed ▪ Observes similarities between two objects ▪ Notes symmetries when cutting pieces of material to make clothing ▪ Visualizes the proposed movements in a physical exercise ▪ Finds his/her location in a building based on a scale plan
▪ Producing representations of the physical environment and its transformations	▪ Draws a diagram of a mechanical component ▪ Uses an isometry to represent the movement of an object ▪ Draws up a plan for renovating part of his/her home ▪ Designs a pattern for a ceramic tile ▪ Draws the mirror image of an object ▪ Alters a digital image to change the size of a picture ▪ Describes leg movements in a choreography

Categories of Actions	Examples of Actions
▪ Determining measurements and ratios	▪ Calculates the actual measurement of one side of a plot of land represented in a plan ▪ Estimates what portion of a plot of land will be occupied by a vegetable garden ▪ Calculates the volume of his/her swimming pool ▪ Converts the measurements in a recipe ▪ Performs calculations related to a photographic enlargement ▪ Determines the measurement of a microscopic object by enlarging it under a microscope ▪ Compares the dimensions of two objects indicated in different units of measure ▪ Calculates the dimensions of the cake pan needed when a recipe is doubled ▪ Adjusts the dimensions of a pattern to make a larger garment

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 the physical environment and its transformations

Categories of Actions

- Forming perceptions of the physical environment and its transformations
- Producing representations of the physical environment and its transformations
- Determining measurements and ratios

Operational Competencies

Thinks logically

- Infers the properties of similar and congruent figures
- Deduces implicit information in representations of the physical environment
- Anticipates situations in which it is appropriate to use geometric transformations or plans
- Deduces the transformations that take place in the physical environment
- Selects the instrument required to take accurate measurements
- Makes sure his/her conclusions are plausible and consistent

Communicates

- Accurately decodes symbols, notations and terms pertaining to arithmetic and geometric language
- Identifies shapes, quantities, alterations and movements
- Checks his/her interpretation with other people
- Anticipates situations in which it is appropriate to use geometric transformations or plans
- Structures the message appropriately by using precise mathematical models
- Rigorously uses the symbols, notations and terms pertaining to arithmetic and geometric language
- Makes sure the message is clear

Essential Knowledge

- Plans
- Geometry of transformations
- Plane figures
- Solids
- Measurements
- Arithmetic
- Proportional relationship

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
The real-life situations in the class *Representing the physical environment and its transformations* involve perceiving and producing geometric representations of the physical environment and its transformations, as well as determining the measurements and ratios needed to deal with these situations. Adult learners form perceptions of the physical environment and its transformations through direct observation, or from descriptions or illustrations. They may, for example, understand the instructions for using a tool, form a precise mental image of an observed motion, follow a layout plan or anticipate the result of a transformation that occurs in the physical environment, such as the position of an object that has undergone a rotation or translation. To do this, they must accurately decode the symbols, notations and terms relating to arithmetic and geometric language. They use their inferences with respect to the properties of similar or congruent figures in order to deduce implicit information in the representations of the physical environment and its transformations (e.g. unknown angle or segment measurements, partially represented geometric figures). They may also deduce transformations that take place in the physical environment, such as isometries that result in an object being moved from one position to another. When representations of the physical environment or its transformations are conveyed to them, adult learners identify shapes, quantities (measurements and ratios), alterations and movements. If in doubt, they check their interpretation by consulting other people. Lastly, they check the plausibility and consistency of their conclusions to ensure that the information they have deduced is a true reflection of reality. Adult learners produce representations of the physical environment and its transformations in order to draw up renovation plans, to describe the path of light in an optical device or to describe how a tool works. To do this, they make appropriate use of the symbols, notations and terms pertaining to arithmetic and geometric language. Because they are able to anticipate situations in which it is appropriate to use geometric transformations and plans, they select the geometric figures and transformations that are best suited to the situation they wish to describe or illustrate, and construct them using appropriate techniques. When conveying their representations, they structure their message appropriately by using precise mathematical models (e.g. scale plans, illustrations of isometries, arithmetic expressions). They also make sure their descriptions and illustrations are clear, so that other people are able to clearly perceive the physical environment and its transformations. Adult learners determine measurements and ratios for a number of reasons, whether it is to produce a representation, to form perceptions of the physical environment and its transformations, or to develop a better understanding of the real-life situation concerned. They select appropriate arithmetic operations to convert measurements from one system to another, or to determine unknown measurements (e.g. angles,

segments, volumes), scale factors or similarity ratios, or the scale of a plan. In particular, they determine the actual measurement corresponding to a segment on a scale plan, or conversely, take an actual measurement and determine the length of the corresponding segment on a scale plan. The results of their calculations are accurate. Adult learners also deduce measurements based on the properties of congruent and similar figures. Thanks to their understanding of units of measure, they are able to estimate measurements in the physical environment and select the instrument required to obtain precise measurements of different kinds (e.g. mass, length, capacity, angle). They check the plausibility and consistency of their conclusions (e.g. estimates, measurements) by referring among other things to their previous observations.

Evaluation Criteria

- Forms an appropriate and realistic perception of the physical environment and its transformations
- Produces clear and appropriate representations of the physical environment and its transformations
- Accurately 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 make connections and draw conclusions when dealing with real-life situations in the class *Representing the physical environment and its transformations*. It involves making deductions and inferences pertaining to geometric representations and transformations. Adult learners think logically when they infer the properties of similar or congruent figures after observing them in different contexts. For example, they may infer that the interior angle measurements of similar figures are identical, or that the original dimensions of a figure remain unchanged after it has undergone a rotation. They look for examples to verify their conjectures, or for counterexamples to clarify, adjust or refute them. In this way, they are able to make connections between geometric transformations, plans and transformations in the physical environment, and are therefore more easily able to determine when it is appropriate to use geometric transformations and plans to represent real-life situations.	Adult learners deduce implicit information from representations of the physical environment and its transformations. For example, when observing or producing a drawing or plan, they are able to deduce that two figures are similar or congruent, and then deduce any unknown angle or segment measurements. They can also deduce transformations that occur in the environment, such as isometries that result in an object being moved from one position to another. Conversely, they can predict the results of a transformation in the physical environment, such as the position of an object that has undergone a rotation or translation. Thanks to their understanding of units of measure, they are able to estimate certain measurements in the physical environment and select the instrument required to take accurate measurements. They then check the plausibility and consistency of their conclusions (e.g. estimates, measurements) by referring among other things to their previous observations.

Contribution of the Operational Competency *Communicates*

The operational competency *Communicates* helps adult learners to interpret and produce simple messages containing geometric representations or transformations when they deal with real-life situations related to the class *Representing the physical environment and its transformations*. It involves carefully decoding and using the mathematical language associated with representations.

When interpreting a message, adult learners accurately decode the symbols, notations and terms pertaining to the various measurement systems, geometric figures and transformations, plans and arithmetic. Regardless of whether the message is delivered orally or in writing, adult learners are able to form clear perceptions of the transformation or environment that is represented by identifying shapes, quantities, movements and alterations. This helps them to better understand instructions for using a tool, how to perform a movement during a physical exercise, the layout of a room, and so on. When in doubt, they make sure they have properly interpreted the geometric representation of the environment and its transformations contained in the message by consulting with other people.

When producing a message, adult learners convey their mental representations of the physical environment and its transformations. They structure the message appropriately using precise mathematical models (e.g. scale plans, illustrations of isometries, arithmetic expressions). They make appropriate use of the symbols, notations and terms pertaining to arithmetic and geometric language, correctly associating the symbols and notations with the information they wish to convey in their representations. They use the geometric figures and transformations that most closely reflect the situation or item they wish to describe or illustrate. They may, for example, use isometries to illustrate object displacement, image formation or pattern repetition in a visual representation. Where appropriate, they clearly identify the scale of a plan, the centre of rotation, the line of reflection or the translation vector of a figure. In this way, learners are able to describe an object, convey measurements or produce a scale layout plan. Lastly, they ensure that their message is clear and appropriate for both the situation and the audience.

Essential Knowledge

All of the knowledge shown in the table below is compulsory since it is essential for dealing with a number of situations in the class *Representing the physical environment and its transformations.*

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 representing the physical environment and its transformations. In some cases, the knowledge outlined in this column is included with more general knowledge in the left-hand column. It is nonetheless listed in italics to make it easier to identify learners' previously acquired knowledge.

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Plans	**Plans**
• Ways of representing a scale on a plan	• *Scale on a map* • Alphanumerical coordinate system (on road maps and geographical maps)
• Determining the actual measurement of a length shown on a plan • Reading scale plans • Producing scale plans	• *Determining an actual distance from a map* • *Reading road maps and geographical maps*
Geometry of transformations	**Plane figures**
• Isometry • Symmetry • Congruent figures and similar figures • Properties of congruent and similar figures • Geometric transformations (dilatation, translation, reflection and rotation)	• Classifying triangles and quadrilaterals • Properties of simple figures (regular convex polygons and different types of triangles and quadrilaterals)

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Geometry of transformations (cont'd) • Constructing the image of a simple geometric figure under a dilatation or an isometry • Calculating the scale factor representing the ratio between the segment lengths of a figure and its image • Calculating the similarity ratio of two similar figures • Determining an angle or segment measurement in a figure based on the given measurements of a similar or congruent figure	**Plane figures (cont'd)** • Constructing simple figures (circles and polygons) • Breaking down a complex figure into simple figures • Using the formulas for perimeter and area (circle, square, rectangle, parallelogram, triangle, rhombus and trapezoid)
Solids • Breaking down a complex solid into simple solids • Possible nets of solids (cubes, right prisms, right cylinders)	**Solids** • Simple solids (cube, cone, right prism, right cylinder, right pyramid, sphere) • Using the formulas for volume, lateral area and total area (cube, cone, right prism, right cylinder, right pyramid, sphere)
Measurements • Units of measure of length, angles, area, capacity, volume, temperature and mass • Measuring and estimating length, angle size, area, capacity, mass and temperature • Estimating volume • Converting measurements from one system to another (e.g. centimetres to inches or cups to litres) • Converting from kilograms to pounds, and vice-versa	**Measurements** (international system only) • *Units of measure of length, angles, area, capacity, volume, temperature and mass* • *Measuring and estimating length, angle size, area, capacity, mass and temperature* • *Estimating volume* • *Converting from one measurement to another within the international system*

New compulsory knowledge	Compulsory knowledge acquired in previous courses
Arithmetic • Positioning rational numbers on the number line (to use measuring instruments in the Imperial system)	**Arithmetic** • *Positioning decimals on the number line (including negative numbers)* • Square root and cube root • Exponential notation using exponent 2 and exponent 3 • Comparing rational numbers • Representing rational numbers (using the base 10 number system and visual aids: blocks, illustrations, etc.) • Solving sequences of arithmetic operations on rational numbers • Making a mental estimate of the results of operations or sequences of operations on rational numbers • Representing relations using arithmetic models consisting of rational numbers **Proportional relationship** • Directly and inversely proportional relationships • Finding the unknown value in a proportional relationship

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	Curiosity
Adult learners with this attitude are accurate in taking measurements and producing representations of the physical environment and its transformations. They are able to estimate measurements, perform calculations correctly and check the plausibility of their results.	Adult learners with this attitude carefully observe the physical environment, its transformations or their representations in order to identify geometric figures and transformations and seek the information they need to improve their mental representations.

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
▪ Various kinds of companies (e.g. landscaping, construction, decorating) ▪ Museums ▪ Optical specialists	▪ Calculator ▪ Geometry instruments ▪ Sewing patterns ▪ Balance ▪ Instruments for measuring capacity (e.g. cup, spoon) ▪ Set of blocks to represent fractions ▪ Home renovation and decorating magazines ▪ Furniture assembly instructions ▪ Dynamic geometry software ▪ Image processing software ▪ Recipe books ▪ Works of art (e.g. paintings, sculptures) ▪ Optical instruments (e.g. mirror, microscope, telescope, binoculars) ▪ Cameras ▪ Plans (e.g. evacuation plans, layout plans) ▪ Road maps and geographical maps

Contribution of the Subject Areas

The contribution of other subject areas, in particular knowledge related to 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: Languages

Program of Study: *English, Language of Instruction*

- In many of the real-life situations addressed by this course, adult learners may be required to produce and interpret written and verbal descriptions. Consequently, a knowledge of the language of instruction will often be required throughout the course.

Subject Area: Mathematics, Science and Technology

Program of Study: *Computer Science*

- In some of the real-life situations addressed by this course, adult learners may need some knowledge of computers, for example when they use dynamic geometry software to view a layout, image processing software to enlarge pictures based on similarity ratios, or the Web to search for information on construction materials and plans.

Program of Study: *Technology*

- To deal with real-life situations involving construction, renovation, studies of production lines, the use of optical instruments and technical drawing, adult learners use concepts from the *Technology* program (e.g. types of materials, measuring devices, the characteristics of motion, mechanisms that transmit motion or bring about a change in motion, techniques for preparing schematic diagrams or construction drawings).

Program of Study: *Relationship With the Environment*

- When preparing a landscape design, adult learners may need to explore such matters as climate, survival conditions and plant species. Similarly, when describing their surroundings, they may need to refer to the different features of elements from the natural environment.

Program of Study: *Mathematics*

- In addition to the knowledge that is compulsory for the *Geometric Representations and Transformations* course, working with some real-life situations may require knowledge of mathematical content covered in other courses in the Common Core Basic Education Program. This is the case, for instance, when producing representations of three-dimensional figures or using the Pythagorean theorem to find the unknown length of a segment.

Andragogical Context

The *Geometric Representations and Transformations* course allows adult learners to deal with numerous everyday situations ranging from descriptions of the movement of objects to precise illustrations of layout plans. Adult learners will realize that what they have learned has improved their perception of the physical environment and its transformations, allowing them to produce clearer, more accurate representations in this regard. It is recommended that real objects be used in the classroom, so that adults are able to base their work on elements that are familiar to them.

Although the course focuses on geometry, it also builds on the arithmetic knowledge acquired in previous courses and in everyday life. If adult learners do not have the prerequisite knowledge they need (shown in the right-hand column of the Essential Knowledge table), the teacher will have to set aside time and assign simpler learning situations to allow them to construct this knowledge. In particular, learners will probably not be completely comfortable with fractional notation, even though it has been used in previous courses. If they are to deal with situations in the class *Representing the physical environment and its transformations*, they will need to consolidate their knowledge of the different types of ratios and the way they are expressed in fractional notation. They should be able to use this knowledge to represent scale factors, similarity ratios and portions of objects. They may also use it to indicate and calculate measurements in the Imperial system or portions of objects that provide a better description of the physical environment. This course therefore provides an excellent opportunity to ensure that adult learners are comfortable with fractional notation and the four operations on simple and improper fractions as well as mixed numbers.

Since the development of logical reasoning is at the heart of this course, the teacher should foster the ability of adult learners to infer the properties of similar or congruent figures. Learners will find it easier to make the required deductions in the case of unknown measurements in figures or objects if they themselves have inferred the properties of these figures, which serve as the basis for finding these measurements. If emphasis is placed on the meaning of geometric transformations rather than on the techniques for constructing these transformations, adults will also be able to deduce the transformations required to move an object from one position to another.

The ability to communicate should also play an important role in this course. Adult learners must be able to use the correct terms and mathematical models to illustrate or describe the physical environment, pattern repetitions, object movements, alterations to photographs and so on. In particular, the course should focus on the ability to understand and produce plans in accordance with the conventions of mathematical language, since this knowledge is essential in many real-life situations. Plans can be used to reinforce knowledge of other concepts covered in this course, such as proportional relationships and similarity.

The teacher draws on the real-life experience of learners in order to present them with plausible 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. Since some of the essential knowledge in this course is difficult to apply in everyday life (e.g. nets of solids, dilatations), the teacher should refer to various trades and products of technical work (e.g. technical drawing, architecture, mosaics, photography, optometry, component design and manufacturing). These fields are likely to be of interest to some of the learners in this course and are therefore an excellent means of placing this knowledge in context.

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

Rearranging a Room

The real-life situation chosen for the class *Representing the physical environment and its transformations* involves rearranging a room because of a change in the adult learner's life (e.g. departure of a roommate, birth of a child, organization of a home office, purchase of new furniture). In the related learning situation, learners are asked to select a location that could be rearranged (e.g. a bedroom, living room, classroom). They then produce a scale plan of the room and its furniture, and accurately describe the changes they want to make, using isometries.

The first step is to select the room. Adult learners then produce the scale plan of the room and furniture. This allows them to consolidate their knowledge of plans, which have already been studied in this course. They then take the necessary measurements and draw a precise plan, clearly showing the scale. The teacher decides on the duration of this learning activity in light of the work to be done at home (i.e. taking measurements).

The next learning activity takes place in the classroom. The teacher moves an object around, asking adult learners to describe each movement and explaining the concepts related to isometry (reflection, rotation and translation). He/she then asks learners to associate isometric transformations with examples from everyday life (e.g. the movement of the hands on a clock, rotation of a globe, pressing the keys of a computer keyboard) in order to check their comprehension. Working alone, each learner can look at these concepts in more depth by answering a set of questions on the association of movements with isometries.

Adult learners then decide on the changes they wish to make to the positioning of the furniture in their room. The teacher asks them to close their eyes and visualize these changes. By doing this, they anticipate the results of moving the furniture around and take into account any constraints such as the location of windows and the aesthetic effect. They then deduce the isometries that correspond to these changes and describe them in writing. They must also ensure that their description refers to at least one translation and one rotation (reflections are not relevant in this case).

Addressing the whole class, the teacher demonstrates the exact techniques used to construct isometries. Learners perform a number of isometric constructions to ensure that they have understood these techniques, and then apply them to their existing plan by constructing two of the isometries they have determined (one rotation and one translation).

At the end of this learning activity, adult learners form teams of two and exchange their descriptions with their partner. Each learner then makes a drawing based on his/her partner's description. The teacher reminds them of the importance of forming a clear mental picture of what they want to illustrate before beginning to draw. Partners then compare their written descriptions with the drawings, and change either the text or the drawing, as necessary, to ensure that they correspond.

To conclude the learning situation, the teacher hands out a self-evaluation questionnaire to make sure that learners used the appropriate mathematical language (e.g. accurate measurements, centre of rotation and scale clearly indicated) when producing their plans, texts and isometries.

Elements of the Course Addressed by the Learning Situation

Class of Situations	
Representing the physical environment and its transformations	
Learning Situation	
Rearranging a Room	
Categories of Actions	
▪ Forming perceptions of the physical environment and its transformations ▪ Producing representations of the physical environment and its transformations ▪ Determining measurements and ratios	
Operational Competencies	**Essential Knowledge**
▪ Thinks logically ▪ Communicates	▪ Scale ▪ Ways of representing a scale on a plan ▪ Producing scale plans ▪ Isometry ▪ Geometric transformations ▪ Constructing the image of a simple geometric figure under an isometry ▪ Units of measure of length and angles ▪ Measuring and estimating length and angle size
Complementary Resources	
▪ Geometry instruments ▪ Home renovation and decorating magazines	▪ Calculator