DEFINITION OF THE EVALUATION DOMAIN

Adult General Education

Diversified Basic Education Program

Science and Technology

MECHANIZATION OF WORK TSC-4063-2

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Québec

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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.[1]

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.[2] The DEDs and the criterion-referenced rubrics (contained in the evaluation instruments) may be used for this purpose.

[1] Québec, Ministère de l'Éducation du Québec, *Policy on the Evaluation of Learning* (Québec: Gouvernement du Québec, 2003), 47.

[2] Ibid., 9.

Evaluation Content

General Information

Broad Areas of Learning

- Health and Well-Being
- Environmental Awareness and Consumer Rights and Responsibilities
- Career Planning and Entrepreneurship
- Media Literacy
- Citizenship and Community Life

Subject Area

- Mathematics, Science and Technology

Families of Situations

- Research
- Expertise

Program of Study

- Environmental Science and Technology

Course

- Mechanization of Work

Essential Elements Targeted by the Evaluation

Subject-Specific Competencies

1. Seeks answers or solutions to scientific or technological problems
2. Makes the most of his or her knowledge of science and technology
3. Communicates in the languages used in science and technology

Categories of Knowledge

General Concepts:

- Graphical language
- Mechanical engineering
- Materials
- Manufacturing
- Force and motion
- Fluids

Techniques:

- Graphical language
- Manufacturing
- Measurement

Evaluation Criteria

Evaluation Criteria for Competencies 1 and 3

1.1 Appropriate representation of the situation
1.2 Development of a suitable plan of action
1.3 Appropriate implementation of the plan of action
1.4 Development of relevant explanations, solutions or conclusions

Evaluation Criteria for Competencies 2 and 3

2.1 Accurate interpretation of the problem
2.2 Relevant use of scientific and technological knowledge
2.3 Appropriate formulation of explanations or solutions

Proficiency in Subject-Specific Knowledge

Proficiency in subject-specific knowledge presupposes its acquisition, understanding, application and mobilization, and is therefore linked with the evaluation criteria for the competencies.

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 draw a design plan. It also evaluates the adult learner's ability to describe the operation of the technological application based on the solution chosen.

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 produce the technical diagram for the prototype, to draw orthogonal projections with measurements or to draw the development of a simple shape. It also evaluates the adult learner's ability to determine the operations, manual or machine tools and machining characteristics, as well as the manufacturing techniques to be used, as they would in a manufacturing process sheet.

1.3 Appropriate implementation of the plan of action

This criterion evaluates the adult learner's ability to safely construct a prototype, taking the machining characteristics into account when using the chosen techniques. It also evaluates the adult learner's ability to control the quality of parts and their movement and 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 a part with specifications, justify any changes made to the prototype in an effort to solve problems encountered during its inspection or simply to make it better. 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 Accurate interpretation of the problem

This criterion evaluates the adult learner's ability to analyze diagrams, drawings and illustrations representing technological applications. It also evaluates the adult learner's ability to recognize the constraints to which materials are subject, the degree of freedom of the moving parts and the principles related to fluids, types of motion or speed changes needed for the applications to work properly.

2.2 Relevant use of scientific and technological knowledge

This criterion evaluates the adult learner's ability to use concepts, laws, theories or models related to technological applications in order to explain how they work and identify the role of each component. It also evaluates the adult learner's ability to determine the characteristics of materials and the desired degree of freedom of moving parts 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 how a technological device works, justify his or her choice of mechanical functions or materials used to make the application's movable parts and, if applicable, suggest improvements. 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 six 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. Similarly, it is not necessary to include all the techniques for a given category of techniques.

For the knowledge targeted by the evaluation of the competencies:

- Four to six 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, at least six of the techniques must be covered, including safely using machines and tools.

For the knowledge targeted by explicit evaluation:

- Three to five 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	• Axonometric projection • Multiview orthogonal projection • Functional dimensioning • Developments • Standards and representations
Mechanical engineering	• Typical functions • Guiding controls • Mechanical links • Freedom of movement of a part • Adhesion and friction of parts • Construction and characteristics of motion transmission systems • Construction and characteristics of motion transformation systems • Resisting torque, engine torque
Materials	• Characteristics of mechanical properties • Constraints: deflection, shearing • Types and properties: plastics, ceramics, composites • Heat treatments • Modification of properties
Manufacturing	• Characteristics of laying out • Machining • Measurement and inspection

General Concepts	Compulsory Concepts
Force and motion	• Force • Types of forces • Equilibrium of two forces • Relationship between constant speed, distance and time • Relationship between mass and weight
Fluids	• Archimedes' principle • Pascal's law • Bernoulli's principle

Techniques

Categories of Techniques	Techniques
Graphical language	• Producing a graphic representation using instruments • Drawing schematic diagrams • Using vector graphic software
Manufacturing	• Safely using machines and tools • Machining • Finishing • Performing verification and control tasks • Making a part
Measurement	• Using measuring instruments • Checking the reliability, accuracy and sensitivity of measuring instruments

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 180 minutes for the practical part and 120 minutes for the theory part.

Total duration: 300 minutes

Practical part*: Evaluation of Competencies 1 and 3
Duration: 180 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, machine shop 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 mechanism that reflects certain physical principles, which they do by making a technical drawing, developing specifications and making a prototype or part of a prototype. Adult learners must have access to basic manual or machine tools, such as a drill press.

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 in which they analyze a technology in order to identify the physical principles inherent in its construction and operation. Their analysis must include an evaluation of the materials and mechanical functions used. The other section is designed for the explicit evaluation of certain knowledge.

Information-Gathering Tools

Evaluation of competencies

Practical part:

- The adult learner designs and makes an object in a workshop, machine shop or other appropriate location.

Theory part:

- The adult learner analyzes one to three technologies.

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
- 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:

- Machine tools, manual tools and the materials needed to make the prototype

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.[3] 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.

[3] Québec, Ministère de l'Éducation du Québec, *Policy on the Evaluation of Learning* (Québec: Gouvernement du Québec, 2003), 28-29.

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