

BEYOND CONTENT PREPARING STUDENTS TO SOLVE, COMMUNICATE, AND LEAD WITH PRACTICE PATHWAYS

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This brief provides instructional coaches and teachers in established Project Based Learning schools, with the grounding needed to explain why focusing on disciplinary practices through Practice Pathways supports deeper student learning and guidance on incorporating these practices into unit and project design.

Making the Case for the Practice Pathway

*Across grade levels and content areas, educators are expected to develop students' disciplinary practices, such as problem-solving, communication, modeling, research, and argumentation, alongside disciplinary content. These disciplinary skills often surface when outlining an ideal graduate and mirror many of the skills employers seek, especially in the age of increased generative AI usage. Yet these practices often receive less intentional attention than primary content standards during instructional planning. Across all curricula, standards that possess these skills exist but are often pushed aside to favor the subject-specific curriculum. To reach our ideal graduates, we must give students experience with and feedback on these skills. **Practice Pathways address this challenge by making disciplinary practices an intentional design element rather than an incidental outcome of instruction.***

*Practice Pathways were developed as a core component of the Project-Based Learning (PBL) Planning Pyramid Framework (DiMaria et al., 2026) to ensure that students intentionally engage with disciplinary practices in PBL projects. **A Practice Pathway is a deliberately designed sequence of learning experiences that provides students with repeated opportunities to develop, apply, reflect on, and refine a disciplinary practice throughout a PBL project or can also be applied to any instructional unit.** While educators often focus on content standards, the Practice Pathway addresses how students engage with that learning. Without a structured pathway, engagement with disciplinary practices—such as modeling, argumentation, or data analysis—can be left to chance or treated as isolated activities. The Practice Pathway ensures these skills are cultivated with increasing complexity and ownership throughout a project or instructional unit.*

Building a Case through the Principles

Building through principles to design a Practice Pathway creates a sustainable integration of Practice Pathways into existing unit or project plans (DiMaria et al., 2026).

Principle 1

Center disciplinary practices in the service of meaningful, authentic, purpose.

Research across mathematics, science, and project-based learning suggests that students develop deeper, more equitable disciplinary understanding when teachers intentionally connect what students learn (content) with how students use knowledge (disciplinary practices) through coherent, scaffolded learning pathways. The National Research Council (2012) framework argues that students should not only learn scientific ideas but also participate in the practices scientists use to develop and apply knowledge.

In practice this looks like:

Intentionally choosing a key practice connected to the learning goal

- Modeling
- Analyzing evidence
- Constructing explanations
- Solving problems
- Using tools strategically

Resource to Explore

[Reinvigorating STEM with Project-Based Learning Toolbox for Secondary Educators](#)

Principle 2

Plan for repeated opportunities to engage with and refine the practice with the material.

Research shows that students build deep understanding when they have multiple opportunities to engage with important ideas and practices over time. Sircar et al. (2024) explain that a Practice Pathway intentionally sequences opportunities for students to “iteratively build their use” of important disciplinary practices throughout a project—not just demonstrate them once in a final product. Rather than saving the application for the end of a unit, students build expertise through repeated participation in the discipline’s authentic work.

In practice this looks like:

- creating multiple moments for students to revisit important ideas and practices throughout a unit
- building checkpoints where students revise their thinking, explanations, models, or solutions
- Having students revisit the same way of thinking multiple times with new content, contexts, or challenges

Resource to Explore

[Science and Math Project-Based Learning: Finding Balance of Content Standards, Disciplinary Practices, and Elements of Project-Based Learning](#)



While these disciplinary practices are not entirely new, they demand a high level of intentionality.

Teachers should recognize that although this may seem like familiar work they already do, the real impact comes from purposefully and strategically planning instruction to systematically enhance students' proficiency in these practices.

Principle 3

Make student thinking visible and support them in naming their growth.

Learning becomes visible when students have repeated opportunities to explain how they think, justify their decisions, question ideas, and revise their understanding with others. Research on collaborative learning shows that when students make their thinking visible through questioning, explaining, justifying ideas, and reflecting with peers, they engage in metacognitive practices that help them monitor and deepen their understanding (Hurme, Palonen, & Järvelä, 2006). Making student thinking visible also supports equitable participation by positioning students as capable contributors whose ideas, reasoning, and experiences are valuable resources for collective learning (Bartell et al., 2017).

Principle 4

Design with students' identities, assets, and experiences in mind.

Students need access to the practices, conversations, identities, and ways of thinking valued in the discipline. Simply setting high expectations without attending to students' experiences can reproduce existing inequities (Bartell et al., 2017; Apple, 1992). Culturally relevant teaching positions students' cultural knowledge and experiences as assets for learning, supporting students in developing academic success, strengthening their identities as capable learners, and using disciplinary knowledge to examine and engage with the world around them (Ladson-Billings, 1995; Ladson-Billings, 2014). When students have opportunities to make meaningful decisions, explore questions, and bring their perspectives into learning, projects move beyond completion of assignments toward authentic participation.

In practice this looks like:

- creating opportunities for students to document their thinking on a poster
- using mini whiteboards to write out their problem-solving processes
- using rubrics to reflect on how their ideas develop
- helping students see not only what they learned but how their ability to think and work within the discipline has grown over time

Resource to Explore

[Help Students Monitor and Reflect on Their Learning – Social Regulation of Learning Primer \(Digital Promise\)](#)

In practice this looks like:

- drawing on students' lived experiences in lesson and unit planning
- positioning students as capable contributors
- valuing multiple ways of reasoning and communicating
- connecting disciplinary work to real-world questions

Resource to Explore

[Teaching STEM in Ways that Respect and Build Upon Indigenous Peoples' Rights](#)

Practice Pathways are Not	Practice Pathways Are
 An add-on	 Multiple opportunities embedded in an existing unit
 A separate initiative	 Enriching disciplinary content by engaging students in the work of the discipline
 A full curriculum overhaul	 A strategic implementation of existing standards
 About replacing content instruction	 Enhancing content instruction
 Require teachers to change everything at once	 Allows shifts in emphasis throughout a unit

Summary Table of Practice Pathways

How to Get Started

The following is an overview of how to begin planning for Practice Pathways. Intentionally planning for disciplinary practices requires you to know the practice standards and the extent to which your students will engage with a practice at their current grade level.

Prework

1. **Refresh yourself with the language of the practices in your content area.** In Common Core State Standards (CCSS) they are the Standards for Mathematical Practice, in Next Generation Science Standards (NGSS) they are the Science and Engineering Practices, and in the Texas Education Knowledge Standards (TEKS) they are represented as process standards.
2. **Identify the level of proficiency appropriate for your students to attain over the course of the year.** This may occur through more formal vertical alignment of practice standards or individually by reflecting on the language of the standard and your context.

By understanding your standards, you can set measurable growth targets for your students.

Get Started

The following process is reflective of the suggested path described in the PBL Planning Pyramid framework:

1. **Select Standards and Duration:** Choose a bundle of standards and select a Priority Practice for your specified project. As described by DiMaria, Madis, and Orr, a Priority Practice is the one practice you will choose to scaffold and assess over the course of your project.
2. **Unpack Your Priority Practice:** Identify the specific parts of the practice you will support students in growing for the duration of this project.
3. **Inventory Student Assets:** Inventory the assets and prior knowledge students bring to the project.
4. **Priority Opportunities:** Identify and plan multiple ways for students to engage with the practice across the project and key checkpoints (moments of accountability).
5. **Feedback Opportunities:** Identify and plan ways students will receive feedback after engaging with the practice throughout the project.

Keep in mind the principles for planning a Practice Pathway as you build out the experiences for students to engage with and receive feedback from. The next section will share an example of how this may look in planning, while not exhaustive, it offers a visual of the process.

Planning Example

The following example outlines a family budgeting project for Algebra 1 with the selected TEKS process standard of *1D: Communicate mathematical ideas, reasoning, and their implications using multiple representations*.

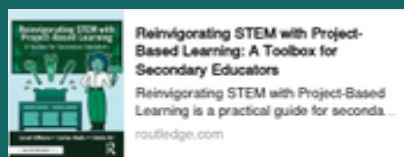
Step 1: Select Standards & Duration	Use your pacing guide or other tools to select a bundle of content standards and duration for the project: (2.5 weeks) A.2 Linear Relationships • A.2A – Determine and analyze proportional relationships. • A.2B – Represent proportional relationships in multiple ways. • A.2C – Write equations that model linear situations. • A.2D – Interpret and analyze linear relationships in context. A.3 Linear Functions • A.3A – Determine whether a relation is linear from tables, graphs, equations, and verbal descriptions. • A.3B – Represent linear functions in multiple forms. • A.3C – Determine slope and interpret rate of change. • A.3D – Use slope to compare and analyze linear relationships. • A.3E – Write, graph, and interpret linear equations in different forms. <i>*** TEKS language has been abbreviated for document length. In practice it is recommended to put the full language of the standard in your planning document.</i>
Step 2: Unpack a Priority Practice	Choose a Priority Practice to grow students in during this project. Copy the exact language below: (1) Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to: (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate

Step 3: Inventory Student Assets	Generate a list of assets your current students bring to this unit and practice: • Unpack knows/need to knows of a given problem • Basic multiplication and addition skills • Solving one variable equation • Question asking • Graphing skills • Understanding of mathematical symbols • Use of tools: calculator, white boards, rulers Based on your specific students, what aspects of this practice would you like to see grow over the duration of this unit? • Students can communicate slope in context from tables and graphs. • Students can describe a given equation in terms of its application. • Students can reason with linear models. • Students can create general equations to form multiple representations.
Step 4: Practice Opportunities	Generate a list of tasks and activities that allow students to engage in the Priority Practice. Use the checkpoints below to consider how these activities support the Priority Practice; the list is not intended to be exhaustive. • Checkpoint 1: Draft budget model ◦ Table/graph/equation workshop ◦ Group budget research document with estimated costs ◦ Workshop: modeling and describing equations • Checkpoint 2: Final budget model with visuals ◦ Table/graph/equation group task ◦ Project equation description sheet (individual) ◦ Desmos Representations Lab • Checkpoint 3: Financial proposal ◦ Representation description partner task ◦ Practice presentations and notecards
	Review your list of tasks and activities. Select specific moments where students will receive feedback explicitly around their growth in the Priority Practice: • Student Self Assessment after: ◦ Table/Graph/Equation Workshop • Teacher Check In after: ◦ Group Budget Research Document with estimated costs • Student Partner Reflection at end of: ◦ Representation Description Partner Task • Teacher written feedback after: ◦ Representation Description Partner Task

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