Learning Pathway Development for Assessments

NCTM 2024 Research Conference

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Accessible Teaching, Learning, & Assessment Systems

Assessment and Alignment

- In an education system, alignment is that its components are in line with the same learning expectations for students (Martone & Sireci, 2009).
- Alignment of assessments to grade-level teaching and learning goals, as well as curriculum, is important (National Council of Teachers of Mathematics, 2023).
- Assessment needs to be a part of an assessment system (Jimenez & Modaffari, 2021).

Need of effective models for assessments aligned to grade-level learning targets

Assessment and Learning Model

- Learning progressions in science education are proposed for:
  - designing and developing assessments with student learning research (Smith et al., 2006)
  - scaffolding formative assessment practices (Furtak, 2012)
- Learning trajectories in mathematics education are used in:
  - organizing curriculum and designing diagnostic assessments (Confrey et al., 2017)

Use of learning models as an understructure for an assessment system

Pathways for Instructionally Embedded Assessment (PIE)

- PIE is a four-year Competitive Grants for State Assessments (CGSA) project funded by the U.S. Department of Education.
  - leading by the Missouri Department of Elementary and Secondary Education (DESE), in partnership with the Accessible Teaching, Learning, and Assessment Systems (ATLAS), the University of Kansas
  - aiming to build a prototype assessment system by using cognitive learning models, known as learning pathways, aligned with learning targets addressed in the project lead state's 25 content standards in grade 5 mathematics (see Missouri DESE, 2021, for the content standards)

Learning Pathway

- Learning pathways is a research-based cognitive model.
  - drawing on existing ideas from the literature:
    - Confrey et al.'s (2017) ideas in linking learning trajectories to grade-level content standards
    - Furtak's (2012) ideas about the learning progression construct: "intermediate and lower-anchor ideas could help teachers identify what students know and inform them in determining the best path forward" (p. 1184)
  - representing hypothetical progressions of learning towards grade-level content standards' learning targets in three pathway levels (Kim et al., 2024)

Educator Review

- As they were built using existing literature, draft learning pathways were planned to be reviewed by educators (see Clark & Karvonen, 2021; Confrey, 2019; Dynamic Learning Maps [DLM] Consortium, 2016, for the expert review ideas).
- Guiding questions for the educator review of 25 draft learning pathways were:
  1) Are the learning pathways aligned to the intended target standards, delineated at an appropriate grain size and distinct from the preceding and/or succeeding levels, and described using clear and accurate language?
  2) Do the structures of the learning pathways follow a logical progression?
  3) How do reviewers perceive the learning pathway review process and procedures?

Methods: Leaning Pathway Development

- Learning pathway development process consisted of five steps (Kim et al., 2024).
  - adapting current development procedures of learning maps (Bechard et al., 2021; DLM Consortium, 2016; Swinburne Romine et al., 2018)
  - conducting the process in order of:
    - identifying knowledge, skills, and understandings targeted by the content standards
    - constructing learning trajectories through literature synthesis
    - validating the learning pathway construct using other learning models (DLM Consortium, 2016; Kingston & Broaddus, 2017)
    - drafting learning pathways and pathway levels
    - collecting educator feedback

Methods: Review Practice Activity Learning Pathway Map

Learning Pathway Map

PIE.5.GM.D.8

Mathematics

Geometry and Measurement (GM)

Grade 5

This document provides (a) the target grade-level content standard; (b) three levels of a learning pathway aligned with the learning target; (c) the knowledge, skills, and understandings associated with each level; and (d) a map view of the full learning pathway.

Learning Target

5.GM.D. Solve problems involving measurement and conversions within a measurement system.

8. Convert measurements of capacity, length, and weight within a given measurement system.

Learning Pathway in Three Levels

The learning pathway presents three vertical levels that consist of knowledge, skills, and understandings that build toward and meet the learning target. **Level 1** represents emerging concepts and skills related to the learning target. **Level 2** represents concepts and skills approaching the learning target. **Level 3** represents the learning target and aligns with the grade-level content standard.

Level 1
Recognize relative magnitudes of measurement units.

↓

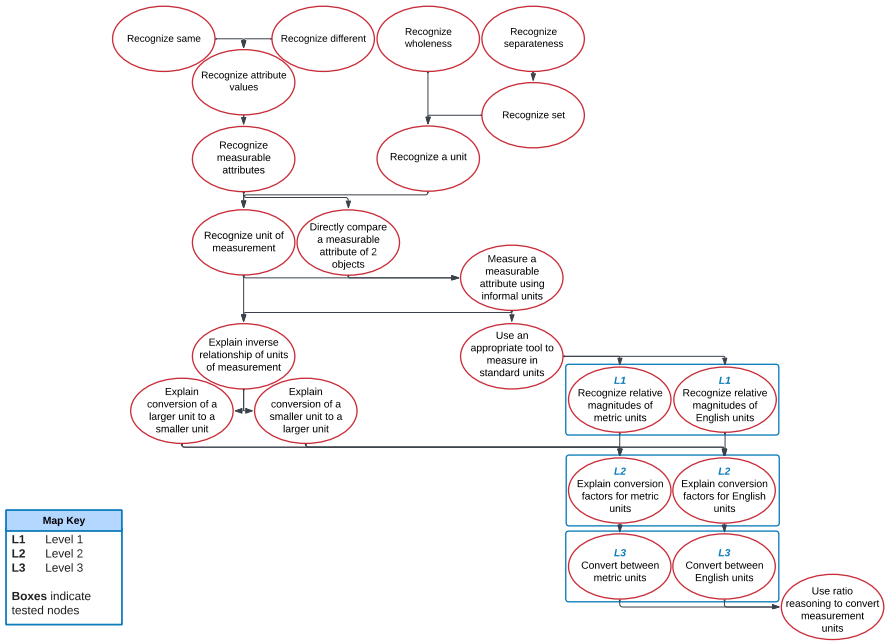
Level 2
Explain conversion factors for measurement units.

↓

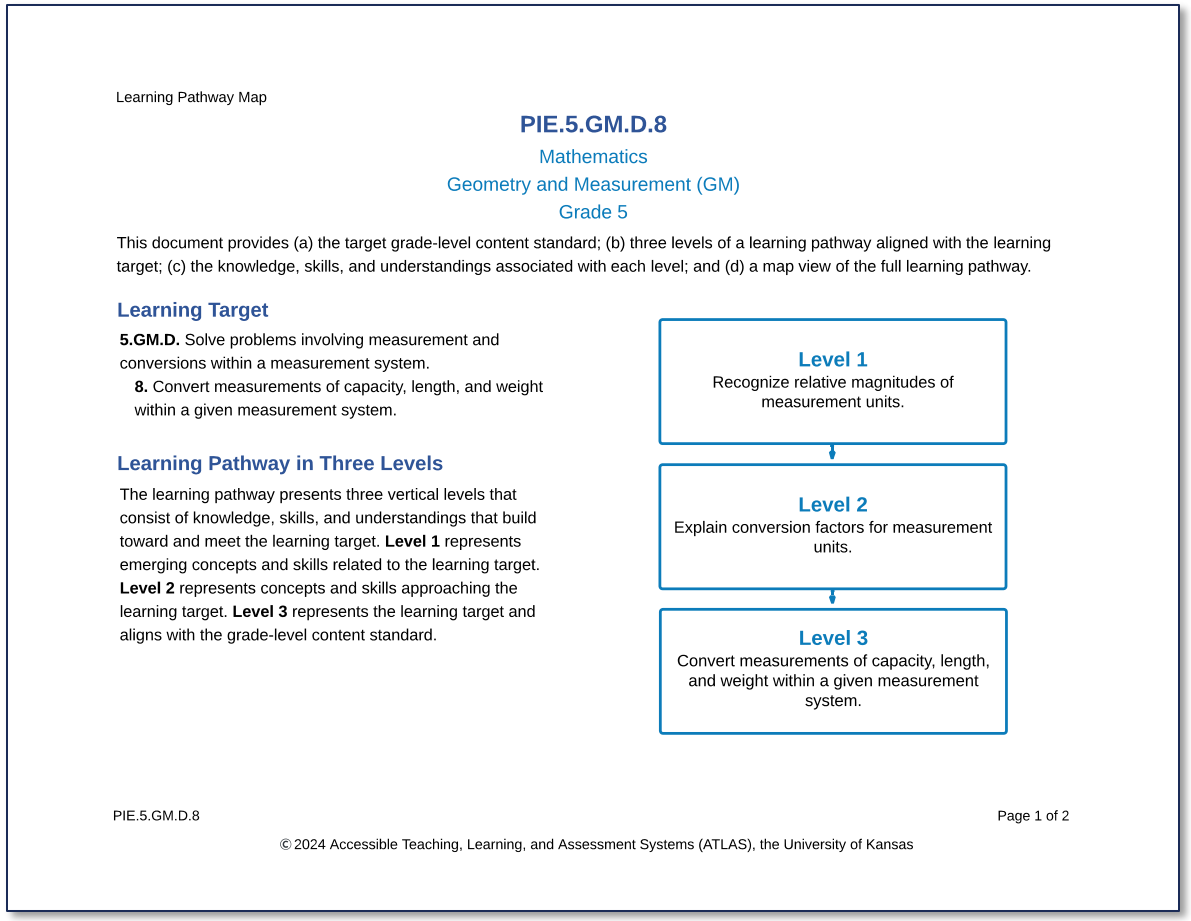
Level 3
Convert measurements of capacity, length, and weight within a given measurement system.

Learning Pathway Map

PIE.5.GM.D.8 Learning Pathway Map View



Methods: Review Practice Activity Learning Pathway Map (Cont'd)



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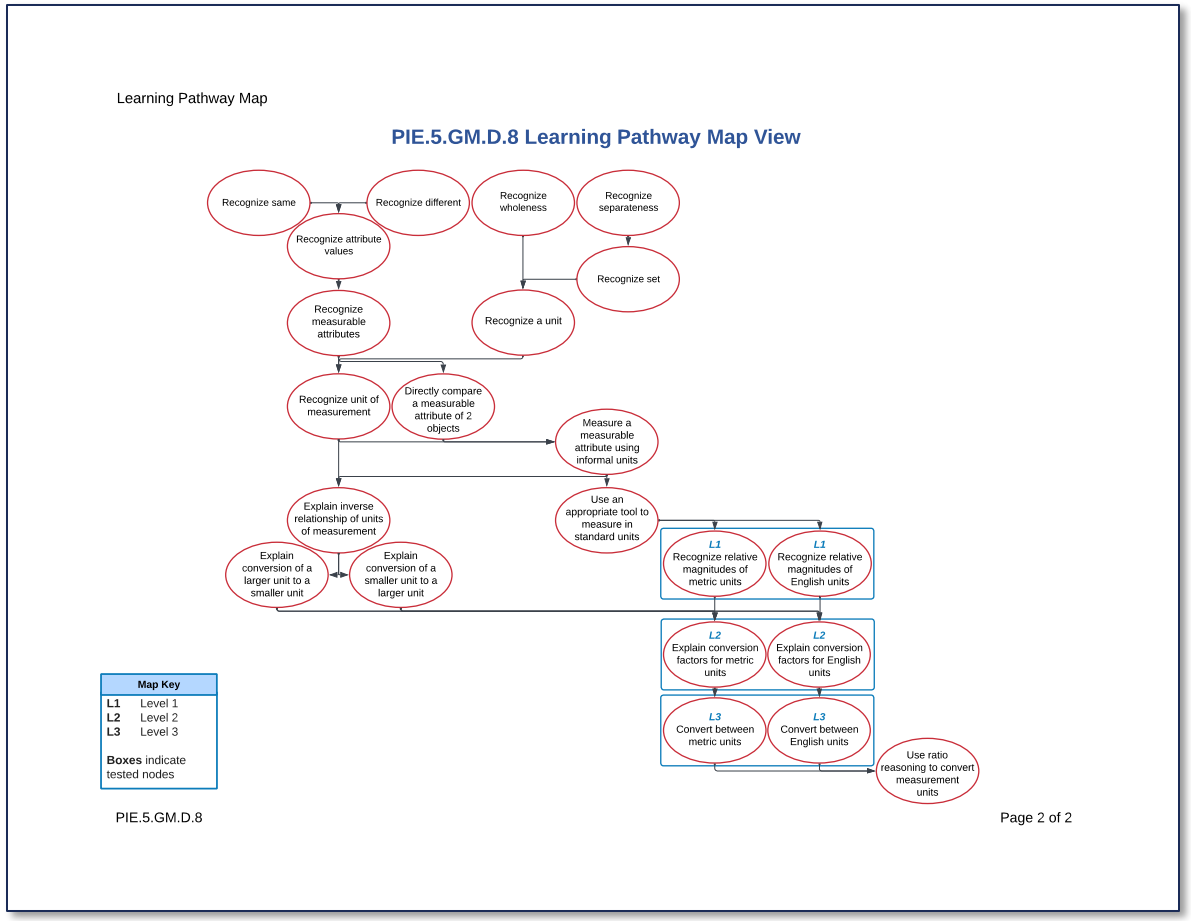
PIE.5.GM.D.8 Page 1 of 2

- Front page content
  - target standard (Missouri DESE, 2021)
  - level characteristic description (Kim et al., 2024)
  - three pathway level statements

Methods: Review Practice Activity Learning Pathway Map (Cont'd)



- Second page content
  - a map view of learning pathway
    - concepts and skills (ovals)
    - relationships between concept and skills (arrows)
    - three levels (rectangles)

Methods: Educator Review Event

- Educator review was an on-site, two-day review event held in a Midwest state (Kim et al., 2024).
  - eight educators recruited from two Midwest states
    - having mathematics teaching experience from two to 26 years (a median year of 15.5)
    - conducting the review process, adapted from Swinburne Romine et al. (2018), in order of:
      - reviewing research synthesis
      - examining learning pathway maps
      - making individual ratings against review criteria
      - discussing as a group for revision recommendations
    - completing a feedback survey

Methods: Review Criteria

- Educators used five review criteria (Kim et al., 2024).
  - adapting the criteria used in learning map development and review (DLM Consortium, 2016; DLM Science Consortium, 2017; Swinburne Romine et al., 2018)
  - consisting of:
    - three content review criteria: alignment, size, and clarity
    - two structure review criteria: consistency and progression

Results: Collected Educator Feedback

- Regarding 75 pathway levels from 25 learning pathways, a significant amount of educator feedback was obtained (Kim et al., 2024).
  - counting the number of levels (feedback counts)
    - flagged and given revision recommendations
    - not flagged, but given additional refinement suggestions
  - collecting, in total, 108 educator feedback:
    - 25 (33.3%) alignment, 12 (16.0%) size, and 35 (46.7%) clarity content feedback
    - 7 (9.3%) consistency and 29 (38.7%) progression structure feedback

Results: Pathway Levels That Met Review Criteria

- For 75 pathway levels from 25 learning pathways, reviewers considered (Kim et al., 2024):
  - 53 (70.7%), 63 (87.5%), and 43 (57.3%) pathway levels to meet the alignment, size, and clarity content criteria, respectively
  - 70 (93.3%) and 51 (68.0%) pathway levels to meet the consistency and progression structure criteria, respectively

Results: Survey Outcomes

- In the feedback survey, participants indicated (Kim et al., 2024):
  - review training components to be either very or somewhat effective (8 responses)
  - practice review activity to be the most important training resource (5 responses)
  - review process quality to be either very satisfied or satisfied (7 responses)
  - strong agreement or agreement with the review rating confidence statement (7 responses)
  - strong agreement or agreement with the overall review experience value statement (8 responses)

Discussion

- Practical implications:
  - improving learning pathway content and structure and educator review procedures
- Potential implication:
  - using learning pathways in building “a shared and accessible knowledge base” (Confrey, 2019, p. 5)
- Further discussion:
  - When thinking of formative assessment in the classroom as “a dynamic pedagogical process between students and teachers” (Duckor et al., 2017, p. 336), in what ways can learning pathways aid instructional practices, responding to individual student’s thinking (see Furtak, 2012)?

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The work reported here is supported by a grant from the U.S. Department of Education, which is funded through Competitive Grants for State Assessments, for the Pathways for Instructionally Embedded Assessment under Grant No. S368A220019. Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the author(s) and do not necessarily reflect the views of the U.S. Department of Education and Competitive Grants for State Assessments.

THANK YOU!

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