

**MASSACHUSETTS DEPARTMENT OF EDUCATION  
CONTENT INSTITUTES  
2006**

**KEY CONCEPTS, PRE-/POST-TEST, and SUMMARY REPORT**

**TIMELINE**

<b>February 27, 2006 - Noon</b>	<b>Proposals due at the Department</b>
<b>March</b>	<b>Grant review and negotiations</b>
<b>Late March</b>	<b>Grant awards announced</b>
<b>April 11</b>	<b>Technical assistance session for all grant recipients</b>
<b>April 27</b>	<b>Key Concepts and Pre-/Post-tests due to the Department for final approval</b>
<b>June 20-August 31</b>	<b>Institute sessions</b>
<b>September-December</b>	<b>Follow-up sessions</b>
<b>February 1, 2007</b>	<b>Summary Report due to the Department</b>

**PRE-TESTS, POST-TESTS**

Each educator-participant at a Content Institute (CI) must participate in a pre-test and post-test on the key content concepts to be presented during the institute. The pre-test/post-test method of demonstrating content knowledge growth has been used by the Content Institutes for several years. It is consistent with the Recertification Professional Development Points (PDPs).

More importantly, clarifying the pre-institute knowledge base of the participants allows the CI providers to gear the material of their institutes to the needs of the teacher-participants (a classroom practice used by many exemplary PreK-12 teachers). The knowledge gains demonstrated by the post-test serve three purposes:

- teachers have tangible proof of the value of the time and energy they have committed to participation;
- providers receive feedback on the success of their instructional programs; and
- the Department can demonstrate the value of continuing and expanding the funding for the CI program.

Although the CI pre-/post-tests are not required to meet rigorous psychometric standards, they are expected to model good test construction techniques for the teacher-participants.

**KEY ACADEMIC CONCEPTS**

A concept is an abstract or generic idea generalized from particular instances. It provides structure for understanding the discipline. A key concept is focused on important content in the discipline. It defines clearly content knowledge and understanding in a way that can be measured. An effective key concept is expressed in a complete sentence.

A key concept is often a thesis statement or hypothesis that can be proven using a choice of examples, facts, or details. It may express a relationship (cause and effect, comparison or contrast, stages in development or in a process).

The following chart shows key concepts from a variety of content areas as they are developed from draft to final form.

### DEVELOPING KEY CONCEPTS

Drafts and Comments	Guiding Questions	Key Concept
<p>Matisse responded to the world around him.</p> <p><i>(Comment: This is vague and too broad.)</i></p>	<p><i>What specifically do I want participants to know and understand about Matisse's subjects and techniques?</i></p>	<p>Matisse used specific design strategies to transform natural forms in his cut paper collages.</p> <p><b>(Comment: Concept is measurable, clear, and focused on important content. Expresses a cause-and-effect relationship.)</b></p>
<p>Greek mythology</p> <p><i>(Comment: This is a topic, not a concept.)</i></p>	<p><i>What statement(s) express clearly what I want participants to know and understand about Greek mythology?</i></p>	<p>Greek myths often explain the origins of mysterious natural phenomena and/or demonstrate basic human emotions.</p> <p><b>(Comment: Concept is measurable, clear, and focused on important content. Expresses a cause-and-effect relationship.)</b></p>
<p>Conflict arose between the English colonists and the Wampanoag.</p> <p><i>(Comment: This vague statement simply summarizes the historical situation without suggesting the need for a deeper understanding of the events.)</i></p>	<p><i>What do I want participants to understand about the conflict aside from the facts of the events?</i></p> <p><i>What generalization would suggest deeper understanding of the reasons for the conflict?</i></p>	<p>Conflict between the English colonists and the Wampanoag resulted when one culture tried to impose itself upon the other within the same geographic area.</p> <p><b>(Comment: Concept is measurable, clear, and focused on important content. Expresses a cause-and-effect relationship.)</b></p>
<p>Formulate and test conjectures about shapes that tessellate.</p> <p><i>(Comment: This is an activity, not a concept.)</i></p>	<p><i>What do participants need to know and understand to perform these investigations thoughtfully and efficiently?</i></p> <p><i>Why is it important that participants learn to test conjectures?</i></p>	<ol style="list-style-type: none"> <li>1. The polygons that will tessellate are determined by their properties.</li> <li>2. Validation of conjectures requires the use of logical proof.</li> </ol> <p><b>(Comment: Concepts are measurable, clear, and focused on important content. They express a cause-and-effect or a process relationship.)</b></p>
<p>Distance vs. time graphs</p> <p><i>(Comment: This is a vocabulary term, not a concept.)</i></p>	<p><i>What is it about this type of graph that I want participants to know and understand?</i></p> <p><i>Do I expect participants to create them, analyze them, and apply them in problem solving?</i></p>	<p>Distance vs. time graphs can be created in order to analyze the motion of an object in terms of both magnitude and direction.</p> <p><b>(Comment: Concept is measurable, clear, and focused on important content. Expresses a comparison relationship.)</b></p>
<p>Engineering design is a process.</p> <p><i>(Comment: Too broad and vague.)</i></p>	<p><i>What specifically do I want participants to know and understand about the engineering design process?</i></p>	<p>Effective engineering design uses a step-by-step process to solve a problem.</p> <p><b>(Comment: Concept is measurable, clear, and focused on important content. Expresses a process relationship.)</b></p>

## DEVELOPING TEST ITEMS

The first step in developing a quality assessment instrument is to define each Key Content Concept in a way that participant knowledge can be measured. Each content concept must be linked to a Learning Standard in the curriculum frameworks.

Participant knowledge can be measured through close-ended items (multiple-choice, etc.), rubric-scored open-ended items (essays, etc.), rubric-scored portfolios, and/or rubric-scored performance tasks. The best assessments use a combination of item types that are appropriate to the concepts being taught.

In some cases, a series of close-ended items may be necessary to test one concept. These items can be a rich source of information if the respondents are asked to “explain how” they derived their answers.

Essays and other open-ended assessment methods are most often used to assess depth of understanding about a concept, but usually the respondent is not expected to report all possible correct information.

Regardless of the types of test items, it is critical that they are worded clearly and precisely to give test takers a fair opportunity to demonstrate competence and achieve the maximum points awarded by the scoring rubric.

Rubrics for test items should be defined clearly and specifically and include what response content will receive the maximum points, what will receive the next highest number of points, etc. Rubrics should be developed for all open-ended items, portfolios, and performance tasks. An exemplary response should be written for each open response item. An answer sheet with all acceptable responses must be developed for objective items (e.g., 1.5, 1½, or 3/2).

The examples below are key academic concepts, pre- and post-assessment items, and rubrics taken from exemplary content institute proposals.

### **EXAMPLE 1.**<sup>1</sup> **English Language Arts Standard 16.11**

Analyze the characters, structure, and themes of classical Greek drama and epic poetry.

#### **Key Academic Concept**

The plot of contemporary and classical tragedies contains common elements, which are seen in Anouilh’s *Antigone*, Sophocle’s *Antigone*, and Shakespeare’s *King Lear*.

#### **Question and Rubric**

Explain the function of the chorus in a tragedy (one point), and compare the way in which Anouilh uses it and Sophocles uses it (one point). Why do they use it differently (one point) and what is the impact (one point)? Answers may be brief but an exemplary one is shown.

**Sample Answer:** In Greek tragedy, the chorus represents the city at large and the sense of a collective fate. A comparison with crowd scenes in Shakespeare can be useful. Just as in Shakespeare’s historical tragedies, we need to be reminded, through the chorus of Greek tragedy, that the drama that involves the protagonists cannot be isolated, but is necessarily related to an outside world and to the fate of other human beings. Meanwhile, the form given to the chorus, highly ritualized and involving singing and dancing, is a reminder that tragedy had almost religious overtones and was, for the Greeks, of a highly ceremonial nature. But for modern interpretations, the chorus is often the hardest part to “translate”: the form must be poetic, and must evoke both the notion of the collective and of the ritualistic. These formal features go against the grain of modern theatre that often favors psychology and realism. This explains why Anouilh has maintained only one function of the chorus (explanation and commentary on the action) and he ends up turning this figure into an extra voice. Almost like a narrator in fiction, this character helps toward the elucidation of the action or provides an ironic perspective. What is lost meanwhile is the sense of a collective understanding and participation in the unfolding drama as well as the sense of theater as collective ritual.

---

<sup>1</sup> 2003 Content Institute #4 Boston University and Bedford Public Schools

**EXAMPLE 2.<sup>2</sup> Mathematics Standard A.I.P.12**

Solve everyday problems that can be modeled using systems of linear equations or inequalities. Apply algebraic and graphical methods to the solution. Use technology where appropriate. Include mixture, rate, and work problems.

**Key Academic Concept**

Explain consistent, inconsistent, and dependent simultaneous linear equations in two variables and their solutions. Formulate and solve word problems using simultaneous equations in two variables.

**Question and Rubric**

A teacher said to his student, "When I was your age, you were 2 years old; when you are my age, I will be 41 years old." What are the ages of the teacher and the student? Full credit: Ages 15 and 28.

**Solution Method 1**

Let student's current age = S; Let teacher's current age = T; ***Their age difference T – S remains the same at all times.***

In the past: "When I was your age, you were 2 years old" That means, when the teacher was S years old, the student was 2 year old. Their difference is T - S.  $S - 2 = T - S$  ----- (1)

In the future: "When you are my age, I will be 41 years old." That means, when the student is T years old, the teacher will be 41 years old. Their difference is still T - S.  $41 - T = (T - S)$  ----- (2)

To solve (1) and (2) for S and T, we rewrite (1) and (2) in standard form

$$2S - T = 2 \text{ ----- (3)} \quad S - 2T = -41 \text{ ----- (4)}$$

Solving the above system of linear equations, one gets S = 15, T = 28.

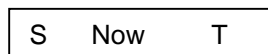
**Solution Method 2**

Some people prefer to define the age difference as a third unknown variable T – S = D. We then have a system of three equations with 3 unknowns:  $T - S = D$   $S - 2 = D$   $41 - T = D$

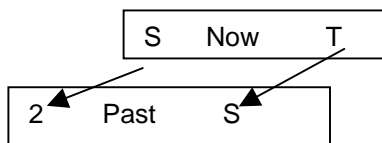
One can either solve for T, S, and D in a standard way, or one can **add up the three equations** to get  $39 = 3D$   $D = 13$ , so, T = 28 and S = 15.

**Solution Method 3**

Some people prefer to understand the problem graphically by drawing three "age difference" blocks on the time axis:



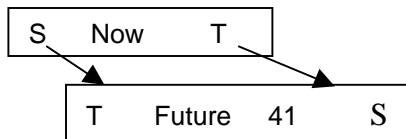
In the past: "When I was your age, you were 2 years old." That means, when the teacher was S years old, the student was 2 years old. Their age difference, which is represented by the length of the bar, remains constant. However, since this happened in the past, we will need to draw the bar shifted to the left:



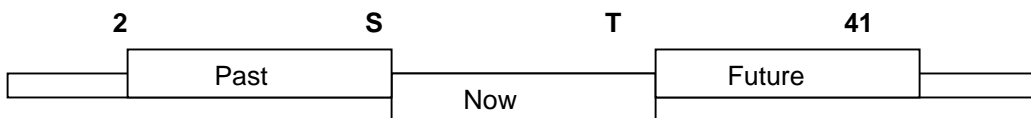
In the future: "When you are my age, I will be 41 years old."

<sup>2</sup> 2003 Content Institute #20 EduTron Corporation and Middleborough Public Schools

That means, when the student is  $T$  years old, the teacher will be 41 years old. Their difference is still  $T - S$ . Their age difference, which is represented by the length of the bar, remains constant. However, since this happens in the future, we will need to draw the bar shifted to the right:



Now “combine” all three bars on the same time line.



**Notice the three bars have the same length and the total length is  $41 - 2 = 39$ .**  
So each bar is 13 years long. One then finds  $S = 2 + 13 = 15$ ;  $T = S + 13 = 28$ .

### Scoring Rubric

Score	Code	Response
<b>Correct Response</b>		
5	30	See Solution Methods 1
5	31	See Solution Methods 2
5	32	See Solution Methods 3
5	39	Other correct responses
<b>Partial Response</b>		
4	20	Correctly setting up the system of 2 equations with 2 unknowns but only 1 of the 2 ages was solved correctly
3	21	Correctly setting up the system of 2 equations with 2 unknowns but none of the two ages was solved correctly
4	22	Correctly setting up the system of 3 equations with 3 unknowns but only one of the three ages was solved correctly
3	23	Correctly setting up the system of 3 equations with 3 unknowns but none of the three ages was solved correctly
2.5	24	Correctly setting up the one of the two equations in the system of 2 equations with 2 unknowns. No correct answer
2.5	25	Correctly setting up the 1 or 2 of the 3 equations in the system of 3 equations with 3 unknowns. No correct answer
2	26	Identifying clearly, with any representation (graphics, words, equations, etc.), the crucial fact that the age difference remains the same at all times
4	27	Correctly representing the linear system graphically (or using other equivalent methods) but only one of the two ages was obtained correctly
3	28	Correctly representing the linear system graphically (or using equivalent methods) but did not obtain any of the correct ages
1	29	Certain minimal response the grader may strongly deem appropriate
<b>Incorrect Response</b>		
0	70	Incorrect or inadequate calculations and representations
<b>No response</b>		
0	90	Crossed out/erased, illegible, or impossible to interpret
0	99	BLANK

## PRE-TEST AND DEPARTMENT SURVEY ADMINISTRATION

The CI pre-tests and Department Survey are to be used to inform the provider of the pre-institute knowledge level of the participants and their experience in education, so instruction can be geared to the participants' needs.

Several options for the timing of the Department Survey and pre-test administration, along with their pros and cons, are discussed below.

1. Pre-test responses and the Department Survey may be **delivered with application to enroll** in the CI to the institute provider. This method is least likely to cause participant reluctance and/or test anxiety. It also gives the provider the greatest amount of time to review the responses and adjust the planned syllabus to the needs of the participants. It requires early approval of the pre-test and instructions that the responses are to be derived independently. *[Note: The pre-test should not be used as a screening device!]*
2. Pre-tests and the Department Survey may be **administered at a pre-Institute workshop** day. This method gives the provider time to review the responses and to adjust the planned syllabus before the actual institute begins and eliminates concerns about the independence of responses. It requires early approval of the pre-test.
3. Pre-tests and the Department Survey may be **administered early on the first day** of the CI. Institutes that have on-site performance tasks (e.g., sight reading music) can administer these assessments at a pre-Institute workshop or on the first day of the CI. First-day administration allows little time to review the responses/measures in order to adjust the planned syllabus and it takes class time. Having a test as the first activity of a CI, even one that is pre-announced, may not be the most positive way to start an institute.

Pre-tests should be reviewed/graded as quickly as possible in order to inform institute instruction. The items and expected responses should be discussed with the participants after they have been tested or after scoring has been completed.

## POST-TEST ADMINISTRATION FOR CONTENT INSTITUTES

Unless the partnership has pre-test and post-test instruments that have demonstrated validity and reliability, the pre-test should be re-administered as the post-test. Participants should **not** be informed that the same items will be used for both tests.

In order to insure time for coverage of all Key Content Concepts and maximum knowledge gain, the post-test must be administered on the last summer meeting day of the CI (prior to follow-up sessions). The date and time for the post-test must be identified clearly in CI publicity and all enrollees who will receive PDPs are required to participate.

## ADMINISTRATION OF DEPARTMENT SURVEYS

**Department Survey #1** must be administered on **the FIRST day of the Summer Session** of the CI. This survey includes demographic information about the participants and items about the Summer Session. This survey must be sent to Joyce Bowen at the Department by September 22, 2006.

**Department Survey #2** must be administered at **the LAST Follow-Up session**. This survey includes items about the follow-up sessions and about implementation of the content and technology presented in the CI in the participants' classroom. This survey must be sent to Joyce Bowen at the Department by December 15, 2006.

## Summary Report for 2006 Content Institutes

Please send a summary report from each Content Institute, along with appendices, **on or before February 1, 2007** to:

**Joyce Bowen**  
**Department of Education**  
**350 Main Street**  
**Malden, MA 02148-5023**

This document should be brief (no more than 3-4 pages, not counting appendices) and should follow the outline below.

### **Cover Page: (Title, Institute Number, Partners, Presenters)**

- I. Description of follow-up activities
- II. Description of participant projects
- III. Reflections and Conclusions, including quotes of participants. Please include in your conclusions a discussion of what worked, what did not work, what surprised you, what changes you would make in future institutes, and any recommendations for the Department.
- IV. Attachments:
  - A. One sample of a representative participant project
  - B. Institute photos (preferably on disk), if available

**INDIVIDUAL PARTICIPANT CONTENT GAIN REPORT  
CONTENT INSTITUTES 2006**

INSTITUTE NAME: \_\_\_\_\_

REPORT PREPARED BY \_\_\_\_\_ PHONE (    ) \_\_\_\_\_

Maximum Points on Pre-Test\* and on Post-Test\* \_\_\_\_\_ (100 IS EASIEST!)

\* Pre-Test and Post-Test must have the SAME number of maximum points.

	PARTICIPANT CODE NAME	PRE-TEST		POST-TEST		GAIN	
		Points	%	Points	%	Points	%
EX.	Suzie Q (If 100 total Points)	43	43%	82	82%	39	39%
EX.	Darth V (If 65 total Points)	35	54%	61	94%	26	40%
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
17							
18							
19							
20							

Please make additional pages as necessary.

**KEY CONCEPTS CONTENT GAIN REPORT  
CONTENT INSTITUTES 2006**

INSTITUTE NAME: \_\_\_\_\_

REPORT PREPARED BY \_\_\_\_\_ PHONE ( ) \_\_\_\_\_

**NOTE:** Each individual Key Concept must have the SAME number of maximum points on the Pre-Test and Post-Test. Different Key Concepts can have different maximum points.

KEY CONCEPT (Use same KC number on all forms)	QUESTIONS AND POINTS TO TEST THE CONCEPT	MAXIMUM POINTS FOR CONCEPT (Total of the question points)	CLASS AVERAGE PRE-TEST SCORE		CLASS AVERAGE POST-TEST SCORE		CLASS AVERAGE CONTENT GAIN	
			POINTS	%	POINTS	%	POINTS	%
EX. Concept 17	Q1 – 4 pts Q3 – 2 pts Q4 – 2 pts	8	3.7	46.2%	7.0	87.5%	3.3	41.3%
EX. Concept 22	Q8 – 10 pts	10	4.8	48%	8.5	85%	3.7	37%
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Please make additional pages as necessary.