DYNAMIC®
LEARNING MAPS

2020–2021 Technical Manual Update

Pennsylvania Science Supplement

February 2022

Dynamic Learning Maps Consortium. (2021, December). *2020–2021 Technical Manual Update—Pennsylvania Science Supplement*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.

Acknowledgements

The publication of this technical manual update builds upon the documentation presented in the *2015–2016 Technical Manual—Science* and annual technical manual updates. This document represents further contributions to a body of work in the service of supporting a meaningful assessment system designed to serve students with the most significant cognitive disabilities. Hundreds of people have contributed to this undertaking. We acknowledge them all for their contributions.

Many contributors made the writing of this technical manual update possible. Dynamic Learning Maps® (DLM®) staff who made significant writing contributions to this technical manual update are listed below with gratitude.

W. Jake Thompson, Ph.D., *Senior Psychometrician*
Amy K. Clark, Ph.D., *Associate Director for Operational Research*
Brooke Nash, Ph.D., *Associate Director for Psychometrics*

The authors wish to acknowledge Noelle Pablo for her role in organizing and compiling this update. The authors also wish to acknowledge Brianna Beitling, Alson Cole, Karen Erickson, Jeffrey Hoover, Zachary Hopper, Susan K. Thomas, Jessie Lancaster, Mari Langas, Ronda Layman, Mitch McCann, and Michelle Shipman for their contributions to this update. For a list of project staff who supported the development of this manual through key contributions to design, development, or implementation of the Dynamic Learning Maps Alternate Assessment System, please see the *2015–2016 Technical Manual—Science*, and the subsequent annual technical manual updates.

We are also grateful for the contributions of the members of the DLM Technical Advisory Committee who graciously provided their expertise and feedback. Members of the Technical Advisory Committee during the 2020–2021 operational year include:

Russell Almond, Ph.D., *Florida State University*
Karla Egan, Ph.D., *EdMetric*
Claudia Flowers, Ph.D, *University of North Carolina-Charlotte*
Robert Henson, Ph.D., *University of North Carolina-Greensboro*
Joan Herman, Ed.D., *University of California, Los Angeles*
James Pellegrino, Ph.D., *University of Illinois-Chicago*
Edward Roeber, Ph.D., *Assessment Solutions Group/Michigan Assessment Consortium*
David Williamson, Ph.D., *Educational Testing Service*
Phoebe Winter, Ph.D., *Independent Consultant*

Contents

1 Introduction **1**
1.1 State-Specific Supplement Overview 1

2 Essential Element Development **2**

3 Item and Test Development **3**

4 Test Administration **4**
4.1 Overview of Key Administration Features 4
4.1.1 Test Windows 4
4.1.2 DLM Statement on Virtual Assessment Administration 4
4.2 Administration Evidence 5
4.2.1 Administration Time 5
4.2.2 Device Usage 5
4.2.3 Adaptive Delivery 6
4.2.4 Administration Incidents 9
4.3 Implementation Evidence 9
4.3.1 Kite System Updates 9
4.3.2 User Experience With the DLM System 9
4.3.3 Remote Assessment Administration 10
4.3.4 Accessibility 11
4.3.5 Data Forensics Monitoring 13
4.4 Conclusion 13

5 Modeling **14**

6 Standard Setting **15**

7 Assessment Results **16**
7.1 Impacts to Assessment Administration 16
7.2 Student Participation 16
7.3 Student Performance 18
7.3.1 Overall Performance 18
7.3.2 Subgroup Performance 19
7.3.3 Linkage Level Mastery 19
7.4 Data Files 20
7.5 Score Reports 21
7.5.1 Individual Student Score Reports 21
7.6 Quality Control Procedures for Data Files and Score Reports 23
7.7 Conclusion 23

8 Reliability **24**

9 Validity Studies **25**

10 Training and Professional Development **26**

11 Conclusion and Discussion **27**

12 References **28**

List of Tables

4.1 Distribution of Response Times per Testlet in Minutes 5
4.2 Correspondence of Complexity Bands and Linkage Levels 7
4.3 Adaptation of Linkage Levels Between First and Second Science Testlets 8
4.4 Teacher Responses Regarding Test Administration 10
4.5 Teacher Responses Regarding Administration Setting 11
4.6 Teacher Responses Regarding Circumstances Applicable to Remote Testing 11
4.7 Accessibility Supports Selected for Pennsylvania Students 12
4.8 Reason Student Was Unable to Effectively Use Available Accessibility Supports 13
7.1 Student Participation by Grade or Course 17
7.2 Demographic Characteristics of Participants 17
7.3 Percentage of Students by Grade and Performance Level 18
7.4 Science Performance Level Distributions by Demographic Subgroup 19
7.5 Students' Highest Linkage Level Mastered Across Science EEs by Grade 20

List of Figures

4.1 Distribution of Devices Used for Completed Testlets 6
7.1 Example Page of the Performance Profile for 2020–2021. 22
7.2 Example Page of the Learning Profile for 2020–2021. 23

1. Introduction

During the 2020–2021 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 *2015–2016 Technical Manual—Science* (DLM Consortium, 2017). Additionally, the 2020–2021 update to the science technical manual provides updated information for the 2020–2021 administration, including only sections with changes *2020–2021 Technical Manual Update—Science* (DLM Consortium, 2021b). This volume provides state-specific information for two of those chapters. For a complete description of the DLM system, refer to the *2014–2015 Technical Manual—Year-End Model* (DLM Consortium, 2016). For a complete description of DLM science assessments, refer to the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

1.1. 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 test administration for Pennsylvania during the 2020–2021 year. The chapter describes the DLM policy on virtual test administration and provides a summary of updated Personal Needs and Preferences Profile selections, a summary of administration time and device usage, and teacher survey results regarding user experience, remote assessment administration, and accessibility.

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 2020–2021 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. Due to the confounding factors of assessment administration changes and COVID-19, these results should be interpreted with caution and should not be directly compared to previous assessment administrations. Finally, the chapter provides descriptions of changes to score reports and data files during the 2020–2021 administration.

Chapter 8, Chapter 9, Chapter 10, and Chapter 11 are not included in the state-specific supplement. For a complete summary, see the *2020–2021 Technical Manual Update—Science* (DLM Consortium, 2021b).

2. Essential Element Development

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. Item and Test Development

For a description of updates to the Dynamic Learning Maps® (DLM®) Alternate Assessment System's item and test development for the 2020–2021 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 *2020–2021 Technical Manual Update—Science* (DLM Consortium, 2021b).

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. Test Administration

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 2020–2021 for the state of Pennsylvania, including the DLM policy on virtual test administration, a summary of administration time, adaptive routing, Personal Needs and Preferences Profile selections, and teacher survey responses regarding user experience, remote assessment administration, and accessibility.

Overall, administration features remained consistent with the 2019–2020 intended 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 available resources and materials and information on monitoring assessment administration, see the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

4.1. Overview of Key Administration Features

This section describes DLM test administration for 2020–2021. For a complete description of key administration features, including information on assessment delivery, Kite® Student Portal, and linkage level selection, 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 2020–2021* (DLM Consortium [DLM Consortium], 2021a) and the *Educator Portal User Guide* (DLM Consortium, 2021d).

4.1.1. Test Windows

Instructionally embedded assessments were available for teachers to optionally administer between September 14 and December 21, 2020, and between January 1 and February 24, 2021. During the consortium-wide spring testing window, which occurred between March 8 and July 2, 2021, students were assessed on each Essential Element (EE) on the blueprint. Each state education agency sets its own testing window within the larger consortium spring window. Because the 2020–2021 year was disrupted by the COVID-19 pandemic, states were offered increased flexibility in their testing windows. Pennsylvania chose to extend the spring testing window into fall 2021. Therefore the spring testing window for Pennsylvania remained open through September 30, 2021.

4.1.2. DLM Statement on Virtual Assessment Administration

In October 2020, DLM staff released a policy document stating that DLM assessments must be administered in person by a qualified test administrator, not virtually (e.g., over Zoom, Microsoft Teams, Google Hangouts, etc., in which the test administrator is not physically present during administration). This policy was supported by a resolution from the DLM Technical Advisory Committee, who agreed that there would be too many risks associated with a virtual administration (e.g., student ability to access the content, test security, validity of score inferences). The policy does not require an in-school administration. For example, a test administrator could travel to the student's house, or a separate off-site testing facility could be used.

4.2. Administration Evidence

This section describes evidence collected during the 2020–2021 operational administration of the DLM alternate assessment. The categories of evidence include data relating to administration time, device usage, and the adaptive delivery of testlets in the spring window.

4.2.1. Administration Time

Estimated administration time varies by student and subject. During the spring testing window, estimated total testing time was between 45 and 135 minutes per student, with each testlet taking approximately 5–15 minutes. Actual testing time per testlet varies depending on each student's unique characteristics.

Kite Student Portal captured start and end dates and time stamps for every testlet. Actual testing time per testlet was calculated as the difference between start and end times. Table 4.1 shows the distribution of test times per testlet for students in Pennsylvania. Most testlets took approximately 2–3 minutes to complete. Testlets time out after 90 minutes.

Table 4.1

Distribution of Response Times per Testlet in Minutes

Grade	Min	Median	Mean	Max	25Q	75Q	IQR
Elementary	0.13	2.27	3.02	84.62	1.47	3.50	2.03
Middle school	0.08	1.90	2.58	70.75	1.20	3.03	1.83
High school	0.15	2.17	2.90	76.67	1.40	3.35	1.95

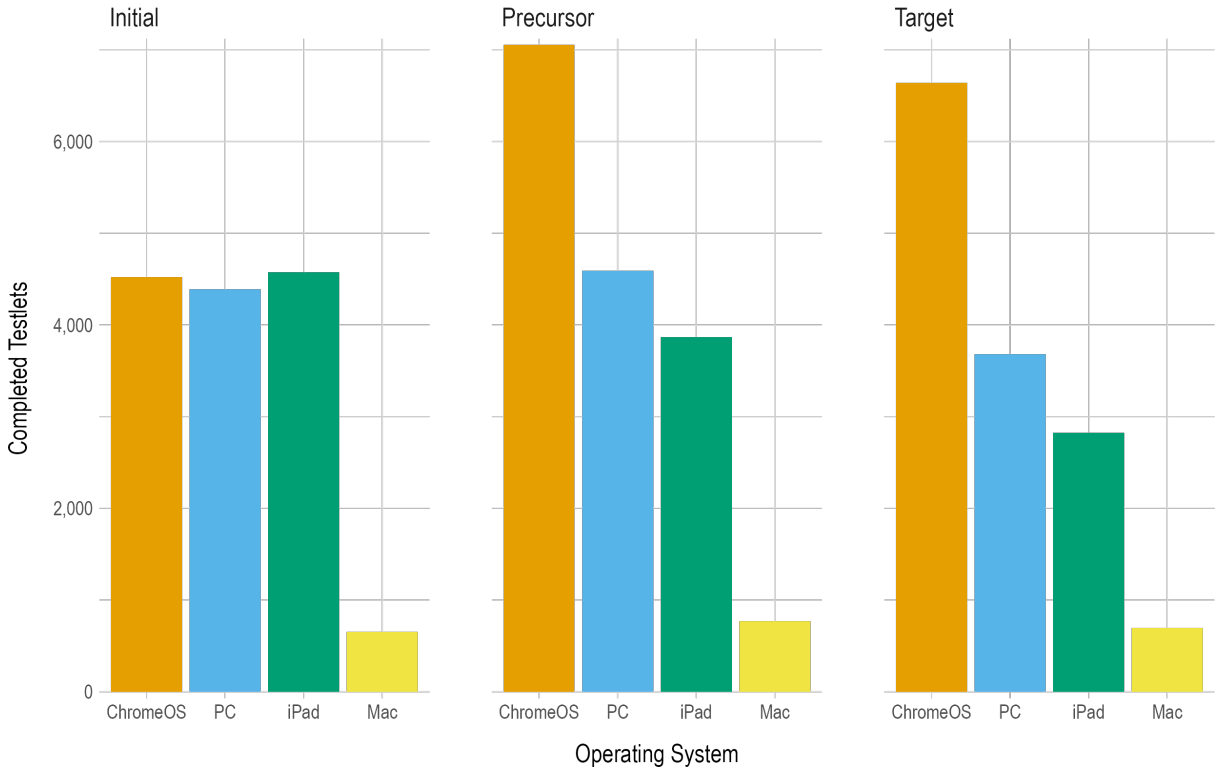
Note. Min = minimum, Max = maximum, 25Q = lower quartile, 75Q = upper quartile, IQR = interquartile range

4.2.2. Device Usage

Testlets may be administered on a variety of platforms. In addition to start and end times, Kite Student Portal captured the operating system used for each testlet completed in 2020–2021. Although this data does not capture specific devices used to complete each testlet (e.g., SMART Board, switch system, etc.), this data does 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 PC. Figure 4.1 shows the number of testlets completed on each operating system, by linkage level. In Pennsylvania, 41% of testlets were completed on a Chromebook, 29% were completed on a PC, 25% were completed on an iPad, and 5% were completed on a Mac. In general, iPads and Chromebooks are the most popular operating system for lower linkage levels, whereas PCs and Chromebooks are more popular at the higher linkage levels. This may reflect that testlets at the lower linkage levels are typically teacher-administered, but higher linkage levels are computer administered. Thus, these results may indicate that teachers and students tend to use different devices for accessing assessment content.

Figure 4.1

Distribution of Devices Used for Completed Testlets



4.2.3. Adaptive Delivery

During the spring 2021 test administration, the science assessments were adaptive between testlets, following the same routing rules applied 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. The correspondence between the First Contact complexity bands and first assigned linkage levels are 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

For a complete description of adaptive delivery procedures, see Chapter 4 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017). For a summary of student adaptive routing during the spring 2019 administration, see Chapter 4 of the *2018–2019 Technical Manual Update—Science* (DLM Consortium, 2019).

Following the spring 2021 administration, analyses were conducted to determine the mean percentage of testlets that adapted up a linkage level, stayed at the same linkage level, or adapted down a linkage level from the first to second testlet administered for students within a grade band or course and complexity band. The aggregated results can be seen in Table 4.3.

For the majority of Pennsylvania students across all grade levels who were assigned to the Foundational Complexity Band by the First Contact survey, testlets did not adapt to a higher linkage level after the first assigned testlet (ranging from 53% to 60%). The majority of students assigned to Complexity Band 3 across all grade levels did not adapt down to a lower linkage level after the first assigned testlet (ranging from 61% to 76%). Most students across all grade levels in Band 1 adapted up to a higher linkage level (ranging from 55% to 75%). Consistent patterns were not as apparent for students who were assigned Complexity Band 2. Further investigation is needed to evaluate reasons for these different patterns. For a description of previous findings, see Chapter 4 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017), and the *2016–2017 Technical Manual Update—Science* (DLM Consortium, 2018a).

Table 4.3

*Adaptation of Linkage Levels Between First and Second Science Testlets (*N = *5,687)*

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 (%)
3–5	40.5	59.5	75.1	24.9	22.7	46.8	30.5	61.0	39.0
6–8	39.8	60.2	58.2	41.8	35.9	43.1	21.0	68.5	31.5
9–12	47.4	52.6	55.1	44.9	43.6	37.2	19.2	75.7	24.3

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

4.2.4. Administration Incidents

As in all previous years, testlet assignment during the spring 2021 assessment window was monitored for evidence that students were correctly assigned to testlets. Administration incidents that have the potential to affect scoring are reported to state education agencies in a supplemental Incident File. No incidents were observed during the spring 2021 assessment window. Assignment of testlets will continue to be monitored in subsequent years to track any potential incidents and report them to state education agencies.

4.3. Implementation Evidence

This section describes evidence collected during the spring 2021 operational implementation of the DLM alternate assessment. The categories of evidence include a description of Kite system updates and survey data relating to user experience, remote assessment administration, and accessibility.

4.3.1. Kite System Updates

Several updates were made to the Kite system during 2020–2021 to improve its functionality. A new Student Roster and First Contact Survey Status extract was created to provide testing readiness information in one place. The roster includes the current grade in which the student is enrolled, all subjects in which the student is rostered, and the student's First Contact survey status and completion date. A majority of the pages in Educator Portal that include tables were reorganized to take advantage of the horizontal space. All tables in Educator Portal were updated to a standard user interface. An update was made to the user interface by having users first enter roster information; roster name and subject, as well as roster location; state, district, and school. Lastly, the voice generator used to create the spoken audio for text to speech on all testlets was updated to a more lifelike voice at a standard reading speed.

4.3.2. User Experience With the DLM System

User experience with the spring 2021 assessments was evaluated through the spring 2021 survey, which was disseminated to all teachers who had a student rostered for DLM assessments. As in previous years, the survey was distributed to teachers in Kite Student Portal, where students completed assessments. Each student was assigned a survey for their teacher to complete. The survey consisted of four blocks. Blocks A and C, which provide information used for the validity argument and information about teacher background, respectively, are administered in every survey. Block B is spiraled, and teachers are asked about one of the following topics per survey: accessibility, relationship to ELA instruction, relationship to mathematics instruction, or relationship to science instruction. Block N was added in 2021 to gather information about educational context during the COVID-19 pandemic.

A total of 1,993 teachers from Pennsylvania responded to the survey (with a response rate of 62%) about 3,856 students' experiences.

Participating Pennsylvania teachers responded to surveys for a median of 1 student. Pennsylvania teachers reported having an average of 9 years of experience in science and 10 years of experience with students with significant cognitive disabilities. The median response to the number of years of experience in science was 7 years, and the median experience with students with significant cognitive disabilities was 9 years. Approximately 8% indicated they had experience administering the DLM science assessment in all six operational years.

The following sections summarize user experience with the system, remote assessment administration, and accessibility. Additional survey results are summarized in Chapter 9 (Validity Studies). Survey results pertaining to

the educational experience of students during the COVID-19 pandemic are described by Accessible Teaching, Learning, and Assessment, Systems (Accessible Teaching, Learning, and Assessment Systems [ATLAS], 2021). For responses to the prior years' surveys, see Chapter 4 and Chapter 9 in the respective technical manuals (DLM Consortium, 2019, 2020).

4.3.2.1. Educator Experience

Survey respondents 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 teachers to respond on a 4-point scale: *strongly disagree, disagree, agree,* or *strongly agree*. Responses are summarized in Table 4.4.

Nearly all Pennsylvania teachers (86%) agreed or strongly agreed that they were confident administering DLM testlets. Most respondents (73%) agreed or strongly agreed that the required test administrator training prepared them for their responsibilities as test administrators. Most teachers also responded that they had access to curriculum aligned with the content that was measured by the assessments (80%) and that they used the manuals and the Educator Resources page (89%).

Table 4.4

Teacher Responses Regarding Test Administration

	SD		D		A		SA		A+SA	
Statement	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
I was confident in my ability to deliver DLM testlets	38	2.8	160	11.8	753	55.4	409	30.1	1,162	85.5
Required test administrator training prepared me for the responsibilities of a test administrator	80	5.9	285	21.0	732	53.9	261	19.2	993	73.1
I have access to curriculum aligned with the content measured by DLM assessments	64	4.7	204	15.0	815	60.1	274	20.2	1,089	80.3
I used manuals and/or the DLM Educator Resource Page materials	41	3.0	111	8.2	872	64.1	337	24.8	1,209	88.9

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

4.3.3. Remote Assessment Administration

Two questions on Block N of the survey asked test administrators where their student took assessments this year, and if the student took any tests remotely (i.e., at a location other than school but with a trained test administrator present), what their remote testing experience was like. As a reminder, the DLM policy on virtual assessment administration required an in-person test administrator, but that administration was not required to occur in school. Table 4.5 summarizes teacher responses regarding the setting of test administration. Most teachers (93%) responded

that DLM assessments were administered to the student at school. Table 4.6 summarizes teachers' responses about the experience of students who took DLM assessments remotely. Of the students who took assessments remotely, very few (14%; 2% of all students) used different accessibility supports than they would normally have access to, experienced technology difficulties, had to respond in a less preferred response mode, and/or had someone other than the teacher administer the assessments remotely (e.g., paraeducator or other qualified test administrator).

Table 4.5

Teacher Responses Regarding Administration Setting

Setting	*n*	%
At school	3,481	93.0
At home	91	2.4
Testing facility not at school	20	0.5
Other	20	0.5
Not applicable	129	3.4

Table 4.6

Teacher Responses Regarding Circumstances Applicable to Remote Testing

Circumstance	Yes (%)	No (%)	Unknown (%)
Student used different accessibility supports when testing remotely than at school	87 (14.3)	468 (76.7)	55 (9.0)
Student experienced technology difficulties during assessments taken remotely	80 (12.0)	533 (80.3)	51 (7.7)
Student had to respond in a less preferred response mode because of remote arrangements	64 (9.9)	534 (82.5)	49 (7.6)
Someone other than the teacher administered the assessments remotely	31 (4.5)	616 (90.1)	37 (5.4)

4.3.4. Accessibility

Accessibility supports provided in 2020–2021 were the same as those available in previous years. The *DLM Accessibility Manual* (DLM Consortium, 2021c), 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 4.7 shows selection rates for the three categories of accessibility supports. The most commonly selected supports were spoken audio, human read aloud, 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 4.7

Accessibility Supports Selected for Pennsylvania Students (N = *5,831)*

Support	*n*	%
Supports provided in Kite Student Portal		
Spoken audio	3,101	53.2
Magnification	1,008	17.3
Color contrast	568	9.7
Overlay color	242	4.2
Invert color choice	204	3.5
Supports requiring additional tools/materials		
Calculator	2,287	39.2
Individualized manipulatives	1,338	22.9
Single-switch system	281	4.8
Alternate form - visual impairment	142	2.4
Two-switch system	63	1.1
Uncontracted braille	10	0.2
Supports provided outside the system		
Human read aloud	4,498	77.1
Test administrator enters responses for student	2,628	45.1
Partner assisted scanning	274	4.7
Sign interpretation of text	92	1.6
Language translation of text	43	0.7

Pennsylvania teachers were asked whether the student was able to effectively use available accessibility supports and whether the accessibility supports were similar to the ones used for instruction. The majority of teachers agreed that students were able to effectively use accessibility supports (94%).

Of the teachers who reported that their student was unable to effectively use the accessibility supports (6%), the most commonly reported reason was that the student could not provide a response even with the support provided (41%). These data are shown in Table 4.8.

Table 4.8

Reason Student Was Unable to Effectively Use Available Accessibility Supports

Reason	*n*	%
Even with support, the student could not provide a response	48	41.0
The student needed a support that wasn't available or allowed	33	28.2
The student was unfamiliar with the support	21	17.9
The student refused the support during testing	11	9.4
There was a technology problem (e.g., KITE display, AAC device)	6	5.1

4.3.5. Data Forensics Monitoring

During the spring 2021 administration, two data forensics monitoring reports were made available in Educator Portal. The first report includes information about testlets completed outside of normal business hours. The second report includes information about testlets that were completed within a short period of time.

The Testing Outside of Hours report allows state education agencies to specify days and hours within a day that testlets are expected to be completed. Each state can select its own days and hours for setting expectations. For example, a state could elect to flag any testlet completed outside of Monday through Friday from 6:00 a.m. to 5:00 p.m. local time. The Testing Outside of Hours report then identifies students who completed assessments outside of the defined expected hours. Overall, 319 (1%) science testlets were completed outside of the expected hours by 275 (5%) students in Pennsylvania.

The Testing Completed in a Short Period of Time report identifies students who completed a testlet within an unexpectedly short period of time. The threshold for inclusion in the report was testlet completion time of less than 30 seconds. The report is intended for state users to identify potentially aberrant response patterns; however there are many legitimate reasons a testlet may be submitted in a short time period. Overall, 600 (1%) testlets were completed in an short period of time by 366 (6%) students in Pennsylvania.

4.4. Conclusion

During the spring 2021 administration, the DLM system was available during two testing windows: an optional instructionally embedded window and the spring window. Administration evidence was collected in the form of administration time data and adaptive delivery results. Implementation evidence was collected in the form of teacher survey responses regarding user experience, remote assessment administration, accessibility, and Personal Needs and Profile selections. New data forensics monitoring reports were made available to state education agencies in Educator Portal.

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 summary of the psychometric model that underlies the DLM assessment system and modeling evidence from the 2020–2021 year, see Chapter 5 of the *2020–2021 Technical Manual Update—Science* (DLM Consortium, 2021b).

For a complete description of the psychometric model used to calibrate and score the DLM assessments, including 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 *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

6. Standard Setting

The standard setting process for the Dynamic Learning Maps® (DLM®) Alternate Assessment System in English language arts (ELA) and mathematics derived cut points for assigning students to four performance levels based on results from the 2014–2015 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. Assessment 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. Technical Manual updates provide a description of data files, score reports, and results for each corresponding academic year.

This chapter presents Pennsylvania-specific Spring 2021 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 2021. Finally, this chapter describes updates made to score reports during the 2020–2021 operational year. For a complete description of score reports and interpretive guides, see Chapter 7 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

In this chapter we describe the results that were reported as part of the 2020–2021 assessment administration. However, due to the confounding factors of assessment administration changes and COVID-19, these results should be interpreted with caution and should not be directly compared to previous assessment administrations.

7.1. Impacts to Assessment Administration

The 2020–2021 school year was significantly impacted by COVID-19. Overall, participation in DLM assessments across all states was lower than what would typically be expected. This decrease was not uniform across demographic subgroups. White students made up a larger percentage of the student population in 2020–2021 than in prior years, whereas African American students, students of Hispanic ethnicity, and English learners made up a smaller percentage of the student population. There were also fewer students who were placed in the Foundational and Band 3 complexity bands, which are used to determine the starting linkage level in each subject (see Chapter 4 of this manual for a description of linkage level assignment). Further, data from the spring teacher survey indicated that students may have had less opportunity to learn, and that many students experienced difficulty with remote learning.

For a complete discussion of student performance and the potential impacts of assessment administration changes and COVID-19, see ATLAS (2021).

7.2. Student Participation

During spring 2021, assessments were administered to 5,688 students in Pennsylvania. The assessments were administered by 2,705 educators in 1,533 schools and 642 school districts.

Table 7.1 summarizes the number of students assessed in each grade and course. More than 1,950 students participated in each of the elementary (grades 3–5) and the middle school (grades 6–8) grade bands.[1] In high school (grades 9–12) almost 1,800 students participated. The differences in high school grade-level participation can be traced to differing state-level policies about the grade(s) in which students are assessed.

[1] 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 7.1

*Student Participation by Grade or Course (*N = *5,688)*

Grade	Students (*n*)
3	*
4	1,961
5	12
6	*
7	11
8	1,931
11	1,754
12	*

* These data were suppressed because *n* < 10.

Table 7.2 summarizes the demographic characteristics of the students who participated in the spring 2021 administration. The majority of participants were male (68%) and white (64%). About 5% of students were monitored or eligible for English learner services.

Table 7.2

*Demographic Characteristics of Participants (*N = *5,688)*

Subgroup	*n*	%
Gender		
Male	3,845	67.6
Female	1,843	32.4
Race		
White	3,663	64.4
African American	1,011	17.8
Two or more races	806	14.2
Asian	185	3.3
American Indian	15	0.3
Native Hawaiian or Pacific Islander	*	*
Alaska Native	*	*
Hispanic ethnicity		
No	4,991	87.7
Yes	697	12.3
English learner (EL) participation		
Not EL eligible or monitored	5,409	95.1
EL eligible or monitored	279	4.9

* These data were suppressed because *n* < 10.

In addition to the spring administration, instructionally embedded science assessments are also made available for teachers to administer to students during the year. Results from the instructionally embedded science 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 science testlet during 2020–2021.

7.3. Student Performance

Student performance on DLM assessments is interpreted using cut points, determined during standard setting, which categorize student results into four performance levels. For a full description of the standard-setting process, see Chapter 6 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017). Additional cut points were set for grade 3 and grade 7 in 2018–2019. For a description of the cut points for those grades, see Chapter 6 of the *2018–2019 Technical Manual Update—Science* (DLM Consortium, 2019). A student's performance level is determined based on the total number of linkage levels mastered across the assessed Essential Elements (EEs).

For the spring 2021 administration, student performance was reported using the same four performance levels approved by the DLM Consortium 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 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 to be meeting achievement expectations.
- The student demonstrates Advanced understanding of and ability to apply targeted content knowledge and skills represented by the EEs.

7.3.1. Overall Performance

Table 7.3 reports the percentage of Pennsylvania students achieving at each performance level from the spring 2021 administration for science. At the elementary level, the percentage of students who achieved at the At Target or Advanced levels ranged from approximately 0% to 15%; in middle school the percentage ranged from approximately 9% to 21%; and in high school the percentage was approximately 19%.

Table 7.3

Percentage of Students by Grade and Performance Level

Grade	Emerging (%)	Approaching (%)	Target (%)	Advanced (%)	Target+ Advanced (%)
3*	*	*	*	*	*
4 (*n* = 1,961)	60.6	24.7	12.0	2.8	14.7
5 (*n* = 12)	91.7	8.3	0.0	0.0	0.0
6*	*	*	*	*	*
7 (*n* = 11)	27.3	63.6	9.1	0.0	9.1
8 (*n* = 1,931)	53.6	25.2	19.1	2.1	21.2
11 (*n* = 1,754)	49.8	31.2	15.6	3.4	19.0
12*	*	*	*	*	*

* These data were suppressed because *n* < 10.

7.3.2. Subgroup Performance

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

Table 7.4

*Science Performance Level Distributions by Demographic Subgroup (*N = *5,688)*

	Emerging		Approaching		Target		Advanced	
Subgroup	*n*	%	*n*	%	*n*	%	*n*	%
Gender								
Male	2,064	53.7	1,020	26.5	638	16.6	123	3.2
Female	1,056	57.3	510	27.7	245	13.3	32	1.7
Race								
White	1,894	51.7	1,021	27.9	640	17.5	108	2.9
African American	610	60.3	252	24.9	126	12.5	23	2.3
Two or more races	479	59.4	205	25.4	104	12.9	18	2.2
Asian	125	67.6	45	24.3	†	†	*	*
American Indian	*	*	*	*	*	*	*	*
Native Hawaiian or Pacific Islander	*	*	*	*	*	*	*	*
Alaska Native	*	*	*	*	*	*	*	*
Hispanic ethnicity								
No	2,714	54.4	1,343	26.9	794	15.9	140	2.8
Yes	406	58.2	187	26.8	89	12.8	15	2.2
English learner participation								
Not EL eligible or monitored	2,959	54.7	1,447	26.8	855	15.8	148	2.7
EL eligible or monitored	161	57.7	83	29.7	†	†	*	*

* These data were suppressed because $n < 10$.
† These data were complementarily suppressed.

7.3.3. Linkage Level Mastery

As described earlier in the chapter, overall performance in each subject is calculated based on the number of linkage levels mastered across all EEs. Results indicate the highest linkage level the student mastered for each EE. The linkage levels are (in order): Initial, Precursor, and Target. A student can be a master of zero, one, two, or all three linkage levels, within the order constraints. For example, if a student masters the Precursor level, they also master the Initial linkage level. 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 level mastered.

Table 7.5 reports the percentage of Pennsylvania students who mastered each linkage level as the highest linkage level across all EEs for each grade. For example, across all fifth-grade EEs, the Initial level was the highest level that

students mastered 33% of the time. The percentage of students who mastered as high as the Target linkage level ranged from approximately 17% in grade five to 64% in grade seven.

Table 7.5

Students' Highest Linkage Level Mastered Across Science EEs by Grade

	Linkage Level			
Grade	No evidence (%)	Initial (%)	Precursor (%)	Target (%)
3*	*	*	*	*
4 (*n* = 1,961)	4.9	36.5	13.1	45.5
5 (*n* = 12)	16.7	33.3	33.3	16.7
6*	*	*	*	*
7 (*n* = 11)	0.0	9.1	27.3	63.6
8 (*n* = 1,931)	4.7	25.0	18.3	51.9
11 (*n* = 1,754)	4.1	24.6	30.7	40.5
12*	*	*	*	*

Note: IP = Initial Precursor; DP = Distal Precursor; PP = Proximal Precursor; T = Target; S = Successor. * These data were suppressed because *n* < 10.

7.4. Data Files

Data files were made available to DLM state education agencies following the spring 2021 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 the subject for all students who completed any testlets. In addition to the GRF, the DLM Consortium delivered 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. Three new special circumstance codes were available in 2020–2021: 1. Student could not test due to COVID-19; 2. Teacher administered the assessment remotely; and 3. Non-teacher administered. 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. For a description of incidents observed during the 2020–2021 administration, see Chapter 4 of this manual.

Consistent with prior delivery cycles, state partners were provided with a two-week review 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 partners submitted final GRFs via Educator Portal. The final GRF was used to generate score reports.

In addition to the GRF and its supplemental files, states were provided with two additional de-identified data files: a teacher survey data file and a test administration observations data file. The teacher survey file provided state-specific teacher survey responses, with all identifying information about the student and educator removed. The test administration observations file provided test administration observation responses with any identifying information removed. For more information regarding teacher survey content and response rates, see Chapter 4 of this manual.

7.5. Score Reports

The DLM Consortium provides assessment results to all member states to report to parents/guardians, educators, and state and local education agencies. Individual Student Score Reports summarized student performance on the assessment by subject. 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 aggregated reports during spring 2021. Changes to the Individual Student Score Reports are summarized below. For a complete description of score reports, including aggregated reports, see Chapter 7 of the *2014–2015 Technical Manual—Year-End Model* (DLM Consortium, 2016).

7.5.1. Individual Student Score Reports

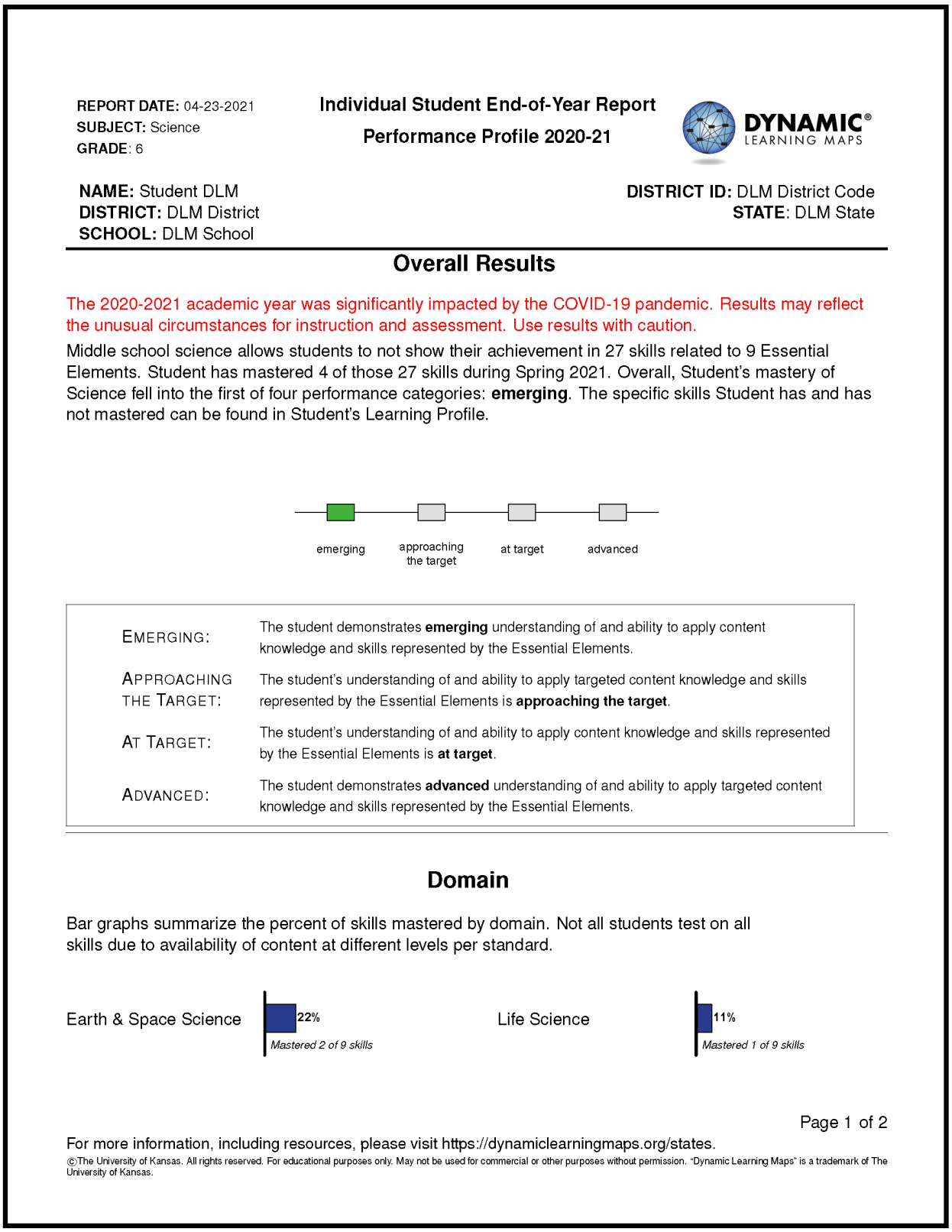
Individual Student Score Reports included a Performance Profile section, which describes student performance in the subject overall. A cautionary statement was added to the 2020–2021 Performance Profile and Learning Profile, which indicated that the 2020–2021 academic year was significantly impacted by the COVID-19 pandemic, and mastery results may have reflected the unusual circumstances for instruction and assessment. For more information on validity considerations and scoring and reporting in flexible scenarios, see (Clark et al., 2021).

EEs were reordered in the table in the Learning Profile to match blueprint order, and the hyperlink for the DLM website's font was increased and moved to the footer before the copyright statement.

A sample Performance Profile and a sample Learning Profile reflecting the 2020–2021 changes are provided in Figure 7.1 and Figure 7.2.

Figure 7.1

Example Page of the Performance Profile for 2020–2021.



REPORT DATE: 04-23-2021
SUBJECT: Science
GRADE: 6

Individual Student End-of-Year Report
Performance Profile 2020-21

DYNAMIC® LEARNING MAPS

NAME: Student DLM
DISTRICT: DLM District
SCHOOL: DLM School

DISTRICT ID: DLM District Code
STATE: DLM State

Overall Results

The 2020-2021 academic year was significantly impacted by the COVID-19 pandemic. Results may reflect the unusual circumstances for instruction and assessment. Use results with caution.

Middle school science allows students to not show their achievement in 27 skills related to 9 Essential Elements. Student has mastered 4 of those 27 skills during Spring 2021. Overall, Student's mastery of Science fell into the first of four performance categories: **emerging**. The specific skills Student has and has not mastered can be found in Student's Learning Profile.

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.

Domain

Bar graphs summarize the percent of skills mastered by domain. Not all students test on all skills due to availability of content at different levels per standard.

Earth & Space Science — 22% — *Mastered 2 of 9 skills*

Life Science — 11% — *Mastered 1 of 9 skills*

Page 1 of 2

For more information, including resources, please visit https://dynamiclearningmaps.org/states.

Figure 7.2

Example Page of the Learning Profile for 2020–2021.

REPORT DATE: 04-23-2021
SUBJECT: Science
GRADE: 6

Individual Student End-of-Year Report
Learning Profile 2020-21

NAME: Student DLM
DISTRICT: DLM District
SCHOOL: DLM School

DISTRICT ID: DLM District Code
STATE: DLM State

The 2020-2021 academic year was significantly impacted by the COVID-19 pandemic. Results may reflect the unusual circumstances for instruction and assessment. Use results with caution.

Student's performance in middle school science Essential Elements is summarized below. This information is based on all of the DLM tests Student took during Spring 2021. Student was assessed on 8 out of 9 Essential Elements expected in middle school science. Student was assessed on 3 out of 3 Domains expected in middle school science.

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.

	Level Mastery		
Essential Element	1	2	3 (Target)
SCI.EE.MS.PS1-2	Identify change	Gather data on properties before and after chemical changes	Interpret data on properties before and after chemical changes
SCI.EE.MS.PS2-2	Identify ways to change motion	Investigate and identify ways to change motion	Investigate and predict changes in motion
SCI.EE.MS.PS3-3	Identify objects or materials that minimize thermal energy transfer	Investigate objects/materials and predict changes in thermal energy transfer	Refine a device to minimize or maximize thermal energy transfer
SCI.EE.MS.LS1-3	Recognize major organs	Model how organs are connected	Make a claim about how organ structure and function support survival
SCI.EE.MS.LS1-5	Match organisms to habitats	Identify factors that influence growth of organisms	Interpret data to show environmental resources influence growth
SCI.EE.MS.LS2-2	Identify food that animals eat	Classify animals based on what they eat	Identify producers and consumers in a food chain

Levels mastered this year | No evidence of mastery on this Essential Element | Essential Element not tested

Page 1 of 2

This report is intended to serve as one source of evidence in an instructional planning process. Results combine all item responses from the full academic year. Because your child may demonstrate knowledge and skills differently across settings, the estimated mastery results shown here may not fully represent what your child knows and can do.

For more information, including resources, please visit https://dynamiclearningmaps.org/states.

7.6. Quality Control Procedures for Data Files and Score Reports

Changes to the quality control procedures were made only to the extent of accommodating the revised score reports for spring 2021 (i.e., checking to be sure changes were correctly and consistently applied). For a complete description of quality control procedures, see Chapter 7 in the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

7.7. Conclusion

Following the spring 2021 administration, six data files were delivered to state partners: GRF, special circumstance code file, exited students file, incident file, teacher survey data file, and test administration observations file. No incidents were observed during the 2020–2021 administration, so an incident file was not needed. Overall, between 0% and 21% of Pennsylvania students achieved at the At Target or Advanced levels across all grades and subjects. However, these results should be interpreted with caution due to the confounding factors of assessment administration changes and COVID-19. Lastly, minor changes were made to score reports to aid in interpretation.

8. Reliability

The Dynamic Learning Maps® (DLM®) Alternate Assessment System uses nontraditional psychometric models (i.e., 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 summary of the methods used to estimate reliability and reliability evidence from the 2020–2021 year, see Chapter 8 of the *2020–2021 Technical Manual Update—Science* (DLM Consortium, 2021b).

For a complete description of the simulation-based methods used to calculate reliability for DLM assessments, including the psychometric background, see Chapter 8 of the *2015–2016 Technical Manual—Science* (DLM Consortium, 2017).

9. Validity Studies

Evidence in support of the overall validity argument for results produced by the Dynamic Learning Maps® (DLM®) Alternate Assessment System is summarized in the chapters of the *2020–2021 Technical Manual Update—Science* (DLM Consortium, 2021b) and the other annual technical manual updates (DLM Consortium, 2017, 2018a, 2018b, 2019, 2020). For a description of additional evidence collected during 2020–2021 for two of the five critical sources of evidence (i.e., evidence based on test content and response process), as described in the *Standards for Educational and Psychological Testing* (American Educational Research Association et al. [AERA et al.], 2014), see Chapter 9 of the *2020–2021 Technical Manual Update—Science* (DLM Consortium, 2021b).

10. Training and Professional Development

For a description of the optional professional development available for the Dynamic Learning Maps® (DLM®) Alternate Assessment System during 2020–2021, see Chapter 10 of the *2020–2021 Technical Manual Update—Science* (DLM Consortium, 2021b).

For a complete description of facilitated and self-directed training and professional development 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).

11. Conclusion and Discussion

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 sixth operational administration year in 2020–2021. The chapters of the *2020–2021 Technical Manual Update—Science* (DLM Consortium, 2021b) provide updated evidence from the 2020–2021 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 11 of the *2020–2021 Technical Manual Update—Science* (DLM Consortium, 2021b) 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).

12. References

Accessible Teaching, Learning, and Assessment Systems. (2021). *2020–2021 DLM administration during COVID-19: Participation, performance, and educational experience* (Technical Report No. 21-02). University of Kansas.

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (2014). *Standards for educational and psychological testing*.

Clark, A. K., Thompson, J. W., Kobrin, J., Kavitsky, E., & Karvonen, M. (2021). *The Impact of COVID-19: Validity Considerations and Scoring and Reporting in Flexible Scenarios*. University of Kansas, Center for Accessible Teaching, Learning, and Assessment Systems.

DLM Consortium. (2021a). *Test Administration Manual 2020–2021*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.

Dynamic Learning Maps Consortium. (2016). *2014–2015 Technical Manual—Year-End Model*. University of Kansas, Center for Educational Testing and Evaluation.

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. (2020). *2019–2020 Technical Manual Update—Science*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.

Dynamic Learning Maps Consortium. (2021b). *2020–2021 Technical Manual Update—Science*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.

Dynamic Learning Maps Consortium. (2021c). *Accessibility Manual 2020–2021*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.

Dynamic Learning Maps Consortium. (2021d). *Educator Portal User Guide*. University of Kansas, Accessible Teaching, Learning, and Assessment Systems.

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.