Out With the Old, In With the New: Rethinking How to Design, Administer, and Score Large-Scale Assessment to Improve Teaching and Learning

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The purpose of this session is to describe an innovative approach to large-scale K-12 alternate assessments, currently employed by the Dynamic Learning Maps® assessment system, which uses:

- interconnected learning map models as the basis for identifying assessment targets;
- task templates based on principles of evidence-centered design to develop items aligned to the maps;
- an embedded assessment administration design to more closely connect instruction to assessment; and
- diagnostic classification modeling to provide information about students’ mastery of skills within the maps.
Objectives

To describe:

1. from a test developer’s perspective, an approach to test development that uses learning map models and evidence-centered design as its foundation;

2. from a psychometrician’s perspective, the scoring model used to provide profiles of student mastery; and

3. from a state education agency’s perspective, implementation evidence of how the system is used and its impact on teachers and students.
Assessment Design and Development
Developing a Map-Based Assessment System

- **Learning Maps as Architecture for Assessment Design**
  - Incorporating research synthesis with Academic Standards
  - Providing multiple access points for assessments
  - Supporting student learning by incorporating elements of Universal Design

- **The Essential Element Concept Map**
  - Making the maps meaningful for test developers
  - A streamlined approach to task templates and item specifications
Learning Map Design Principles

1. People learn.

2. People learn differently.

3. Multiple “pathways” of learning can be represented in large-scale maps.

4. Maps can help avoid getting “stuck.”

5. Maps can be used for multiple purposes.
Charting A Course

- Learning maps are similar to learning progressions, but developed on a larger scale.

- Learning maps represent the acquisition of knowledge, skills, and conceptual understanding.

- Multiple routes to reaching individual academic targets are represented.
Elements of a Learning Map Model

- Nodes represent unique, measurable knowledge, skills, or understandings.
  - Circle
- Connections indicate order of acquisition.
  - Arrows between the circles

SCI-22 Compare weights of substances before and after heating, cooling, or mixing.

SCI-23 Compare the weight of an object before and after melting or freezing.
Interpreting a Map

- Nodes increase in complexity as you move from top to bottom in the figure.

- Arrows are unidirectional.

- Mastery of more complex skills supports inferences about mastery of preceding, less complex skills.
Developing Map Structures

- Applications of Universal Design for Learning
- Content
- Access
- Research Synthesis
- Domain Analysis
- Hypotheses
- Research & Evaluation
- Judgment
They Get Pretty Big
Locating Assessment Targets
Within the Maps

- Each academic standard on the DLM test blueprint has an associated *Minimap*

- Minimaps show
  - the targeted knowledge, skills, and understandings described by the standard
  - precursor nodes representing skills that precede, but are on a pathway to the target
  - successor nodes, representing achievement beyond the expectations described by the standard
Example Math Mini-Map
Testlets

- Items are administered in short testlets
- Testlets are collections of 3-9 items centered around an engagement activity
- Item measures a single standard (known as an Essential Element)
The Essential Elements Concept Map (EECM)

Connects the learning map

Initial Precursor

Distal Precursor

Proximal Precursor

Target

Successor

...to the items delivered.

Behavior

Behavior

Behavior

Behavior

Behavior

IP Testlet

DP Testlet

PP Testlet

T Testlet

S Testlet
EECM

- Full template includes repeated rows for the other linkage level nodes.
- Each EECM contains a minimap view.
- Includes information traditional used in task templates and construct definition materials in an easy to use format.
EECM

- Links the content domain (map) to test development (testlets)
- Places student access to content at the forefront of test development
- EECM specified for each standard
- For each standard, five access points called linkage levels
  - Map nodes measured at each linkage level along with description and observation
  - Vocabulary and key concepts by level
- Describes common misconceptions, common questions to ask
- Ensures consistency across the test development process.
Evaluating the Map-Based, EECM Development Approach

- Strong Evidence of Alignment of relationships in the assessment system
  - Internal Review Panels
  - External Review Panels
  - External, Independent Alignment Study

- Strong Evidence for Response Processes as Intended
  - Test administration observations
  - Cognitive Labs
  - Teacher Survey

- For additional information see
Assessment Administration
Traditional K-12 Large-Scale Assessment

- End of a year, summative evaluation of fixed set of content standards
- Results used to meet federal accountability requirements
- Results are delivered too late in the year and at a level of reporting that lacks utility for instruction (Marion, 2018; Wilson, 2018)
- Associated with negative impacts on disadvantaged students, narrowing of the curriculum, increased testing anxiety, and decreased teacher morale (Blazer, 2012)

Instructionally Embedded Assessment

- **Purpose**
  - Provide an integrated assessment solution for students with significant cognitive disabilities that meets federal accountability requirements, AND is instructionally useful.

- **Advantages**
  - Potential for efficiency in assessment development, testing time, and instruction
  - Results are timely to support teachers’ classroom instruction
Instructionally Embedded Assessment (cont.)

- **Features**
  - Short assessments available throughout the year, administered at instructionally relevant time points
  - Based on flexible blueprints to support teacher choice of content based on individual students’ instructional goals
  - Based on learning map models to show progression of skills
  - Provides timely and fine-grained results as instruction occurs
Instructionally Embedded Administration

- Teachers develop online instructional and assessment plans at the beginning of the academic year
  - Choose which Essential Elements to test and when (can also select level of cognitive complexity to test within each Essential Element)
- Engage in instructional and assessment cycles throughout the year
- Educator interface provides status of instructional and assessment plans and results of student progress
Choose at least three EEs in C1.1, including at least one RL and one Ri.

Claim: ELA.C1 Students can comprehend text in increasingly complex ways.
Conceptual Area: ELA.C1.1 Determine critical elements of text

<table>
<thead>
<tr>
<th>Essential Element</th>
<th>Initial Precursor</th>
<th>Distal Precursor</th>
<th>Proximal Precursor</th>
<th>Target</th>
<th>Successor</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELA.EE.RI.4.1</td>
<td>understand object names</td>
<td>name or identify objects in pictures</td>
<td>identify concrete detail in informational text</td>
<td>identify implicit text details and words</td>
<td>identify implicit text details and words</td>
</tr>
<tr>
<td>ELA.EE.RI.4.2</td>
<td>understand object names</td>
<td>name or identify objects in pictures</td>
<td>identify concrete details in informational texts</td>
<td>identify text topic and related details</td>
<td>identify topic-related words in informational text</td>
</tr>
<tr>
<td>ELA.EE.RI.4.3</td>
<td>understand object names</td>
<td>use category knowledge to draw conclusions</td>
<td>identify concrete details in an informational text</td>
<td>understand concrete details (person, place, idea)</td>
<td>understand key details</td>
</tr>
<tr>
<td>ELA.EE.RI.4.5</td>
<td>determine similar or different</td>
<td>name or identify objects in pictures</td>
<td>understands purpose of pictures</td>
<td>recognize informational text characteristics</td>
<td>understand structural purpose of text</td>
</tr>
</tbody>
</table>
Scoring Model
Traditional (IRT) Scoring

English Language Arts

Mathematics

Science
Diagnostic Classification Modeling as an Alternative

- Because of the desire to provide more fine-grained information beyond a single score value, DLM assessments are not scored using classical or item response theory
  - No raw or scale score
- Instead, a *profile* of *mastered* skills is created to summarize student performance
Moving to a More Fine-Grained Model

**SCI.5.LS.1.1**: Provide evidence that plants need air and water to grow.
Diagnostic Classification Modeling

- Diagnostic classification modeling (DCM) is a statistical method that provides diagnostic feedback about students’ mastery of discrete skills.
Linkage Level Mastery: Probability

Using all student responses to items for a given linkage level within an Essential Element, the statistical model is applied to determine the probability that a student is a master of that linkage level:

0 100

- Definitely Not Mastered (0% chance of mastery)
- Definitely Mastered (100% chance of mastery)
Linkage Level Mastery: Probability

The statistical model tells us the probability that the student is a master. For DLM assessments, the student must have an 80% or greater chance of mastery to be considered a master.

Definitely Not Mastered (0% chance of mastery)

27% chance

53% chance

86% chance

Definitely Mastered (100% chance of mastery)
Essential Element Mastery

- Combine information about linkage levels within an Essential Element to get to the highest linkage level mastered for each EE
  - No evidence of mastery = 0
  - Initial precursor level mastery = 1
  - Distal precursor level mastery = 2
  - Proximal precursor level mastery = 3
  - Target level mastery = 4
  - Successor level mastery = 5
Total Mastery & Performance Levels

- Number of linkage levels mastered is combined across all EEs to get **total linkage levels mastered**
  - For example, if there are 10 EEs x 5 linkage levels = 50 possible linkage levels

<table>
<thead>
<tr>
<th>Performance Level Descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emerging (E)</td>
</tr>
<tr>
<td>The student demonstrates <em>emerging</em> understanding of and ability to apply content knowledge and skills represented by the EEs.</td>
</tr>
<tr>
<td>Approaching (AP)</td>
</tr>
<tr>
<td>Student’s understanding of and ability to apply targeted content knowledge and skills represented by the EEs is <em>approaching the target</em>.</td>
</tr>
<tr>
<td>Target (T)</td>
</tr>
<tr>
<td>The student’s understanding of and ability to apply content knowledge and skills represented by the EEs is <em>at target</em>.</td>
</tr>
<tr>
<td>Advanced (AD)</td>
</tr>
<tr>
<td>The student demonstrates <em>advanced</em> understanding of and ability to apply content knowledge and skills represented by the EEs.</td>
</tr>
</tbody>
</table>
Summary of Stages of Scoring

1. **Items Administered**
   - Value reported in “Learning Profile”

2. **Statistical Modeling of LL Mastery**

3. **Highest LL Mastered by EE**
   - Range of values to set cut points on in standard setting. Value included in “Performance Profile”

4. **Total LLs Mastered**

5. **Performance Level Classification**
   - Value reported in “Performance Profile”
DLM Reports

- **Learning Profile**
  - Linkage level mastery
  - A version is available as a progress report throughout the year to help guide instructional plans

- **Performance Profile**
  - Overall performance level and percent of linkage levels mastered by domain
  - Summarizes student performance data collected from across the year
Student's performance in 10th grade English language arts Essential Elements is summarized below. This information is based on all of the DLM tests Student took during the 2019-20 school year. Grade 10 had 19 Essential Elements in 4 Conceptual Areas available for instruction during the 2019-20 school year. The minimum required number of Essential Elements for testing in 10th grade was 10. Student was tested on 12 Essential Elements in 4 of the 4 Conceptual Areas.

Demonstrating mastery of a Level during the assessment assumes mastery of all prior Levels in the Essential Element. This table describes what skills your child demonstrated in the assessment and how those skills compare to grade level expectations.

<table>
<thead>
<tr>
<th>Area</th>
<th>Essential Element</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 (Target)</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELA.C1.2 ELA.EE.L.9-10.4.a</td>
<td>Identify familiar objects through property word descriptors</td>
<td></td>
<td>Identify definition of words</td>
<td>Identify missing words using sentence context</td>
<td>Use semantic clues to identify word meaning</td>
<td>Use semantic clues to identify phrase meaning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELA.C1.2 ELA.EE.L.9-10.5.b</td>
<td>Draw conclusions from category knowledge</td>
<td>Identify the multiple meanings of a word</td>
<td>Identify word meaning of multiple meaning words using context clues</td>
<td>Identify the intended meaning of multiple meaning words</td>
<td>Understand how multiple meaning words can result in humor</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>ELA.C1.2 ELA.EE.RI.9-10.1</td>
<td>Identify concrete details in a familiar informational text</td>
<td>Identify concrete details in an informational text</td>
<td>Cite textual evidence for inferred information</td>
<td>Discriminate between citations for explicit and inferred information</td>
<td>Cite evidence for a text's specific meaning</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELA.C1.2 ELA.EE.RI.9-10.2</td>
<td>Identify concrete details in an informational text</td>
<td>Identify details relevant to the topic of text</td>
<td>Summarize a familiar informative text</td>
<td></td>
<td>Support implicit and explicit meaning with details</td>
<td></td>
</tr>
</tbody>
</table>
Overall Results

Students in Grade 10 English language arts are expected to be administered assessments covering 50 skills for 10 Essential Elements. Student mastered 40 skills during the year. Overall, Student’s mastery of English language arts fell into the third of four performance categories: at target. The specific skills Student has and has not mastered can be found in Student’s Learning Profile.

![Graph showing performance categories: emerging, approaching the target, at target, advanced]

**Emerging:** The student demonstrates emerging understanding of and ability to apply content knowledge and skills represented by the Essential Elements.

**Approaching the Target:** The student’s understanding of and ability to apply targeted content knowledge and skills represented by the Essential Elements is approaching the target.

**At Target:** The student’s understanding of and ability to apply content knowledge and skills represented by the Essential Elements is at target.

**Advanced:** The student demonstrates advanced understanding of and ability to apply targeted content knowledge and skills represented by the Essential Elements.
Performance Profile, continued

- Use writing to communicate: 40% (Mastered 8 of 20 skills)
- Integrate ideas and information in writing: 60% (Mastered 6 of 10 skills)
State Implementation
Implementation: North Dakota’s Instructionally Embedded Window

- **Instructionally Embedded Assessments** – computer-based assessments that are intended to be integrated with classroom instruction
  - Provide teachers with flexibility in the selection and delivery of testlets for a student (customization)
  - Generate results that teachers can use to inform plans for further instruction
  - For both ELA and Mathematics
North Dakota 2019-20 Participation

- Test sessions: 9,075
- Students: 520
- Teachers: 221
- Schools: 167
- Districts: 66

*With at least one testlet complete between 9/9/2019 and 2/26/2020*
### North Dakota Students Taking 2019-20 Testlets by Grade

<table>
<thead>
<tr>
<th>Grade</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 3</td>
<td>67</td>
</tr>
<tr>
<td>Grade 4</td>
<td>76</td>
</tr>
<tr>
<td>Grade 5</td>
<td>81</td>
</tr>
<tr>
<td>Grade 6</td>
<td>67</td>
</tr>
<tr>
<td>Grade 7</td>
<td>81</td>
</tr>
<tr>
<td>Grade 8</td>
<td>72</td>
</tr>
<tr>
<td>Grade 9</td>
<td>0</td>
</tr>
<tr>
<td>Grade 10</td>
<td>54</td>
</tr>
<tr>
<td>Grade 11</td>
<td>22</td>
</tr>
<tr>
<td>Grade 12</td>
<td>0</td>
</tr>
</tbody>
</table>

*With at least one testlet complete between 9/9/2019 and 2/26/2020*
North Dakota 2019-20 Testing Volume

Testing Volume

Number of Testlets Taken

Day of Instructionally Embedded Testing Window

Oct 7 Oct 21 Nov 4 Nov 18 Dec 2 Dec 16 Dec 30 Jan 13 Jan 27 Feb 10 Feb 24
Number of Linkage Levels Assessed on Essential Elements
**Progress Reports**

**Individual Student Progress Report**

**Name:** First59845 Last59845  
**Subject:** English Language Arts  
**Report Date:** October 05, 2015

First59845's current performance in Grade 5 English Language Arts Essential Elements is summarized below. This information is based on all of the Dynamic Learning Maps tests taken between the beginning of the school year and October 05, 2015. The target level is the grade level expectation for students to have proficient understanding of and ability to apply the Essential Element.

This report does not show progress on all of First59845's instructional goals. First59845 may be taught other academic concepts that have not yet been tested. This report does not show progress on IEP goals.

### Claim: ELA.C2  
**Conceptual Area:** ELA.C2.1 - Use writing to communicate

<table>
<thead>
<tr>
<th>Grade Level Expectation</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELA.C2.1: Conventional Writing</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>introduces topic and writes related information</strong></td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td><strong>Assessed:</strong> 02/26</td>
<td></td>
</tr>
</tbody>
</table>

### Claim: ELA.C1  
**Conceptual Area:** ELA.C1.2 - Construct understandings of text

<table>
<thead>
<tr>
<th>Grade Level Expectation</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELA.C1.1: Demonstrate understanding of words that have similar meanings.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>understand similar word meanings Planned</strong></td>
<td></td>
</tr>
<tr>
<td>ELA.C1.2: Identify the main idea of a text when it is not explicitly stated.</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td><strong>identify implicit main idea and supporting details Mastered: 02/26</strong></td>
</tr>
<tr>
<td>ELA.C1.3: Identify specific theme of a story and apt details</td>
<td></td>
<td></td>
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</tbody>
</table>

### Claim: ELA.C1  
**Conceptual Area:** ELA.C1.1 - Determine critical elements of text

<table>
<thead>
<tr>
<th>Grade Level Expectation</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELA.C1.1: Identify words in the text to answer a question about explicit information.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>can respond to yes/no questions</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td><strong>recognize simple details of familiar text</strong></td>
<td></td>
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</tr>
</tbody>
</table>

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This report provides student results so far for this school year. These results do not guarantee the student's overall performance at the end of the year.
Learning Profiles Help

- Set instructional goals
- Connect previous grade’s EEs to current grade
- Identify strengths and weaknesses
- Guide goal development for a standards-based IEP
Thank You!