

The vision of the Dana Center Mathematics Pathways (DCMP) model is aligned with national perspectives in mathematics education.

The DCMP's guiding standards and instructional strategies, course structure, and course content are aligned with the following standards and recommendations created and adopted by the professional mathematics and statistics communities:

- *Adding It Up, Helping Children Learn Mathematics*, National Research Council (NRC, 2001)
- *Beyond Crossroads, Implementing Mathematics Standards in the First Two Years of College*, American Mathematical Association of Two-Year Colleges (AMATYC, 2006)
- *2004 CUPM Curriculum Guidelines*, Mathematical Association of America (MAA, 2004)
- *2015 CUPM Curriculum Guidelines*, Mathematical Association of America (MAA, 2015)
- *Guidelines for Assessment and Instruction in Statistics Education (GAISE) College Report*, American Statistical Association (ASA, 2005, 2016)
- *Common Core State Standards for Mathematics, Standards of Mathematical Practice*, Council of Chief State School Officers (CCSSO, 2010)
- *Principles and Standards for School Mathematics*, National Council of Teachers of Mathematics (NCTM, 2000)
- *Texas College and Career Readiness Standards*, Texas Higher Education Coordination Board and Texas Education Agency (2009)

Introduction

It is tempting to think of the individual courses as equivalent to the discrete courses in traditional developmental and gateway mathematics programs, especially since the first introductory course is actually shared between the pathways. However, the concept of the pathway as a yearlong experience is critical to the DCMP because these courses are *designed* to articulate in a way that gives students the experience of learning mathematics and/or statistics through coherent, consistent structures, and practices.

The design standards outlined in this document set the guidelines for how the curricular materials for individual DCMP courses will be designed to support that coherent experience for students. They serve both an inward-facing purpose and outward-facing purpose. Internally, the standards will be used by developers to build the curricular materials and by reviewers to ensure that the materials are true to the DCMP vision. Externally, they communicate the DCMP vision for curriculum development to the field.

Note: The numbering in the description of the design standards does not indicate the level of importance.

Standard I: Structure and Organization of Curricular Materials

The DCMP is organized around big mathematical and statistical ideas and concepts as opposed to skills and topics.

1. A primary goal of the curriculum is the development of conceptual understanding and strategies for problem solving.
 - a. This goal is accomplished through curricular materials that actively engage students in learning.
 - b. Proficiency with mathematical and statistical tools, while important, is secondary to this primary goal.
2. The DCMP reconceptualizes traditional course structure around major areas of focus as evidenced by a nontraditional table of contents.
3. Major areas of focus emphasize relationships between topics.
 - a. The curricular materials do not consist of a sequence of isolated discrete topics.
 - b. The curricular materials provide multiple opportunities to revisit important concepts with a variety of instructional strategies and contextual settings. Related concepts are connected and spiraled throughout the materials.

Standard II: Active Learning

The DCMP is designed to actively involve students in doing mathematics and statistics, analyzing data, constructing hypotheses, solving problems, reflecting on their work, and learning and making connections.

Class activities provide regular opportunities for students to actively engage in discussions and tasks using a variety of different instructional strategies (e.g., small groups, class discussions, interactive lectures).

1. Class activities support the development of a “culture of learning” over time (i.e., a safe environment in which students value learning; mistakes and perseverance are valued as learning opportunities; students actively support one another’s learning).
2. Instructor supports provide guidance and advice about implementing various instructional strategies that involve students in active learning of mathematics and statistics. While recognizing that lecture is one instructional tool, every class session should have some time devoted to active-learning tasks. The time spent on such tasks and the methods used to support active learning are determined by the lesson objectives.
3. Out-of-class work provides opportunities for instructors to encourage students to discuss course assignments and concepts with the instructor and/or one another. Individual tasks utilize strategies for supporting active learning such as building on previous experiences from the course and asking students to apply skills in new contexts.

Standard III: Constructive Perseverance

The DCMP supports students in developing the tenacity, persistence, and perseverance necessary for learning mathematics.

1. The curricular materials provide opportunities for students to explore challenging mathematical and statistical situations and to be constructively perseverant.
2. The curricular materials develop skills for independent learning by scaffolding lessons to provide opportunities for mastery experiences and increasing the level of challenge over time.
3. The curricular materials include instruction and information about the role of struggle in learning.
4. The curricular materials provide opportunities for students to self-monitor, evaluate, and reflect on their learning.
5. The instructor supports provide advice and guidance on how to support constructive perseverance.

Standard IV: Problem Solving

The DCMP supports students in developing problem-solving skills, and students apply previously learned skills to solve nonroutine and unfamiliar problems.

1. The curricular materials regularly present tasks that require students to find or develop a solution method.
2. The curricular materials regularly provide tasks that allow for multiple strategies and solution methods. Different solutions are provided for instructors.
3. Classroom activities provide opportunities to share and discuss different solution methods.
4. Lessons are designed such that the instructor models the learning process by using different strategies (e.g., showing solutions with errors or exploring various solution strategies).
5. Instructor supports provide advice and guidance on how to encourage and support students to explore and use multiple solution methods.

Standard V: Context and Interdisciplinary Connections

The DCMP presents mathematics and statistics in context and connects mathematics and statistics to various disciplines.

1. The curriculum uses real data whenever possible.
2. Applications are realistic. While problems from complex contexts may sometimes have to be modified to support a learning objective, the DCMP avoids using word problems that are artificially contrived.

3. The curricular materials use problems from various academic disciplines and programs that are (a) appropriate to the student population and to the programs of study and (b) aligned with a given pathway. For example, curriculum writers and instructors might use problems from courses or careers related to a pathway (e.g., a problem from a social science course in the statistics pathway).

Standard VI: Use of Terminology

The DCMP uses discipline-specific terminology, language constructs, and symbols to intentionally build mathematical and statistical understanding and to ensure that terminology is not an obstacle to understanding.

1. New concepts are introduced in a way that builds bridges between course content and students' experiences and knowledge base. Informal contextual descriptions precede more formal definitions.
2. The curricular materials include intentional instruction around clarification of the use of mathematical and statistical terminology and symbols, especially those used in different contexts or different disciplines (e.g., terminology such as *estimate* and *function*; symbols such as parentheses and the notation for multiplication).
3. Instructor support materials provide advice and guidance on strategies and techniques to support developing proficiency with terminology, language constructs, and symbols.
4. Students actively engage in communicating (verbally and in writing) mathematical ideas in the classroom and in assignments using appropriate terminology.

Standard VII: Reading and Writing

The DCMP develops students' ability to communicate about and with mathematics and statistics in contextual situations appropriate to the pathway.

1. The curricular materials provide students with opportunities to discuss, analyze, and think critically about mathematics and statistics in authentic texts or relevant publications (e.g., newspapers, journals) to evaluate information and make informed decisions.
2. The curricular materials require students to write about mathematics and statistics. Writing tasks take two general forms:
 - a. Writing about mathematical concepts to deepen understanding (e.g., "Explain why taking 15% of a number and then a second 15% of the result is not the same as taking 30% of the original number").
 - b. Authentic, contextual writing tasks that require the use of mathematical or statistical concepts (e.g., writing a brief paper that explains the meaning of the results of a statistical study).
3. Activities are scaffolded to support students in developing the required reading and writing skills. Advice and guidance for instructors are included.

Standard VIII: Technology

The DCMP uses technology to facilitate active learning by enabling students to directly engage with and use mathematical concepts. Technology should support the learning objectives of the lesson. In some cases, the use of technology may be a learning objective in itself, as in learning to use a statistical package in a statistics course. The DCMP assumes the following access to technology:

1. Students have access to calculators. The appropriate type of calculator is determined for each course.
2. Instructors have access to computers, the internet, and projectors in the classroom.
3. Students have access to computers and the internet outside of the classroom.

The DCMP Design Standards were developed by the DCMP Curricular Design Team:

Richelle (Rikki) Blair, Lakeland Community College (OH)
 Rob Farinelli, College of Southern Maryland (MD)
 Amy Getz, Charles A. Dana Center (TX)
 Roxy Peck, California Polytechnic State University (CA)
 Sharon Sledge, San Jacinto College (TX)
 Paula Wilhite, North Texas Community College (TX)
 Linda Zientek, Sam Houston State University (TX)

DCMP Learning Goals

The following five learning goals apply to all DCMP mathematics courses, with the complexity of problem-solving skills and use of strategies in increasing as students advance through the pathways. For each course, we define the ways that the learning goals are applied and the expectations for mastery.

- **Communicative Goal:** Students will be able to interpret and communicate quantitative information and mathematical and statistical concepts using language appropriate to the context and intended audience.
- **Problem Solving Goal:** Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them.
- **Reasoning Goal:** Students will be able to reason, model, and make decisions with mathematical, statistical, and quantitative information.
- **Evaluation Goal:** Students will be able to critique and evaluate quantitative arguments that utilize mathematical, statistical, and quantitative information.
- **Technology Goal:** Students will be able to use appropriate technology in a given context.