

# DEFINITION OF THE EVALUATION DOMAIN

Adult General Education

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Diversified Basic Education Program

Science and Technology

THE ENERGY CHALLENGE

TSC-4061-2

August 2015

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## Introduction

The Definition of the Evaluation Domain (DED) ensures consistency between a course and the related evaluation instruments. The DED is used to select, organize and describe the essential and representative elements of the course. The DED is based on the program of study and the course, but should by no means replace them in the planning of instructional activities.

All the DEDs produced after June 30, 2014, by the Ministère de l'Éducation, de l'Enseignement supérieur et de la Recherche (MEESR) are prescriptive. Consequently, they are the reference documents to be used in the development of all examinations, be they ministerial or those developed by adult education centres or by Société GRICS (BIM). The DEDs thus serve as a model for preparing multiple equivalent versions of examinations that are valid across the province.<sup>1</sup>

In addition, as set out in the *Policy on the Evaluation of Learning*, adult learners must know what they will be evaluated on and what is expected of them.<sup>2</sup> The DEDs and the criterion-referenced rubrics (contained in the evaluation instruments) may be used for this purpose.

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<sup>1</sup> Québec, Ministère de l'Éducation du Québec, *Policy on the Evaluation of Learning* (Québec: Gouvernement du Québec, 2003), 47.

<sup>2</sup> *Ibid.*, 9.

## Evaluation Content

General Information			
<p><b>Broad Areas of Learning</b></p> <ul style="list-style-type: none"> <li>• Health and Well-Being</li> <li>• Career Planning and Entrepreneurship</li> <li>• Environmental Awareness and Consumer Rights and Responsibilities</li> <li>• Media Literacy</li> <li>• Citizenship and Community Life</li> </ul> <p><b>Subject Area</b></p> <ul style="list-style-type: none"> <li>• Mathematics, Science and Technology</li> </ul> <p><b>Families of Situations</b></p> <ul style="list-style-type: none"> <li>• Research</li> <li>• Expertise</li> </ul>	<p><b>Program of Study</b></p> <ul style="list-style-type: none"> <li>• Science and Technology</li> </ul> <p><b>Course</b></p> <ul style="list-style-type: none"> <li>• The Energy Challenge</li> </ul>		
Essential Elements Targeted by the Evaluation			
<p><b>Subject-Specific Competencies</b></p> <ol style="list-style-type: none"> <li>1. Seeks answers or solutions to scientific or technological problems</li> <li>2. Makes the most of his or her knowledge of science and technology</li> <li>3. Communicates in the languages used in science and technology</li> </ol>	<p><b>Categories of Knowledge</b></p> <table style="width: 100%; border: none;"> <tr> <td style="vertical-align: top; width: 50%;"> <p><b>General Concepts:</b></p> <ul style="list-style-type: none"> <li>• Graphical language</li> <li>• Electrical engineering</li> <li>• Electricity</li> <li>• Electromagnetism</li> <li>• Transformation of energy</li> <li>• Organization of matter</li> <li>• Lithosphere, hydrosphere, atmosphere and space</li> </ul> </td> <td style="vertical-align: top; width: 50%;"> <p><b>Techniques:</b></p> <ul style="list-style-type: none"> <li>• Graphical language</li> <li>• Manufacturing</li> <li>• Measurement</li> </ul> </td> </tr> </table>	<p><b>General Concepts:</b></p> <ul style="list-style-type: none"> <li>• Graphical language</li> <li>• Electrical engineering</li> <li>• Electricity</li> <li>• Electromagnetism</li> <li>• Transformation of energy</li> <li>• Organization of matter</li> <li>• Lithosphere, hydrosphere, atmosphere and space</li> </ul>	<p><b>Techniques:</b></p> <ul style="list-style-type: none"> <li>• Graphical language</li> <li>• Manufacturing</li> <li>• Measurement</li> </ul>
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Evaluation Criteria			
<p><b>Evaluation Criteria for Competencies 1 and 3</b></p> <ol style="list-style-type: none"> <li>1.1 Appropriate representation of the situation</li> <li>1.2 Development of a suitable plan of action</li> <li>1.3 Appropriate implementation of the plan of action</li> <li>1.4 Development of relevant explanations, solutions or conclusions</li> </ol> <p><b>Evaluation Criteria for Competencies 2 and 3</b></p> <ol style="list-style-type: none"> <li>2.1 Appropriate interpretation of the issue</li> <li>2.2 Relevant use of scientific and technological knowledge</li> <li>2.3 Appropriate formulation of explanations or solutions</li> </ol>	<p><b>Proficiency in Subject-Specific Knowledge</b></p> <p>Proficiency in subject-specific knowledge presupposes its acquisition, understanding, application and mobilization, and is therefore linked with the evaluation criteria for the competencies.</p>		

## Explanation of the Evaluation Content

### Evaluation Criteria

The evaluation criteria are stated exactly as in the course, except for Criterion 2.1, which is based on Competencies 2 and 3.

Competency 3 is not specifically evaluated. It is integrated into the other two competencies in evaluation situations designed for certification purposes. The evaluation criteria relating to it are based upon the criteria for the first two competencies in the *Framework for the Evaluation of Learning* in general education in the youth sector.

### Information Clarifying the Evaluation Criteria

#### 1.1 Appropriate representation of the situation

This criterion evaluates the adult learner's ability to restate the characteristics of the problem to be solved or the need to be met in his or her own words, and to break it down into steps in order to identify the principles of electricity or electromagnetism to consider in developing a possible solution.

#### 1.2 Development of a suitable plan of action

This criterion evaluates the adult learner's ability to develop an organized plan of action in order to satisfy a need, to develop an electrical circuit diagram and to determine the necessary assembly techniques and the necessary electrical, magnetic or electronic components. It also evaluates the adult learner's ability to explain the operation of the electrical circuit or device he or she has designed and to specify the role of each component.

#### 1.3 Appropriate implementation of the plan of action

This criterion evaluates the adult learner's ability to safely assemble an electrical circuit, taking into account the characteristics of the electrical, magnetic or electronic components used and the way in which they are connected. It also evaluates the adult learner's ability to make the necessary adjustments.

#### 1.4 Development of relevant explanations, solutions or conclusions

This criterion evaluates the adult learner's ability to verify the compliance of an electrical circuit with specifications by taking the appropriate measurements, justifying any changes made to the circuit and, if the circuit is not functional, proposing changes to the plan of action. It also evaluates the adult learner's ability to use scientific terminology, rules and conventions, as well as mathematical symbolism and formalism, if needed.

#### 2.1 Appropriate interpretation of the issue

This criterion evaluates the adult learner's ability to identify the relevant elements of the problem, the connections between them, and the issues arising from the use of energy resources. It also evaluates the adult learner's ability to recognize the operating principles of the electrical devices involved.

#### 2.2 Relevant use of scientific and technological knowledge

This criterion evaluates the adult learner's ability to use scientific and technological concepts, laws, theories or models to explain the environmental impact of the use of energy resources to produce electricity. It also measures the adult learner's ability to interpret an electrical circuit, explain the role of each electrical, magnetic and electronic component or the operation of a device and, as needed, use calculations to support his or her explanations.

### 2.3 Appropriate formulation of explanations or solutions

This criterion evaluates the adult learner's ability to explain the operation of electrical devices, make an informed judgment on an energy issue concerning the production or use of electricity, or propose a solution aimed at satisfying a need and justify his or her judgment or solution based on his or her scientific and technological knowledge. It also evaluates the adult learner's ability to use scientific terminology, rules and conventions, as well as mathematical symbolism and formalism, if needed.

### Proficiency in Subject-Specific Knowledge

Proficiency in subject-specific knowledge is assessed through the evaluation of competencies, using tasks related to the evaluation criteria.

For this course, certain knowledge is explicitly evaluated. The following measurable cognitive skills were selected for evaluation.

#### Skills

- Knows
  - Provides evidence of knowledge of manifestations or components of a scientific or technical reality  
E.g. defines, describes, distinguishes, associates, names, chooses, connects
- Understands
  - Uses elements of prior learning and draws information from them  
E.g. explains, combines, discusses, justifies, demonstrates
- Applies
  - Uses a scientific or technological model or principle to establish information  
E.g. uses, represents, applies, determines, calculates

### Weighting

The weighting for the evaluation of the competencies is determined in accordance with the *Framework for the Evaluation of Learning* in general education in the youth sector.

Competency 1, *Seeks answers or solutions to scientific or technological problems*, and Competency 3, *Communicates in the languages used in science and technology*: 40%

Competency 2, *Makes the most of his or her knowledge of science and technology*, and Competency 3, *Communicates in the languages used in science and technology*: 40%

The weighting corresponding to the knowledge that is explicitly evaluated is 20%.

The weighting of the evaluation criteria appears in the assessment tools provided in the *Correction and Evaluation Guide*. Adult learners must be made aware of the evaluation criteria used to evaluate them and the corresponding weighting of each criterion.

## Knowledge

Knowledge includes concepts and techniques.

The seven<sup>3</sup> general concepts and the three categories of techniques are covered in the examination. It is not necessary, however, to include all the compulsory concepts for a given general concept.

For the knowledge targeted by the evaluation of the competencies:

- Five to seven general concepts must be covered. For these general concepts, a representative sample of the compulsory concepts must be covered.
- The three categories of techniques must be covered. For these three categories, all techniques must be covered.

For the knowledge targeted by explicit evaluation:

- Four to six general concepts must be covered, including those not covered in the evaluation of competencies. For these general concepts, priority is given to compulsory concepts that were not covered in the evaluation of competencies.

### Concepts

General Concepts	Compulsory Concepts
Graphical language	<ul style="list-style-type: none"> <li>▪ Standards and representations: diagrams and symbols</li> </ul>
Electrical engineering	<ul style="list-style-type: none"> <li>▪ Power supply</li> <li>▪ Conduction, insulation and protection (resistance and colour code, printed circuit)</li> <li>▪ Control (lever, pushbutton, toggle, unipolar, bipolar, unidirectional, bidirectional)</li> <li>▪ Transformation of energy (electricity and light, heat, vibration, magnetism)</li> <li>▪ Other functions (capacitor, diode, transistor, relay)</li> </ul>
Organization of matter	<ul style="list-style-type: none"> <li>▪ Periodic table: metals, nonmetals and metalloids</li> <li>▪ Rutherford atomic model</li> <li>▪ Subatomic particles</li> </ul>
Electricity	<ul style="list-style-type: none"> <li>▪ Electrical charge</li> <li>▪ Static electricity</li> <li>▪ Electrical circuits</li> <li>▪ Ohm's law</li> <li>▪ Kirchhoff's laws</li> <li>▪ Relationship between power and electrical energy</li> <li>▪ Coulomb's law</li> <li>▪ Electrical field</li> </ul>
Electromagnetism	<ul style="list-style-type: none"> <li>▪ Forces of attraction and repulsion</li> <li>▪ Magnetic field of a live wire</li> <li>▪ Electromagnetic induction</li> <li>▪ Magnetic field of a solenoid</li> </ul>

<sup>3</sup> The last four general concepts of the program (lithosphere, hydrosphere, atmosphere and space) have been grouped together into a single general concept, since there are very few related compulsory concepts.

Transformation of energy	<ul style="list-style-type: none"> <li>▪ Law of conservation of energy</li> <li>▪ Energy efficiency</li> <li>▪ Distinction between heat and temperature</li> </ul>
Lithosphere, hydrosphere, atmosphere and space	<ul style="list-style-type: none"> <li>▪ Minerals</li> <li>▪ Energy resources</li> <li>▪ Solar energy flow</li> <li>▪ Earth-Moon system (gravitational effect)</li> </ul>

### Techniques

Categories of Techniques	Techniques
Graphical language	<ul style="list-style-type: none"> <li>▪ Drawing schematic diagrams</li> </ul>
Manufacturing	<ul style="list-style-type: none"> <li>▪ Safely using machines and tools</li> <li>▪ Assembling and disassembling</li> </ul>
Measurement	<ul style="list-style-type: none"> <li>▪ Using measuring instruments</li> </ul>



## Specifications for the Evaluation Instruments

### Examination: Number of Parts, Sections, Procedure and Duration

The examination consists of two parts that must be administered during different evaluation sessions. Adult learners are responsible for managing the time available to them, which is 120 minutes for each part.

Total duration: 240 minutes

Practical part\*: Evaluation of Competencies 1 and 3  
Duration: 120 minutes

Theory part: Evaluation of Competencies 2 and 3, and Knowledge that is explicitly evaluated  
Duration: 120 minutes

\* All competency evaluation sessions for the practical part are carried out in a workshop, laboratory or other appropriate location.

### Examination Content

Practical part:

This part involves a situation from the *Research* family of situations designed to evaluate the development of Competencies 1 and 3 using Criteria 1.1, 1.2, 1.3 and 1.4. Adult learners must solve a problem by designing a device to produce or use electrical energy, using a procedure that involves modelling (drawing schematic diagrams) and assembling the electrical circuit for the device. The compliance of the electrical circuit with the specifications will be verified by at least one measurement using a multimeter.

Theory part:

This part has two sections. One section is designed to evaluate the development of Competencies 2 and 3 using Criteria 2.1, 2.2 and 2.3. Adult learners examine one to three situations from the *Expertise* family of situations involving a problem related to the use of energy resources and electricity. The problems inherent in these situations require that the adult learner provide explanations, take a position, justify that position, critique specifications, consider the environmental impact, etc. The other section is designed for the explicit evaluation of certain knowledge.

### Information-Gathering Tools

Evaluation of competencies

Practical part:

- The adult learner designs an object in a workshop, laboratory or other appropriate location.

Theory part:

- The adult learner examines one to three problems.

Explicit evaluation of knowledge in the theory part:

- The adult learner answers short- or long-answer questions.

## Authorized Materials

For the two parts of the examination:

- List of standard symbols
- List of formulas
- Additional blank sheets of paper
- Ordinary or scientific calculator

Information about the calculator:

- The data and programs stored in the calculator's memory must be erased before and after the examination. Before the day of the examination, adult learners must have been given the opportunity to learn how to reset their calculator's memory to zero.

For the practical part of the examination:

- Laboratory materials and equipment required for the design
- Computer, if necessary

## Assessment Tools

The assessment tool for the evaluation of competencies is the criterion-referenced rubric. Criterion-referenced interpretation involves comparing the information gathered with the expected outcomes.<sup>4</sup> The rubrics are appended to the *Correction and Evaluation Guide* and include the following rating scale:

- Excellent
- Very good
- Good
- Weak
- Very weak

Checklists are also provided to make the task easier. These checklists can be found in the *Correction and Evaluation Guide*.

Each checklist and rubric focuses on the evaluation of specific competencies:

- checklist and rubric for the evaluation of Competencies 1 and 3, practical part
- checklist and rubric for the evaluation of Competencies 2 and 3, theory part

For the explicit evaluation of knowledge in the theory part, a correction key is provided in the *Correction and Evaluation Guide*.

## Pass Mark

The pass mark is 60% for the examination as a whole.

## Retakes

The adult learner must retake each part (practical or theory) of the examination separately.

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<sup>4</sup> Québec, Ministère de l'Éducation du Québec, *Policy on the Evaluation of Learning* (Québec: Gouvernement du Québec, 2003), 28-29.

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