



Development of the Dynamic Learning Maps® Essential Elements for Science

The Dynamic Learning Maps® (DLM®) Essential Elements for science are statements of knowledge, skills, and understandings (KSUs) linked to grade-band expectations in general education. A set of Essential Elements for science was developed in 2014 with input from five DLM partner states that initiated the DLM science assessment project (DLM Science Consortium, 2015), targeting only priority areas in the multidimensional *Framework for K–12 Science Education* (National Research Council [NRC], 2012; referred to here as the *Framework*) and *Next Generation Science Standards* (NGSS; NGSS Lead States, 2013). Beginning in 2019, with input from more than 15 DLM partner states that now use DLM science assessments and with advice from the DLM Technical Advisory Committee, DLM staff developed a revised and expanded set of Essential Elements to cover additional breadth of the dimensions in the *Framework* and NGSS. This set included 84 draft Essential Elements that were iteratively developed and reviewed by stakeholders, including state representatives, from March 2022 to September 2023 as described in the following table.



Stage	Development	Timeline
1	<p>Essential Elements created by DLM staff and reviewed internally</p> <ul style="list-style-type: none"> DLM staff used the <i>Framework</i> and NGSS grade-band end points to identify KSUs within the content and practices at reduced depth, breadth, and complexity. DLM staff organized the KSUs for the disciplinary core ideas (DCI) into 14 DCI families, then combined these with one or more science and engineering practices (SEP) to create draft Essential Elements. These were developed for four grade bands (K–2, 3–5, 6–8, and 9–12) based on the <i>Framework</i> end points being defined by grade band. The draft Essential Elements underwent internal review by ATLAS staff with expertise in alternate assessment design, extended content standards, science academic content, accessibility and instruction for students with significant cognitive disabilities, and Universal Design for Learning (CAST, 2018). Revision based on internal review feedback resulted in an initial set of 75 draft Essential Elements, grouped in three domains (life science, Earth and space science, and physical science) for external review. 	March 2022– September 2022
2	<p>Face-to-face review by educators and state and district staff</p> <ul style="list-style-type: none"> Panels included at least one panelist in each of three roles: state education agency representatives, science content experts, or special education population experts. Forty panelists from 17 states participated in the review. Panelists evaluated the Essential Elements in terms of accessibility, alignment, complexity, and progression across grade bands. 	October 2022



Stage	Development	Timeline
3	<p>Essential Elements revised by DLM staff based on reviewer feedback</p> <ul style="list-style-type: none"> DLM staff implemented revisions to improve scientific accuracy, alignment to the <i>Framework</i> dimensions, horizontal alignment across domains, and vertical alignment across grade bands. Nine additional Essential Elements were created to fill gaps that were identified by panelists or emerged as other revisions were implemented. DLM staff identified one or more crosscutting concepts (CCCs) that related to the DCI-SEP intersection defined for each Essential Element. The final set of 84 revised Essential Elements were reviewed by DLM staff with special education expertise to ensure the revisions maintained or improved accessibility relative to the original drafts. 	November 2022–April 2023
4	<p>Final state partner review of revised Essential Elements</p> <ul style="list-style-type: none"> State partners reviewed the set of 84 Essential Elements in advance of the DLM Governance Board meeting. DLM staff provided a proposed list of 26 Essential Elements for the science assessment blueprint. 	May 2023–June 2023
5	<p>DLM Governance Board meeting presentation and discussion of proposed Essential Elements</p> <ul style="list-style-type: none"> The 84 Essential Elements and proposed blueprint were approved by consensus of participating states. 	July 2023
6	<p>Final revision of Essential Elements based on state partner feedback</p> <ul style="list-style-type: none"> Minor wording changes to five of the 84 Essential Elements were implemented following state partner review to improve clarity. An additional blueprint for high school biology was proposed for states with that requirement. 	July 2023–September 2023