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# UNIT 6 COMPETENCY-BASED EVALUATION IN MATHEMATICS

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## 6.1 INTRODUCTION

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Evaluation is a process of finding the strengths and/or weaknesses of any activity. Educational evaluation helps in ascertaining the strengths and/or weaknesses of the learners. Evaluation helps in knowing the extent to which the objectives or predetermined competencies have been achieved and how far the learning experiences have been effective. Educational evaluation is therefore considered to be an integral part of the teaching-learning process.

The teaching-learning process is organized with a view to effecting the desired changes in the behaviour of the learners. If we have a set of predetermined competencies to be developed among children and organize teaching-learning to realize these targets, we would be practising competency-based teaching-learning. Similarly the process of evaluation which is focussed on the development of a set of predetermined competencies by the learners is known as competency-based evaluation. Before undertaking an evaluation exercise one must know: what to evaluate, when to evaluate, and how to evaluate. In this unit you will find answers to these questions in reference to competency-based evaluation in mathematics.

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## 6.2 OBJECTIVES

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After going through this unit, you should be able to:

- discuss the meaning of competency and the nature of evaluation;
- explain the concept of competency-based evaluation;
- prepare competency-based test items; and
- make use of competency-based evaluation in mathematics.

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## 6.3 MEANING OF COMPETENCY

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According to Webster's *Third New International Dictionary*, the word competency means the quality or state of being functionally adequate or of having sufficient knowledge, judgement, skills or strength, i.e., the range of ability or capability.

If a person can do some assigned work successfully we consider him to be competent for that work. Therefore, competence or competency refers to a person's capability to accomplish successfully the given task. The task may be further defined clearly either in terms of certain processes or products which may of course require knowledge and understanding of certain facts/principles, skills, application of knowledge, habits, attitudes etc. Thus every statement of competency would comprise two things: (a) the nature of the task or content and (b) a statement of the expected performance. For example, in a statement of competency "The learner recognizes numerals for numbers 1 to 9", the nature of the task or content is, numerals for numbers 1 to 9 and the statement of the performance is, the learner recognises."

**Check Your Progress**

Notes: a) Write your answers in the space given below.

b) Compare your answer with the one given at the end of this unit.

1. What is the focus of the competency-based teaching-learning process?

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2. What does competency refer to?

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**6.4. NATURE OF EVALUATION IN EDUCATION**

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Educational evaluation is a process of passing judgements on the achievement of pupils in various field of activity. It provides answers to two questions, namely, how much? and what value? It, therefore presents a qualitative measure along with the necessary quantification. Educational evaluation conducted at the primary stage is of two kinds (a) Formative and (b) Summative. These are explained below:

**a) Formative Evaluation**

Formative evaluation goes on with the process of teaching-learning as the child moves ahead. It provides assessment from time to time of the learners' progress. This information is generally used to diagnose the learning difficulties experienced by the children and arranging for remedial teaching.

**b) Summative Evaluation**

Summative evaluation is conducted at the end of a course for taking certain decisions such as assigning of grades, promotion of learners to the next class, comparison of the performance of learners/schools etc.

**Check Your Progress**

Notes: a) Write your answers in the space given below

b) Compare your answer with the one given at the end of this unit.

3. What is formative evaluation ?

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**6.5 COMPETENCY-BASED EVALUATION**

In competency-based evaluation, statement of competencies are given greater significance. All activities pertaining to evaluation are guided by them. The criterion for judging the appropriateness of a test item under competency-based evaluation is whether or not it successfully provides a means to evaluate the given competency. For example, if you want to evaluate the competency stated as "Learner recognizes numerals for numbers 1 to 9" in class I, the following steps would need to be taken :

**Activity 1**

- i) Write numerals 4, 7, 2, 9, 3, 1, 8, 6, 5 on the blackboard.
- ii) Place some objects like pencils, chalk sticks, bottle caps etc. on the table.
- iii) Ask the learners, one by one, to look at a particular numeral, recognize it and pick up as many objects from the table, as are represented by the numeral.
- iv) Repeat these activities taking different objects with different students.

**Activity 2**

- i) Place on one side of table flash cards with numerals for numbers 1 to 9 written on them.
- ii) Place on the other side of the table other flash cards on which sets of objects for 1 to 9 are drawn.
- iii) Ask the learners, one by one, to pick up a flash card of particular numeral and also pick up a matching card of collection of objects.
- iv) Repeat these activities taking different flash cards with different students.

In the above mentioned situation, if a child recognizes all or almost all numerals for numbers 1 to 9, we may presume that he/she has acquired this competency at the level of mastery. The obtained evaluation results are recorded on an evaluation sheet of the following type:

**Competency-Based Evaluation Sheet**

Subject : Mathematics    Class : I/II/III/IV/V

Name of the school : .....

S.No.	Name of the Learner	Competency No.
		Q.No.    1   2   3   4 .....

Separate sheets are used to record the results of oral and written examinations. Sometimes a particular competency may be evaluated through a main question having 3 or 4 sub-questions. In such cases, the evaluator is required to put a tick (✓) mark if the child gives correct responses to two out of three or three out of four questions. In other cases, more than one question may be required to evaluate a particular competency.

Further, it may be noted that since the aim of competency-based teaching-learning is to help children to acquire the stated competencies at the level of mastery, the desired level of performance in the mastery learning approach happens to be 80 per cent (ideally it should be 100 per cent). In the same way competency-based evaluation aims at ascertaining the extent of mastery acquired by children with regard to a given competency. Ideally speaking, it calls for generating an infinite number of items (test questions), but in practice 3 to 5 questions (items) per competency are considered sufficient. Due care needs to be taken while developing items for tests to be used under competency-based evaluation.

### Check Your Progress

Notes: a) Write your answers in the space given below.

b) Compare your answer with the one given at the end of this unit.

4. Which is the most significant aspect of competency-based evaluation?

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A sound competency-based evaluation programme should incorporate the following:

- a) Continuous informal evaluation integrated with teaching-learning process
- b) Periodical evaluation in terms of unit testing with a view to improving performance until it reaches the mastery level
- c) Summative evaluation for comparing the achievements of children as against the laid down standards of performance in the proposed competencies, and
- d) Provision for pre-testing and post-testing of performance in the beginning and at the end of the year.

### 6.5.1 Main Features of Competency-Based Evaluation

As the name suggests, competency occupies a very important place in competency-based evaluation, i.e., the nature/type of activities and process of evaluation as such is planned keeping in view the competency under reference. For example, if the competency comprises learning outcomes related to oral, written or both types in the given subject, the evaluation will follow the same pattern. Here all aspects of the competency are evaluated through reasonable number of test items/questions required. Children are provided with the needed time to respond to the questions. The results of such an evaluation may be interpreted to highlight the performance of individual pupils in various competencies and to obtain meaningful information which may be helpful in the planning and execution of diagnostic and remedial teaching. The main merits of competency-based evaluation are summarized below:

- i) It is helpful in determining which of the specific competencies particular child has attained.

- ii) Listing the competencies which were or were not attained by pupils.
- iii) Classifying children in terms of masters, partial masters and non-masters with regard to the stated competencies.
- iv) Evaluating all aspects of a competency through a reasonably large numbers of items/test questions.
- v) Eliminating chance errors which are likely to influence the results.
- vi) Devising proper strategies for teaching-learning.
- vii) Ensuring a systematic procedure for the instructional process and evaluation.
- viii) Providing sufficient guidance for planning diagnostic and remedial teaching for individuals or groups of individuals.

### 6.5.2 Preparation of Competency-Based Test Items : Some Considerations

Let us consider some important points, which we may keep in mind while preparing Competency-Based (C.B.) test items:

- a) The specifications of the competency must be stated in very clear and precise terms;
- b) Four to five questions are to be prepared for each competency;
- c) Competency-based test items may be of three types:
  - i) Oral
  - ii) Activity-based
  - iii) Written
- d) The language of the test items must be very clear and simple;
- e) Activities chosen for evaluation must be drawn from the immediate environment of the learners;
- f) All competencies must be covered.

### Achievability of Competency

A competency is presumed to have been achieved at mastery level when all the learners respond correctly to almost all the questions, i.e., to at least three out of four questions related to a particular competency. It has been partially achieved if they respond correctly to two out of four questions and has not been achieved if they respond correctly to less than two questions.

### 6.5.3 Developing Items for Competency-Based Evaluation

Developing test items for a competency-based evaluation is an important task which requires a lot of thinking around the competency to decide about the type of evaluation and then developing the test item itself.

Let us take the following examples to understand the process of developing competency-based test items.

**Example 1 Competency :** The learner recognizes and classifies solid objects in the environment with their geometrical names (cuboid, sphere, cube, cone, cylinder).

*Type of Evaluation :* Activity-based.

**Material Required :** Book, notebook, pipe, match-box, chalk box, ball, top, wire, pencil, joker's cap, ice cream cone etc.

**Test Item :** Show the above-mentioned solids one by one and write their names at the appropriate place under the following headings:

Sphere                  Cuboid                  Cube                  Cone                  Cylinder



Ball

**Example 2 Competency :** The learner converts the fractions to percentages and vice-versa. **Type of Evaluation :** Written.

**Test Items :** 1) Express the following as a per cent:

- a)  $\frac{1}{2}$  (.....%)                  b) 1 (.....%)  
c)  $\frac{1}{4}$  (.....%)                  d)  $\frac{3}{2}$  (.....%)

2. Express the following as a fraction:

- a) 12% (                  )                  b) 100% (                  )  
c) 15% (                  )                  d) 1% (                  )

**Example 3 Competency :** The learner finds the per cent of a given number of measure.

**Type of Evaluation :** Written.

**Test Item :** Write the value against each of the following :

- a) 25% of 350 (                  )  
b) 20% of 30.5 kg (                  )  
c) 125% of 1000 litres (                  )  
d)  $12\frac{1}{2}\%$  of Rs. 400 (                  )

**Example 4 Competency :** The learner solves problems involving simple fractions.

**Type of Evaluation :** Written

**Test Item :** 1) Mr. Kanwar gave  $\frac{1}{3}$  of his property to his son,  $\frac{1}{3}$  to his daughter and the remaining to his wife. What part of the property did he give to his wife ?

2) Mahesh has got Rs. 120/-. He gave  $\frac{2}{3}$  of this money to his friend. How much money is left with him ?

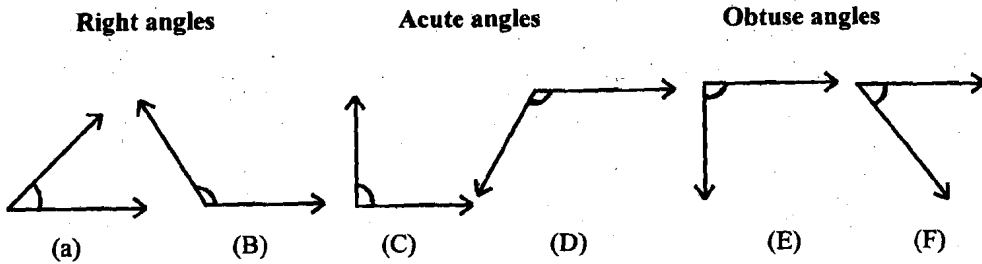
3) A shopkeeper has got 63 fans. Two-seventh of this lot was sold to another shopkeeper and  $\frac{3}{7}$  to customers. The shopkeeper is left with how many fans ?

**Example 5 Competency :** The learner recognizes different type of angles from the different objects in the environment.

**Type of Evaluation :** Activity-based

**Material Required :** Cardboard pieces with different types of angles drawn, watch/alarm time pieces (figures), matchsticks forming angles.

**Test Item :** Classify the following into right angles, acute angles and obtuse angles. Write down the alphabet associated with the figure under the proper heading:



**Example 6 Competency :** The learner writes the multiples of a given number.

*Type of Evaluation :* Written

*Test Items :* 1) Put a tick mark (✓) against the multiples of 4 from the following:

86, 218, 724, 156, 66, 108, 1832

2) Write the next four numbers in the series

21, 28, 35 .....

3) Write the first 4 multiples of 8

.....

**Example 7 Competency :** The learner calculates the L.C.M. of two or three given numbers.

*Type of Evaluation :* Written

*Test Items :* Calculate the L.C.M. of :

1) 48, 56

2) 22, 66

3) 18, 42, 84

4) 21, 77, 143

**Example 8 Competency :** The learner calculates the H.C.F. of two or three given numbers.

*Type of Evaluation :* Written

*Test Items :* Calculate the H.C.F. of the following :

1) 13, 39

2) 18, 42

3) 6, 16, 24

4) 14, 28, 63

**Example 9 Competency.** The learner understands the relationships between different units of length, weight and capacity.

*Type of Evaluation :* Oral

*Test Items :* Which is more ?

1) 1/2 kg or 300 g

2) 1-1/2 kg or 1300 g

3) 700 m or 1 km

4) 1200 ml or 1-1/2 l

**Example 10 Competency :** The learner understands the ordering of decimals.

*Type of Evaluation :* Written

*Test Items :* Write the following decimals in ascending order:

1) 0.01, 1.01, .001, 0.0001, 1.001

2) 0.9, 1.0, 0.09, 0.99, 0.909

3) .11, .01, .001, 1.1, .011

4) 0.7, 0.69, 0.71, 7.7, 7.0

**Example 11 Competency :** The learner writes the place value of a digit in a decimal numeral.

*Type of Evaluation :* Written

*Test Items :* Write the place value of the digits underlined in the following decimals:

i) 4.004      ii) .3545      iii) 0.0097

**Example 12 Competency :** The learner selects different types of fractions.

*Type of Evaluation :* Oral

*Test Items :* Sort out the proper fractions from the following :

$12/7, 1/7, 7/7, 5/7, 3/5, 8/7, 2/1$

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## 6.6 LET US SUM UP

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Development of competencies is the focus of the teaching-learning process. Evaluation also has to be based on competencies. We have discussed the meaning, concept and process of competency-based evaluation in mathematics. We have drawn examples from different content areas to illustrate the development of the test items for competency-based evaluation. You must have good practice in preparing competency-based test items. So take up various competencies prescribed in mathematics for Classes I to V and try to develop test items based on them.

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## 6.7 UNIT-END EXERCISES

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1. Explain the meaning of competency and discuss competency-based evaluation in mathematics.
2. You might be doing evaluation while teaching. How do you find competency-based evaluation different from evaluation in general ?
3. Explain with examples how competency-based evaluation can help in improving the quality of learning.
4. Prepare four competency-based test items for evaluation each one of the following competencies.

*Competency No. 1 :* The learner subtracts a two-digit number from another two/three digit using the concept of borrowing.



*Competency No. 2* : The learner solves daily life problems involving comparison, addition and subtraction of fractions with the same denominator.

*Competency No. 3* : The learner recognizes and classifies various solids in the environment on the basis of their shapes without necessarily mentioning their geometrical names.

5. What information about a pupil's level of learning would you like to transfer to his/her teacher in the next class ?

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## ANSWERS TO CHECK YOUR PROGRESS

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1. The focus of the competency-based teaching-learning process in the development of the competency in learner.
2. Competency refers to a person's capability of successfully accomplishing a given task.
3. The evaluation used for diagnosing the weaknesses of learners and thereby improving their performance is known as formative evaluation.
4. The most significant aspect of competency-based evaluation is the statement of the competency and its development.