



**DYNAMIC**<sup>®</sup>  
LEARNING MAPS

***2022–2023 Technical Manual  
Update***

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Pennsylvania Science Supplement

January 2024

## **DLM TECHNICAL MANUAL PENNSYLVANIA SUPPLEMENT**

### **FOREWARD INFORMATION**

The Dynamic Learning Maps® (DLM®) Consortium is made up of 21 state departments of education that use and develop the DLM Alternate Assessment system. DLM assessments are computer-based and accessible to students with significant cognitive disabilities for whom general state assessments are not appropriate, even with accommodations. Decisions regarding the assessment and reporting are made at the consortium level. As a result, some counts in the technical manual must be rounded to protect the identity of students in smaller states.

DLM serves as the statewide alternate assessment for accountability in Pennsylvania. DLM provides a technical manual annually to include data representative of all students from the consortium states, as well as a state specific supplement. The following Pennsylvania supplement to the DLM technical manual is available to better examine state specific data.

The manual contains tables that are representative of all states in the consortium. Therefore, there may be some slight differences in the data represented in this report and Pennsylvania's final accountability reporting data and student score reporting. For example, Pennsylvania assesses students at grades 3-8 and 11 in English Language Arts and Mathematics, and grades 4, 8, and 11 in Science. If a student is assessed at a grade level outside of these testing grades, that assessment is invalidated in the state's final accountability and reporting process. References to districts in this document include school districts, charter schools and private schools (APS, licensed private schools, etc.).

Questions on the data contained in this Pennsylvania Supplement can be directed to [alternateassessment@pattankop.net](mailto:alternateassessment@pattankop.net).

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# 1. Overview

During the 2022–2023 academic year, the Dynamic Learning Maps® (DLM®) Alternate Assessment System offered assessments of student achievement in mathematics, English language arts (ELA), and science for students with the most significant cognitive disabilities in grades 3 through 8 and high school.

A complete technical manual was created for the first year of operational administration for science (Dynamic Learning Maps Consortium [DLM Consortium], 2017). Additionally, the 2022–2023 update to the science technical manual provides updated information for the 2022–2023 administration, including only sections with changes (DLM Consortium, 2023a). This volume provides state-specific information for two of those chapters. For a complete description of the DLM system for science, refer to the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

## 1.1. Data Suppression

In order to ensure that individual students cannot be identified, disaggregated counts have been randomly rounded to the nearest 10, the suppression threshold specified by Pennsylvania. Random rounding means that a single value could round up or down, with the probability equal to the distance to each rounded value (Matthews & Harel, 2011). For example, a value of 17 would have a 30% chance of rounding down to 10 and a 70% chance of rounding up to 20 (i.e., values are more likely to round to their nearest end point). This method ensures that all the data is properly deidentified, while providing the maximum amount of information. That is, when using simple data suppression, groups that are above the suppression threshold must often be complementarily suppressed in order to ensure that groups below the suppression threshold are properly deidentified. Random rounding allows for results to be reported for all groups, while preserving student confidentiality.

## 1.2. State-Specific Supplement Overview

Chapter 1 provides an overview of the contents of the Pennsylvania state-specific supplement.

Chapter 2 and Chapter 3 do not include data specific to a single state and are not included in the state-specific supplement.

Chapter 4 provides an update on assessment delivery for Pennsylvania during the 2022–2023 year. The chapter provides a summary of administration time, device usage, adaptive delivery, administration incidents, accessibility support selections, and test administrator survey results regarding user experience.

Chapter 5 and Chapter 6 do not include data specific to a single state and are not included in the state-specific supplement.

Chapter 7 reports the 2022–2023 operational results for Pennsylvania, including student participation data. The chapter details the percentage of students at each performance level; subgroup performance by gender, race, ethnicity, and English learner status; and the percentage of students who showed mastery at each linkage level.

Chapter 8, Chapter 9, and Chapter 10 do not include data specific to a single state and are not included in the state-specific supplement. For a complete summary, see the *2022–2023 Technical Manual*



*Update—Science* (DLM Consortium, 2023a).

## 2. Content Structures

Essential Elements (EEs) are a key feature of the Dynamic Learning Maps® (DLM®) Alternate Assessment System, and serve as the conceptual and content basis for the DLM alternate assessment for science. For a description of the process used to develop the EEs, including the detailed work necessary to align them to the *Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (National Research Council, 2012) and the Next Generation Science Standards (NGSS Lead States [NGSS], 2013), and to the needs of the student population, see Chapter 2 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

### **3. Assessment Design and Development**

For a description of updates to the Dynamic Learning Maps® (DLM®) Alternate Assessment System's item and test development for the 2022–2023 academic year, including a summary of external reviews of items and testlets for content, bias, and accessibility; a description of the operational assessments; and a description of field tests, see Chapter 3 of the *2022–2023 Technical Manual Update—Science* (DLM Consortium, 2023a).

For a complete description of item and test development, including a summary of item and testlet information; external reviews of items and testlets for content, bias, and accessibility; a description of operational assessments; and a description of field tests, see the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

## 4. Assessment Delivery

Chapter 4 of the Dynamic Learning Maps® (DLM®) Alternate Assessment System *2015–2016 Technical Manual—Science* (DLM Consortium, 2017) describes general test administration and monitoring procedures. This chapter describes updated procedures and data collected in 2022–2023, including a summary of administration time, device use, adaptive delivery, administration incidents, accessibility support selections, and test administrator survey responses regarding user experience.

Overall, intended administration features remained consistent with the 2021–2022 implementation, including the availability of instructionally embedded testlets, spring operational administration of testlets, the use of adaptive delivery during the spring window, and the availability of accessibility supports.

For a complete description of test administration for DLM assessments—including information on the Kite® Suite used to assign and deliver assessments, testlet formats, accessibility features, the First Contact Survey used to recommend testlet linkage level, available administration resources and materials, and information on monitoring assessment administration—see the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

### 4.1. Overview of Key Features of the Science Assessment Model

This section describes DLM test administration for 2022–2023. For a complete description of key administration features, including information on assessment delivery, the Kite® Suite, and linkage level assignment, see Chapter 4 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017). Additional information about changes in administration can also be found in the *Test Administration Manual* (DLM Consortium, 2023d) and the *Educator Portal User Guide* (DLM Consortium, 2023c).

#### 4.1.1. Assessment Administration Windows

Assessments are administered in the spring assessment window for operational reporting. Optional assessments are available during the instructionally embedded assessment window for educators to administer for formative information. Additional descriptions of how Essential Elements (EEs) and linkage levels are assigned during the spring assessment window can be found in the Adaptive Delivery section later in this chapter.

##### 4.1.1.1. Instructionally Embedded Assessment Window

During the instructionally embedded assessment window, testlets are optionally available for test administrators to assign to their students. When choosing to administer the optional testlets during the instructionally embedded assessment window, educators decide which EEs and linkage levels to assess for each student using the Instruction and Assessment Planner in Educator Portal. The assessment delivery system recommends a linkage level for each EE based on the educator's responses to the student's First Contact Survey, but educators can choose a different linkage level based on their own professional judgment. The dates for the instructionally embedded assessment window are determined by which assessment model each state participates in for English language arts (ELA) and mathematics (i.e., Instructionally Embedded or Year-End). States that only participate in the science assessments follow the

dates for the Year-End model. In 2022–2023, the instructionally embedded assessment window occurred between September 12, 2022, and February 22, 2023, for states that participate in the Year-End model and between September 12, 2022, and December 16, 2022, for states that participate in the Instructionally Embedded model. States were given the option of using the entire window or setting their own dates within the larger window. In Pennsylvania, the instructionally embedded assessment window occurred between September 12, 2022, and February 22, 2023.

#### **4.1.1.2. Spring Assessment Window**

During the spring assessment window, students are assessed on all of the EEs on the assessment blueprint in science. The linkage level for each EE is determined by the system. As with the instructionally embedded assessment window, dates for the spring assessment window are determined by which assessment model is used for ELA and mathematics. In 2022–2023, the spring assessment window occurred between March 13, 2023, and June 9, 2023, for states that participate in the Year-End model and between February 6, 2023, and May 19, 2023, for states that participate in the Instructionally Embedded model. States were given the option of using the entire window or setting their own dates within the larger window. In Pennsylvania, the spring assessment window occurred between March 13, 2023, and May 5, 2023.

## **4.2. Evidence From the DLM System**

This section describes evidence collected by the DLM system during the 2022–2023 operational administration of the DLM alternate assessment. The categories of evidence include administration time, device use, adaptive delivery, administration incidents, and accessibility support selections.

### **4.2.1. Administration Time**

Estimated testlet administration time varies by student and subject. Testlets can be administered separately across multiple testing sessions as long as they are all completed within the testing window.

The published estimated total testing time per testlet is around 5–15 minutes (DLM Consortium, 2023d). The estimated total testing time is 45–135 minutes per student in the spring assessment window. Published estimates are slightly longer than anticipated real testing times where students are interacting with the assessment because of the assumption that test administrators need time for setup. The actual amount of testing time per testlet for a student varies depending on each student's unique characteristics.

Kite Student Portal captured start dates, end dates, and time stamps for every testlet. The differences between these start and end times were calculated for each completed testlet. Table 4.1 summarizes the distribution of test times per testlet for students in Pennsylvania. The distribution of test times in Table 4.1 is consistent with the distribution observed in prior years. Most testlets took around 3 minutes or less to complete. Time per testlet may have been affected by student breaks during the assessment or use of accessibility supports. Testlets with shorter than expected administration times are included in an extract made available to each state education agency. State agency staff can use this information to monitor assessment administration and address as necessary. Testlets time out after 90 minutes.

**Table 4.1**

*Distribution of Response Times per Testlet in Minutes*

Grade	Min	Median	Mean	Max	25Q	75Q
Elementary	0.1	2.2	3.0	88.9	1.5	3.4
Middle school	0.1	1.9	2.6	88.0	1.2	3.0
High school	0.1	2.2	2.9	87.1	1.4	3.4

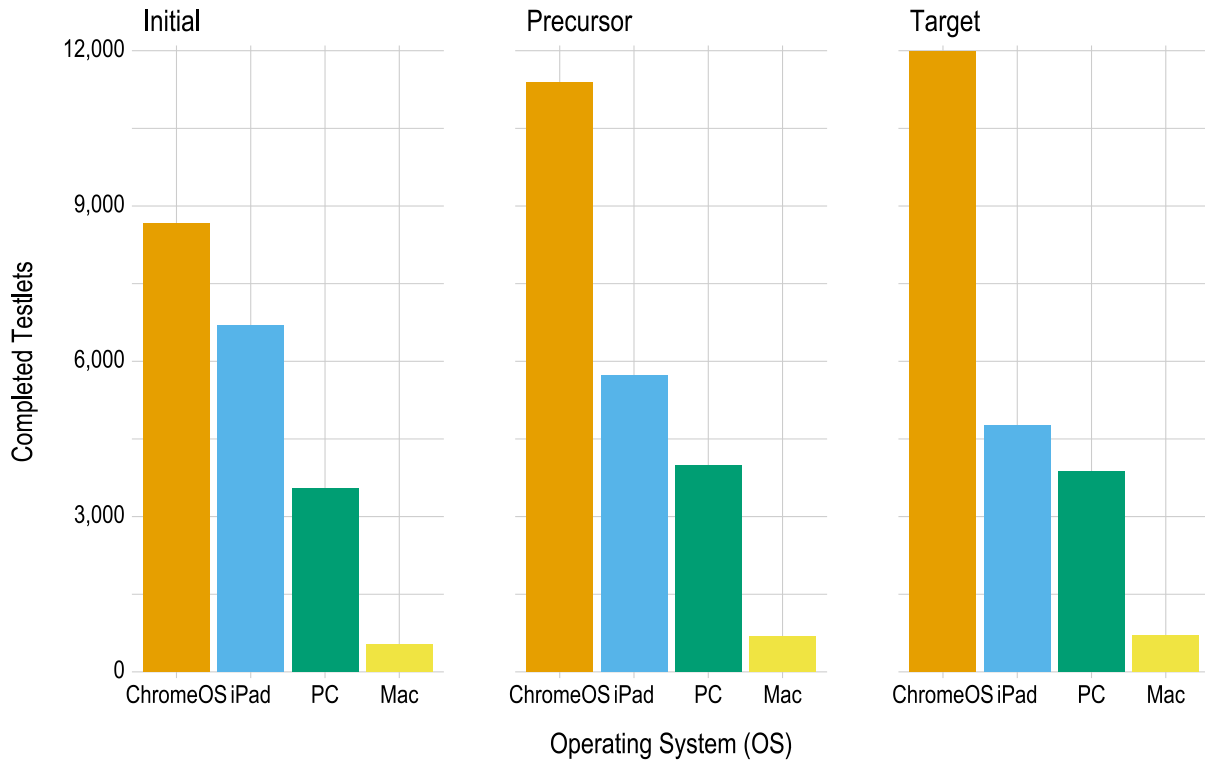
*Note.* Min = minimum; Max = maximum; 25Q = lower quartile; 75Q = upper quartile.

### **4.2.2. Device Use**

Testlets may be administered on a variety of devices. Kite Student Portal captured the operating system used for each testlet completed. Although these data do not capture specific devices used to complete each testlet (e.g., SMART Board, switch system, etc.), they provide high-level information about how students access assessment content. For example, we can identify how often an iPad is used relative to a Chromebook or traditional personal computer. Figure 4.1 shows the number of testlets completed on each operating system by linkage level for 2022–2023. In Pennsylvania, 51% of testlets were completed on a Chromebook, 27% were completed on an iPad, 18% were completed on a personal computer, and 3% were completed on a Mac.

**Figure 4.1**

*Distribution of Devices Used for Completed Testlets*



*Note.* PC = personal computer.

### 4.2.3. Adaptive Delivery

The science assessments are adaptive between testlets. In spring 2023, the same routing rules were applied as in prior years. That is, the linkage level associated with the next testlet a student received was based on the student’s performance on the most recently administered testlet, with the specific goal of maximizing the match of student knowledge and skill to the appropriate linkage level content.

- The system adapted up one linkage level if the student responded correctly to at least 80% of the items measuring the previously tested EE. If the previous testlet was at the highest linkage level (i.e., Target), the student remained at that level.
- The system adapted down one linkage level if the student responded correctly to less than 35% of the items measuring the previously tested EE. If the previous testlet was at the lowest linkage level (i.e., Initial), the student remained at that level.
- Testlets remained at the same linkage level if the student responded correctly to between 35% and 80% of the items on the previously tested EE.

The linkage level of the first testlet assigned to a student was based on First Contact Survey responses.<sup>1</sup> The correspondence between the First Contact complexity bands and first assigned linkage levels are

<sup>1</sup> See Chapter 4 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017) for more details.

shown in Table 4.2.

**Table 4.2**

*Correspondence of Complexity Bands and Linkage Levels*

First Contact complexity band	Linkage level
Foundational	Initial
Band 1	Initial
Band 2	Precursor
Band 3	Target

Following the spring 2023 administration, analyses were conducted to determine the mean percentage of testlets that the system adapted from the first to second testlet administered for students within a grade or course and complexity band. The aggregated results can be seen in Table 4.3.

Due to small sample size, data regarding the adaptation of linkage levels in Pennsylvania was only available for grades 4, 8, and 11. For the majority of students assigned to Band 3, the system did not adapt down to a lower linkage level after the first assigned testlet (ranging from 59% to 88%). In contrast, students assigned to Band 1 tend to adapt up to a higher linkage level after their first testlet (ranging from 61% to 76%). Consistent patterns were not as apparent for students who were assigned to Band 2. Results indicate that linkage levels of students assigned to higher complexity bands are more variable with respect to the direction in which students move between the first and second testlets. However, this finding of more variability in adaptation patterns in the higher complexity bands is consistent with prior years, which showed the same trend. Several factors may help explain these results, including more variability in student characteristics within this group and content-based differences across grades. For a description of previous findings, see Chapter 4 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017) and the subsequent technical manual updates (DLM Consortium, 2018a, 2018b, 2019, 2021, 2022).



**Table 4.3**

*Adaptation of Linkage Levels Between First and Second Science Testlets (N = 7,097)*

Grade	Foundational		Band 1		Band 2			Band 3	
	Adapted up (%)	Did not adapt (%)	Adapted up (%)	Did not adapt (%)	Adapted up (%)	Did not adapt (%)	Adapted down (%)	Did not adapt (%)	Adapted down (%)
Grade 3	*	*	*	*	*	*	*	*	*
Grade 4	43.3	56.7	76.3	23.7	23.9	49.3	26.8	59.3	40.7
Grade 5	*	*	*	*	*	*	*	*	*
Grade 6	*	*	*	*	*	*	*	*	*
Grade 7	*	*	*	*	*	*	*	*	*
Grade 8	40.1	59.9	69.0	31.0	36.1	43.2	20.6	71.1	28.9
Grade 9	*	*	*	*	*	*	*	*	*
Grade 10	*	*	*	*	*	*	*	*	*
Grade 11	51.2	48.8	60.8	39.2	38.0	44.1	17.9	87.5	12.5
Grade 12	*	*	*	*	*	*	*	*	*
Biology	*	*	*	*	*	*	*	*	*

*Note.* Foundational and Band 1 correspond to the testlets at the lowest linkage level, so the system could not adapt testlets down a linkage level. Band 3 corresponds to testlets at the highest linkage level in science, so the system could not adapt testlets up a linkage level.

#### **4.2.4. Administration Incidents**

DLM staff annually evaluate testlet assignment to promote correct assignment of students to testlets. Administration incidents that have the potential to affect scoring are reported to state education agencies in a supplemental Incident File. One incident occurred during the spring 2023 administration in which the complexity band was calculated incorrectly. Complexity bands are used to assign the linkage level of the first testlet administered in spring. This occurred because responses to the First Contact Survey for some students were changed while complexity bands were still being calculated in the system from the original responses. Because complexity band calculation was already in progress, a new calculation was not triggered when the responses were updated. As soon as this miscalculation was identified, the system was updated to allow for additional complexity band calculations to queue behind ongoing calculations, and additional quality control procedures were put in place to ensure that the miscalculation is not repeated. However, prior to the correction, two students completed testlets with an incorrect complexity band, and therefore began their assessment at an unintended linkage level. State education agencies were given the option to revert students to the beginning of the assessment at the intended linkage level or proceed. Both affected students proceeded without a test reset.

As in previous years, an Incident File was delivered to state partners with the General Research File, which provided the list of students who did not have their assessment reset. States were able to use this file during the 2-week review period to make decisions about invalidation of records at the student level based on state-specific accountability policies and practices. For more information on the General Research File and supplemental files, see Chapter 7 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

#### **4.2.5. Accessibility Support Selections**

Accessibility supports provided in 2022–2023 were the same as those available in previous years. The *DLM Accessibility Manual* (DLM Consortium, 2023b) distinguishes accessibility supports that are provided in Kite Student Portal via the Personal Needs and Preferences Profile, require additional tools or materials, or are provided by the test administrator outside the system. Table 4.4 shows selection rates for the three categories of accessibility supports. Overall, 6,393 students enrolled in the DLM system (82%) had at least one support selected. The most commonly selected supports in 2022–2023 were human read aloud, spoken audio, and test administrator enters responses for student. For a complete description of the available accessibility supports, see Chapter 4 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

**Table 4.4**

*Accessibility Supports Selected for Pennsylvania Students (N = 6,393)*

Support	<i>n</i>	%
Supports provided in Kite Student Portal		
Spoken audio	3,680	47.3
Magnification	1,020	13.1
Color contrast	610	7.8
Overlay color	240	3.1
Invert color choice	200	2.6
Supports requiring additional tools/materials		
Calculator	2,270	29.2
Individualized manipulatives	1,710	22.0
Single-switch system	270	3.5
Alternate form—visual impairment	160	2.1
Two-switch system	60	0.8
Uncontracted braille	10	0.1
Supports provided outside the system		
Human read aloud	5,290	68.0
Test administrator enters responses for student	3,130	40.3
Partner-assisted scanning	310	4.0
Sign interpretation of text	100	1.3
Language translation of text	70	0.9

*Note.* Counts were randomly rounded to the nearest 10.

### 4.3. Evidence From Test Administrators

This section describes evidence collected from the spring 2023 test administrator survey. Test administrators receive one survey per rostered DLM student, which annually collects information about that student’s assessment experience. As in previous years, the survey was distributed to test administrators in Kite Student Portal, where students completed assessments. Instructions indicated the test administrator should complete the survey after administration of the spring assessment; however, users can complete the survey at any time. The survey consisted of three blocks. Blocks 1 and 3 were administered in every survey. Block 1 included questions about the test administrator’s perceptions of the assessments and the student’s interaction with the content, and Block 3 included questions about the test administrator’s background, to be completed once per administrator. Block 2 was spiraled, so test administrators received one randomly assigned section. In these sections, test administrators were asked about one of the following topics per survey: relationship of the assessment to ELA, mathematics, or science instruction.

### **4.3.1. User Experience With the DLM System**

A total of 2,560 test administrators (77%) from Pennsylvania responded to the survey about 5,362 students' experiences. Test administrators are instructed to respond to the survey separately for each of their students. Participating Pennsylvania test administrators responded to surveys for between 1 and 28 students, with a median of 2 students. Pennsylvania test administrators reported having an average of 10 years of experience in science and teaching students with significant cognitive disabilities.

The following sections summarize responses regarding both educator and student experience with the system.

#### **4.3.1.1. Educator Experience**

Test administrators were asked to reflect on their own experience with the assessments as well as their comfort level and knowledge administering them. Most of the questions required test administrators to respond on a 4-point scale: *strongly disagree*, *disagree*, *agree*, or *strongly agree*. Responses are summarized in Table 4.5.

Nearly all Pennsylvania test administrators (98%) agreed or strongly agreed that they were confident administering DLM testlets. Most respondents (94%) agreed or strongly agreed that the Required Test Administrator Training prepared them for their responsibilities as test administrators. Most test administrators agreed or strongly agreed that they had access to curriculum aligned with the content that was measured by the assessments (86%) and that they used the manuals and the Educator Resource page (92%).

**Table 4.5**

*Test Administrator Responses Regarding Test Administration*

Statement	SD		D		A		SA		A+SA	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
I was confident in my ability to deliver DLM testlets.	15	1.0	22	1.5	642	43.4	800	54.1	1,442	97.5
Required Test Administrator Training prepared me for the responsibilities of a test administrator.	27	1.8	62	4.2	709	48.0	680	46.0	1,389	94.0
I have access to curriculum aligned with the content measured by DLM assessments.	45	3.0	167	11.3	743	50.2	524	35.4	1,267	85.6
I used manuals and/or the DLM Educator Resource Page materials.	31	2.1	88	6.0	799	54.2	555	37.7	1,354	91.9

*Note.* SD = strongly disagree; D = disagree; A = agree; SA = strongly agree; A+SA = agree and strongly agree.

## 4.4. Conclusion

Delivery of the DLM system was designed to align with instructional practice and be responsive to individual student needs. Assessment delivery options allow for necessary flexibility to reflect student needs while also including constraints to maximize comparability and support valid interpretation of results. The dynamic nature of DLM assessment administration is reflected in adaptive delivery between testlets. Evidence collected from the DLM system and test administrators indicates that students are able to successfully interact with the system to demonstrate their knowledge, skills, and understandings.

## 5. Modeling

The Dynamic Learning Maps® (DLM®) Alternate Assessment System draws upon a well-established research base in cognition and learning theory but relatively uncommon operational psychometric methods to provide feedback about student performance. The approach uses innovative operational psychometric methods to provide feedback about student mastery of skills. For a complete description of the psychometric model used to calibrate and score the DLM assessments, the psychometric background, the structure of the assessment system suitability for diagnostic modeling, and a detailed summary of the procedures used to calibrate and score DLM assessments, see Chapter 5 of the *2021–2022 Technical Manual Update—Science* (DLM Consortium, 2022).

## 6. Standard Setting

The standard setting process for the Dynamic Learning Maps® (DLM®) Alternate Assessment System in science derived cut points for assigning students to four performance levels based on results from the 2015–2016 DLM alternate assessments. For a description of the process, including the development of policy performance level descriptors, the 3-day standard setting meeting, follow-up evaluation of impact data and cut points, and specification of content-specific performance level descriptors, see Chapter 6 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

## 7. Reporting and Results

Chapter 7 of the Dynamic Learning Maps® (DLM®) Alternate Assessment System *2015–2016 Technical Manual—Science* (DLM Consortium, 2017) describes assessment results for the 2015–2016 academic year, including student participation and performance summaries and an overview of data files and score reports delivered to state education agencies.

This chapter presents Pennsylvania-specific spring 2023 student participation data; the percentage of students achieving at each performance level; and subgroup performance by gender, race, ethnicity, and English learner status. This chapter also reports the distribution of students by the highest linkage level mastered during spring 2023.

For a complete description of score reports and interpretive guides, see Chapter 7 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

### 7.1. Student Participation

During spring 2023, assessments were administered to 7,097 students in Pennsylvania. The assessments were administered by 3,109 educators in 1,653 schools and 650 school districts. A total of 62,529 test sessions were administered during the spring assessment window. One test session is one testlet taken by one student. Only test sessions that were complete at the close of the spring assessment window counted toward the total sessions.

Table 7.1 summarizes the number of students assessed in each grade and course. More than 2,440 students participated in each of the elementary and the middle school grade bands.<sup>2</sup> In high school, almost 2,200 students participated.

**Table 7.1**

*Student Participation by Grade or Course (N = 7,097)*

Grade	Students ( <i>n</i> )
4	2,480
8	2,440
11	2,190

*Note.* Counts were randomly rounded to the nearest 10.

Table 7.2 summarizes the demographic characteristics of the students who participated in the spring 2023 administration. The majority of participants were male (68%), White (54%), and non-Hispanic (84%). About 6% of students were monitored or eligible for English learning services.

<sup>2</sup> In an effort to increase science instruction beyond the tested grades, several states promoted participation in the science assessment at all grade levels (i.e., did not restrict participation to the grade levels required for accountability purposes).



**Table 7.2**

*Demographic Characteristics of Participants (N = 7,097)*

Subgroup	<i>n</i>	%
Gender		
Male	4,820	68.0
Female	2,270	32.0
Race		
White	3,830	53.9
African American	1,550	21.8
Two or more races	1,400	19.7
Asian	290	4.1
American Indian	30	0.4
Native Hawaiian or Pacific Islander	10	0.1
Hispanic ethnicity		
Non-Hispanic	5,980	84.2
Hispanic	1,120	15.8
English learning (EL) participation		
Not EL eligible or monitored	6,680	94.2
EL eligible or monitored	410	5.8

*Note.* Counts were randomly rounded to the nearest 10.

In addition to the spring assessment window, instructionally embedded science assessments are also made available for educators to optionally administer to students during the year. Results from the instructionally embedded assessments do not contribute to final summative scoring but can be used to guide instructional decision-making. No students in Pennsylvania took an instructionally embedded testlet during 2022–2023.

## 7.2. Student Performance

Student performance on DLM assessments is interpreted using cut points determined by a standard setting study<sup>3</sup>. Student achievement is described using four performance levels. A student’s performance level is determined by the total number of linkage levels mastered across the assessed Essential Elements (EEs).

For the spring 2023 administration, student performance was reported using the same four performance levels approved by the DLM Governance Board for prior years:

- The student demonstrates *Emerging* understanding of and ability to apply content knowledge and skills represented by the EEs.
- The student’s understanding of and ability to apply targeted content knowledge and skills

<sup>3</sup> For a description of the standard setting process used to determine the cut points, see Chapter 6 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

represented by the EEs is *Approaching the Target*.

- The student’s understanding of and ability to apply content knowledge and skills represented by the EEs is *At Target*. This performance level is considered meeting achievement expectations.
- The student demonstrates *Advanced* understanding of and ability to apply targeted content knowledge and skills represented by the EEs.

### 7.2.1. Overall Performance

Table 7.3 reports the percentage of Pennsylvania students achieving at each performance level from the spring 2023 administration for science. At the elementary level, the percentage of students who achieved at the At Target or Advanced levels (i.e., proficient) was approximately 20%; In middle school the percentage of students meeting or exceeding At Target expectations was approximately 26%; in high school the percentage was approximately 24%.

**Table 7.3**

*Percentage of Students by Grade and Performance Level*

Grade	<i>n</i>	Emerging (%)	Approaching (%)	At Target (%)	Advanced (%)	At Target + Advanced (%)
4	2,480	59.5	20.2	15.8	4.5	20.2
8	2,440	51.9	21.8	21.4	4.9	26.3
11	2,190	47.7	28.4	17.9	6.0	23.9

*Note.* Counts were randomly rounded to the nearest 10.

### 7.2.2. Subgroup Performance

Data collection for DLM assessments includes demographic data on gender, race, ethnicity, and English learning status. Table 7.4 summarizes the Pennsylvania disaggregated frequency distributions for science performance levels, collapsed across all assessed grade levels.

**Table 7.4**

*Science Performance Level Distributions by Demographic Subgroup (N = 7,097)*

Subgroup	Emerging		Approaching		At Target		Advanced		At Target + Advanced	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
<b>Gender</b>										
Male	2,560	53.0	1,080	22.4	910	18.8	280	5.8	1,190	24.6
Female	1,220	53.5	580	25.4	400	17.5	80	3.5	480	21.1
<b>Race</b>										
White	1,900	49.6	930	24.3	770	20.1	230	6.0	1,000	26.1
African American	880	57.1	350	22.7	250	16.2	60	3.9	310	20.1
Two or more races	790	56.8	310	22.3	240	17.3	50	3.6	290	20.9
Asian	200	66.7	60	20.0	30	10.0	10	3.3	40	13.3
American Indian	20	40.0	10	20.0	10	20.0	10	20.0	20	40.0
Native Hawaiian or Pacific Islander	10	50.0	10	50.0	0	0.0	0	0.0	0	0.0
<b>Hispanic ethnicity</b>										
Non-Hispanic	3,140	52.7	1,390	23.3	1,110	18.6	320	5.4	1,430	24.0
Hispanic	630	56.2	260	23.2	190	17.0	40	3.6	230	20.5
<b>English learning (EL) participation</b>										
Not EL eligible or monitored	3,540	53.0	1,550	23.2	1,240	18.6	350	5.2	1,590	23.8
EL eligible or monitored	240	58.5	100	24.4	60	14.6	10	2.4	70	17.1

*Note.* Counts were randomly rounded to the nearest 10.

### 7.3. Mastery Results

As described above, student performance levels are determined by applying cut points to the total number of linkage levels mastered. This section summarizes student mastery of assessed EEs and linkage levels.

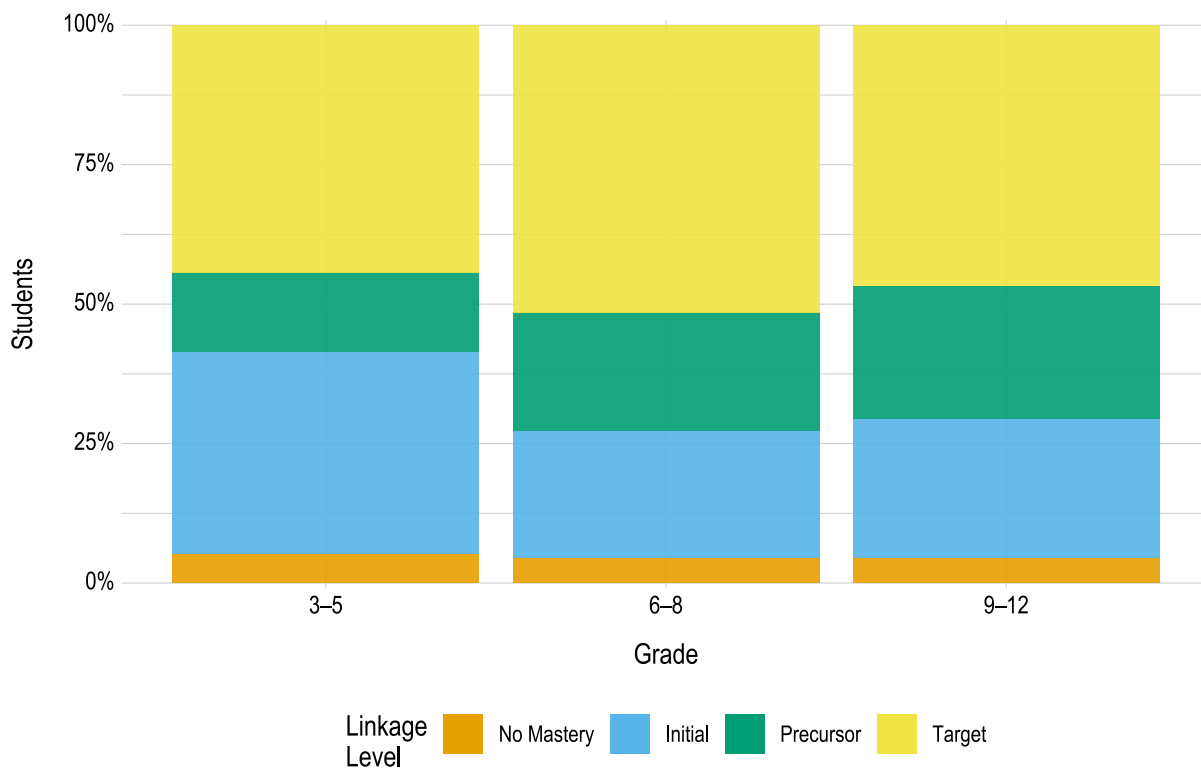
#### 7.3.1. Linkage Level Mastery

Scoring for DLM assessments determines the highest linkage level mastered for each EE. This section summarizes the distribution of students by highest linkage level mastered across all EEs. For each student, the highest linkage level mastered across all tested EEs was calculated. Then, for each grade, the number of students with each linkage level as their highest mastered linkage level across all EEs was summed and then divided by the total number of students who tested in the grade. This resulted in the proportion of students for whom each level was the highest linkage level mastered.

Figure 7.1 displays the percentage of Pennsylvania students who mastered each linkage level as the highest linkage level across all assessed EEs in science. For example, across all 3-5 science EEs, the Target level was the highest level that 44% of students mastered. The percentage of students who mastered as high as the Target linkage level ranged from approximately 44% to 52%.

**Figure 7.1**

*Students' Highest Linkage Level Mastered Across Science Essential Elements by Grade*



## 7.4. Data Files

DLM assessment results were made available to DLM state education agencies following the spring 2023 administration. Similar to prior years, the General Research File (GRF) contained student results, including each student's highest linkage level mastered for each EE and final performance level for science for all students who completed any testlets. In addition to the GRF, the states received several supplemental files. Consistent with prior years, the special circumstances file provided information about which students and EEs were affected by extenuating circumstances (e.g., chronic absences), as defined by each state. State education agencies also received a supplemental file to identify exited students. The exited students file included all students who exited at any point during the academic year. In the event of observed incidents during assessment delivery, state education agencies are provided with an incident file describing students impacted.

Consistent with prior delivery cycles, state education agencies were provided with a two-week window following data file delivery to review the files and invalidate student records in the GRF. Decisions about whether to invalidate student records are informed by individual state policy. If changes were made to the GRF, state education agencies submitted final GRFs via Educator Portal. The final GRF was used to generate score reports.

## 7.5. Score Reports

Assessment results were provided to state education agencies to report to parents/guardians, educators, and local education agencies. Individual Student Score Reports summarized student performance on the assessment. Several aggregated reports were provided to state and local education agencies, including reports for the classroom, school, district, and state.

No changes were made to the structure of individual or aggregated reports during spring 2023. For a complete description of score reports, including aggregated reports, see Chapter 7 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

### 7.5.1. Individual Student Score Reports

Similar to prior years, Individual Student Score Reports included two sections: a Performance Profile section, which describes student performance in the subject overall, and a Learning Profile section, which provides detailed reporting of student mastery of individual skills. Chapter 7 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017) describes evidence related to the development, interpretation, and use of Individual Student Score Reports and contains sample pages of the Performance Profile and Learning Profile.

## 7.6. Quality-Control Procedures for Data Files and Score Reports

No changes were made to the quality-control procedures for data files and score reports for 2022–2023. For a complete description of quality-control procedures, see Chapter 7 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

## 7.7. Conclusion

Results for DLM assessments include students' overall performance levels and mastery decisions for each assessed EE and linkage level. During spring 2023, assessments were administered to 7,097 students in Pennsylvania. Between 20% and 26% of Pennsylvania students achieved at the At Target or Advanced levels across all grades.

Lastly, following the spring 2023 administration, four data files were delivered to state education agencies: the GRF, the special circumstance code file, the exited students file, and an incident file. No changes were made to the structure of data files, score reports, or quality-control procedures during 2022–2023.

## 8. Reliability

The Dynamic Learning Maps® (DLM®) Alternate Assessment System uses diagnostic classification models to produce student score reports. As such, evidence for the reliability of results is based on methods that are commensurate with the models used to produce score reports. For a complete description of the simulation-based methods used to calculate reliability for DLM assessments and the psychometric background for these methods, see Chapter 8 of the *2021–2022 Technical Manual Update—Science* (DLM Consortium, 2022).

## 9. Training and Professional Development

To support the instruction and the implementation of the Dynamic Learning Maps® (DLM®) Alternate Assessment System, training is offered for state and local education agency staff and test administrators. Additionally, optional professional development is provided for teachers and other staff.

For a complete description of facilitated and self-directed training for DLM assessments, including a description of training for state and local education agency staff, see Chapter 10 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

For a description of the optional professional development available for the Dynamic Learning Maps® (DLM®) Alternate Assessment System during 2022–2023, see Chapter 9 of the *2022–2023 Technical Manual Update—Science* (DLM Consortium, 2023a).



## 10. Validity Argument

The Dynamic Learning Maps® (DLM®) Alternate Assessment System is based on the core belief that all students should have access to challenging, grade-level academic content. Therefore, the DLM assessments provide students with the most significant cognitive disabilities the opportunity to demonstrate what they know and can do. It is designed to map students' learning after a full year of instruction.

The DLM system completed its eighth operational administration year in 2022–2023. The chapters of the *2022–2023 Technical Manual Update—Science* (DLM Consortium, 2023a) provide updated evidence from the 2022–2023 year to support the propositions and assumptions that undergird the assessment system as described at the onset of its design in the DLM theory of action. Chapter 10 of the *2022–2023 Technical Manual Update—Science* (DLM Consortium, 2023a) summarizes that manual's contents and describes plans for future studies. For a complete summary of evidence collected for the DLM theory of action, also see the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

## 11. References

- Dynamic Learning Maps Consortium. (2017). *2015–2016 Technical Manual—Science*. University of Kansas, Center for Educational Testing and Evaluation.
- Dynamic Learning Maps Consortium. (2018a). *2016–2017 Technical Manual Update—Science*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.
- Dynamic Learning Maps Consortium. (2018b). *2017–2018 Technical Manual Update—Science*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.
- Dynamic Learning Maps Consortium. (2019). *2018–2019 Technical Manual Update—Science*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.
- Dynamic Learning Maps Consortium. (2021). *2020–2021 Technical Manual Update—Science*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.
- Dynamic Learning Maps Consortium. (2022). *2021–2022 Technical Manual Update—Science*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.
- Dynamic Learning Maps Consortium. (2023a). *2022–2023 Technical Manual Update—Science*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.
- Dynamic Learning Maps Consortium. (2023b). *Accessibility Manual 2022–2023*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.
- Dynamic Learning Maps Consortium. (2023c). *Educator Portal User Guide*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.
- Dynamic Learning Maps Consortium. (2023d). *Test Administration Manual 2022–2023*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.
- Matthews, G. J., & Harel, O. (2011). Data confidentiality: A review of methods for statistical disclosure limitation and methods for assessing privacy. *Statistics Surveys*, 5, 1–29.  
<https://doi.org/10.1214/11-SS074>
- National Research Council. (2012). *A framework for K-12 science education: Practice, crosscutting concepts, and core ideas*. The National Academies Press.
- NGSS Lead States. (2013). *Next Generation Science Standards: For states, by states*. The National Academies Press.