Frameworks for Mathematics and Collegiate Learning

Course Essentials

Dana Center Mathematics PATHWAYS

For faculty using the DCMP *Frameworks* materials **June 2014**

The *Frameworks for Mathematics and Collegiate Learning* course curricular materials are intended as a tool for faculty members implementing a learning frameworks course at their institution, especially faculty implementing the Dana Center Mathematics Pathways. The DCMP *Frameworks* authors developed this *Course essentials* resource to support instructors as they modify or deepen activities to meet the needs of their students.

The *Frameworks* course is designed to meet the following criteria set forth in the Texas *Academic Course Guide Manual* (ACGM) for the cross-listed Psychology 1300 and Education 1300 course:

> A study of the 1) research and theory in the psychology of learning, cognition, and motivation, 2) factors that impact learning, and 3) application of learning strategies. Theoretical models of strategic learning, cognition, and motivation serve as the conceptual basis for the introduction of college-level student academic strategies.
>
> Students use assessment instruments (e.g., learning inventories) to help them identify their own strengths and weaknesses as strategic learners. Students are ultimately expected to integrate and apply the learning skills discussed across their own academic programs and become effective and efficient learners. Students developing these skills should be able to continually draw from the theoretical models they have learned.

This course is designed to provide faculty with flexibility regarding what to teach and when. Several of its components, however, are crucial to ensuring the course still meets the ACGM criteria for a college-credit-level course. Some components are integral to supporting students who are pursuing an academic pathway in the Dana Center Mathematics Pathways curricular model.

These two criteria—meeting the ACGM requirements and speaking to the needs of the students enrolled in developmental math—inform the guiding questions addressed by this *Course essentials* resource:

- **Which *Frameworks* course components support the defining features of a learning frameworks course?**
- **Which *Frameworks* course components are essential in light of the role the course plays in the DCMP curricular model?**

We hope that this resource, in conjunction with other DCMP curricular resources, will help you personalize the course as you use these materials with your own students.

Additional DCMP materials and resources (available on the Dana Center Mathematics Pathways Resource Site) that provide context for this *Essentials* resource include:

- The DCMP's four guiding principles[1]
- The DCMP curriculum design standards[2]
- *Frameworks for Mathematics and Collegiate Learning* pillars[3]
- *Frameworks for Mathematics and Collegiate Learning* course introduction, learning outcomes, course overview, and annotated bibliography of selected research that informs the course.[4]

This resource includes selected quotations from experienced *Frameworks* course instructors who shared their thoughts on ways to improve the materials and support instructors using these materials for the first time.

We hope that their thoughts, extensions, and modifications of the activities—as reflected in their comments—are useful to you as you make your own modifications based on your students' needs.

Which *Frameworks* course components support the defining features of a learning frameworks course?

What are the defining features of a learning frameworks course?

The *Frameworks* course meets the Texas ACGM criteria for a learning frameworks course (PSYC 1300/EDUC 1300).

In an important piece on learning frameworks courses, Greg Hodges, Carol Dochen, and De Sellers (2001) note that other student success courses focus on orienting students to campus resources and services, adjusting to college life, or building study skills, but **learning frameworks courses engage students in a study of the theoretical perspectives on knowledge acquisition**.

They go on to describe some distinguishing characteristics of learning frameworks courses, including the following:

- Course material is grounded in research and theory from psychology and the learning sciences.
- Study of learning theory is a basis for the development of individual learning strategies.
- Integration of skills and knowledge from cognitive, affective, and behavioral psychology helps students develop strategies for persisting in their coursework and adapt those

[1] The DCMP's four guiding principles are described here: https://dcmathpathways.org/dcmp/dcmp-model.

[2] The DCMP's eight curriculum design standards are described here: https://dcmathpathways.org/resources/curriculum-design-standards-selected-supporting-research-annotated-bibliography.

[3] The DCMP's *Frameworks for Mathematics and Collegiate Learning* course's four pillars (or themes) are described here: https://dcmathpathways.org/resources/dcmp-frameworks-mathematics-and-collegiate-learning-selected-supporting-research.

[4] These *Frameworks* course materials can be accessed here: https://dcmathpathways.org/resources/dcmp-frameworks-mathematics-and-collegiate-learning-course-materials.

strategies as appropriate for different contexts.

How are these defining features represented in Frameworks?

The following activities represent the lessons in which specific theories are discussed and opportunities to apply that theory are provided. Since theory and application are critical elements of a frameworks course, both are included here. Specific theories include:

- Carol Dweck's[5] theory of intelligence
- Albert Bandura's social learning theory (including self-efficacy)
- Bernard Weiner's attribution theory of motivation and emotion
- Paul Pintrich's and Barry Zimmerman's models of self-regulation, including John Flavell's work on metacognition
- The information processing model (IPM) of learning influenced by George Miller and others.

You may choose to integrate an additional learning theory; removing or resequencing one of the following activities, however, could disrupt the coherent flow of the core material. The course is structured to follow Kurt Lewin's model of change. That is, early lessons focus on helping students "unfreeze" any existing beliefs and behaviors that could hinder their learning. The course then moves on to building student understanding and providing opportunities for them to apply new learning, and then on to helping them deepen understanding and solidify connections by engaging with the course content in new ways that helps the new learning "stick."

Based on these learning theories and the requirements for a learning frameworks course as laid out in the ACGM, these lessons and activities are not about memorizing lists of techniques or study skills; rather, they are explicitly designed first to support *Frameworks* students' intellectual engagement with theories (e.g., how the brain stores understanding into long-term memory) and second, to identify and practice strategies that leverage this understanding.

For greatest fidelity to the *Frameworks* course design, we recommend that the following lessons be implemented in the order they appear in the course materials. These lessons cover the theoretical contexts for the course and are designed to dovetail together.

Lesson	Why it's essential	Veteran *Frameworks* faculty say
Lesson 3: The plastic brain and smart thinking	Lesson immediately challenges long-held beliefs (e.g., "I'm not smart enough to succeed in math") by demystifying intelligence. Lesson then begins the study of how the brain	*Students were amazed at what they learned about the brain. "Your plastic brain" was extremely beneficial along with the discussion about "fixed intelligence." I think it set the stage for alleviating some of their "self-fulfilled prophesies" about their abilities and capabilities to conquer math!"* *This lesson is an essential one, one that must not*

[5] For related citations, see the reference list at the end of this resource.

Lesson	Why it's essential	Veteran *Frameworks* faculty say
	changes during learning.	*be rushed through. . . . There were a lot of group discussions with this lesson.*
Lesson 7:[6] **Building success teams and identifying your impact on the world**	The creation of success teams is critical for students' sense of belonging and mutual support in this course. Goal setting is a key component of learning and motivation theory.	*The flow was great! Discussing self-efficacy and confidence after their first exam was very beneficial. They could then transition into setting achievable goals. Without confidence in themselves and their abilities and capabilities, they would be unable to really internalize and visualize the value of goal setting.*
Lesson 8: Creating motivating goals and the career project	These lessons look at theories of motivation, including beliefs, values, interests, efficacy, attributions, and orientation toward mastery. The launching of the career project provides an appropriate application of the theories of goal setting and motivation that students are learning.	*The exercise with "Herman" and revising the goal based on the SMART goal model was right on point. They were then able to conduct their own expansion goal activity more seriously.* *Establishing long-term goals and SMART goals is essential to building an effective framework for success. Activity 1 was one of my favorite activities! It really helps the students begin to identify what their purpose is.*
Lesson 9: Managing priorities and time	Although time management is a typical "study skill," the *Frameworks* course makes a strong connection between time management and students' personal goals and aspirations.	*Managing priorities and time are essential to college success. This is a very important Lesson and should not be ignored. Activities 1 and 2 (where does the time go and prioritizing, planning, and personal responsibility) are easy to explain to students, and they should not have any problems understanding.* *Activity 3 was a little different. The idea seems simple, but students cannot begin to do this until they can identify where they are losing time. This was a very strong lesson.*

[6] Lesson 7 should take place just as students are taking their first exam in the DCMP's co-requisite *Foundations of Mathematical Reasoning* course.

Lesson	Why it's essential	Veteran *Frameworks* faculty say
Lesson 10: **Metacognition and financial advisor visit**[7]	*Metacognition* is a key idea in learning theory and self-regulation. This lesson provides practical applications in which students can use metacognitive self-regulation.	*Students benefitted from the metacognition regulation process; they referred to this throughout the semester.* *The students had different reactions to the coin challenge. Some loved it. Some hated it. Some solved it quickly, some gave up.*
Lesson 11: **Build a better memory, part I: Attention and deep processing** **Lesson 12:** **Build a better memory, part II: Elaboration and organization strategies**	Students explore cognition and relate various specific study strategies to each strategy's potential to enhance understanding. These activities include specific extensions to connect to students' study of mathematics.	*Activity 2 definitely didn't turn out the way it was supposed to. The "constructing the story" group had the lowest average. But the group with "counting letters and capital letters" actually rewrote the words in order of the number of letters and this helped them remember the words better. Made for great discussion.* *I did make a graph of their averages with 3 trials on the horizontal axis and the number of correct words on the vertical axis. They were amazed at how much those averages rose by adding context. I had the students figure out the average number of correct words within their groups and then they calculated the class averages as well. I did this to make an explicit connection to math content and frameworks concepts.*
Lesson 14: **Critical thinking strategies and questions**	The course is structured and assessed such that students are required to think and respond at high levels of cognition (as defined in, for example, Bloom's Taxonomy). This lesson provides key support while also connecting back directly to the metacognitive strategies discussed in	*The most important concept that was introduced in this lesson was Bloom's Taxonomy. We referred to Bloom's throughout the course since its introduction in Lesson 14. Very important piece of the pie!*

[7] The financial advisor visit should not be considered an essential part of this specific lesson.

Lesson	Why it's essential	Veteran *Frameworks* faculty say
	Lesson 10.	
Lesson 18: Midterm exam debrief	Students lead the whole-class construction of a plan to review and reflect upon their performance on an assignment.	*Relating the debriefing activity to [practices in] other organizations, such as the military or athletic teams, and events helped to personalize this process. I think that the important part of this for students was that we are not assigning blame; we are learning from the experience.*

What about topics that aren't included in the Frameworks *materials?*

You may notice that some topics typically associated with student success courses (e.g., a discussion of learning styles[8]) are not explicitly included within this curriculum. The topics included in the curriculum

- are grounded in empirical evidence for their effectiveness.
- are the most critical to the overall course objectives and corresponding pacing.
- support the other topics.

That said, there are many empirically supported theories that are not included in the *Frameworks* course curriculum due to time constraints.

For example, while *Frameworks* includes many motivational concepts (e.g., discussion of *beliefs* and *mindsets*, *interests*, *self-efficacy*, *locus of control*, *mastery goals*, *attributions*), there are other theories of motivation that you could add to meet the needs of your students. Such additions would fit within the DCMP model, as long as a valid empirical evidence base supports them.

[8] See Pashler, McDaniel, Rohrer, and Bjork (2008) for a review of the literature on the empirical basis for learning styles.

Which *Frameworks* course components are essential in light of the role the course plays in the DCMP curricular model?

In the DCMP curricular model, students complete a common foundational mathematics course before moving on to a college level mathematics course that is aligned to their program of study. Because the *Frameworks* course was designed to support this model, certain of its elements are essential to implementing this model. These elements include:

- Use pedagogical theories that align with the DCMP curriculum design standards.
- Target the needs of developmental math students enrolled in DCMP courses.
- Build a sense of community within the classroom and across campus.
- Support students as they gather evidence to support their mathematics pathway decision.

Use pedagogical theories that align with the DCMP curriculum design standards.	**Veteran *Frameworks* faculty say**
Context: In designing the Dana Center Mathematics Pathways courses, we were motivated by the empirical evidence that learning is a social endeavor and that it involves the development of understanding by connecting new knowledge to currently held knowledge. We also believe that students must be provided a supportive learning community in which discussion, sense making, and reflection—with classmates and individually—are central features. So we do not believe that teaching is telling nor do we believe that students benefit from a series of lessons that help them catalog discrete facts and "tricks" for succeeding in college. These beliefs are guided by current recommendations of professional mathematics associations and leading education researchers. They have been codified in the DCMP's curriculum design standards.[9] **Key:** Use student-centered instructional practices aligned with the DCMP curriculum design standards. As these design standards represent current best practices in teaching and learning, we encourage you to use them for guidance	*My learning was challenged as I found myself teaching the concepts of cooperative learning … Although I had many, many, many, many sleepless nights and weekends, I found teaching DCMP to be a very rewarding experience.* ***

[9] While *Frameworks* is not a mathematics content course, these pedagogical approaches and standards are used in all DCMP courses.

as you modify activities to ensure they support your students.

For many instructors, teaching with these design standards in mind may constitute a shift in approach, since the "control" of the learning is placed in the hands of the student, with the instructor serving as facilitator, rather than as the sole source of knowledge.

Using this *Frameworks* curriculum, your classroom will be noisy, with talking, processing, creating, and other audible (and visible!) signs of student collaboration. The ratio of instructor voice to student voices is reversed from traditional lecture-based courses.

For a detailed discussion of the following DCMP curriculum design standards, please see the DCMP Resource Site:[10]

Standard I: Structure and Organization of Curricular Materials

Standard II: Active Learning

Standard III: Constructive Perseverance

Standard IV: Problem Solving

Standard V: Context and Interdisciplinary Connections

Standard VI: Use of Terminology

Standard VII: Reading and Writing

Standard VIII: Technology

The DCMP curriculum and pedagogy has made me an advocate of cooperative learning—getting students to explain concepts to the others in their group and to the class, promoting positive interdependence yet impressing upon students that they have an individual accountability for learning as well, and promoting interactivity.

How:

While every *Frameworks* lesson contains some of these elements, the following activities are good examples to reference:

- ☐ Lesson 1: Building the foundation for our success; Activity 2: Letting go of fears and anxiety about math
- ☐ Lesson 9: Metacognition; Activity 1: Thinking about thinking
- ☐ Lesson 14: Critical thinking strategies and questions; Activity 3: Bloom's Taxonomy
- ☐ Lesson 16: Where we've been, Where we're going; Activity 1: Connecting course concepts.

Target the needs of developmental math students enrolled in DCMP courses.

Context:

Students enrolled in DCMP, itself a targeted math intervention, tend to enter the classroom with preconceived (and often negative) beliefs about their own capabilities.

[10] The DCMP's eight curriculum design standards are described here: https://dcmathpathways.org/resources/curriculum-design-standards-selected-supporting-research-annotated-bibliography.

Research shows that these negative beliefs in turn negatively affect student academic success and persistence.

Research also shows, however, that given the right environment and instruction, students can reevaluate their self-perceptions and begin to change them.

To construct positive self-perceptions, students need a supportive environment in which to redefine this part of their identity, opportunities to reflect on their beliefs, and opportunities to construct new beliefs about their capabilities.

Key:

Specifically address beliefs about mathematics on the first day of class, acknowledging students' past struggles and successes with math. Discuss how this course will support them as they grow as learners and especially as mathematics learners.

How:

The following *Frameworks* activities are good examples to reference:

☐ Lesson 1: Building the foundation for our success; Activity 2: Letting go of fears and anxiety about math

Context:

The co-requisite *Foundations of Mathematical Reasoning* course is unlike traditional math courses and the difference is evident on Day 1. Students collaborate with one another and the instructor, use real-world data, and are encouraged to see the many possible ways of thinking mathematically, rather than just to apply memorized formulas to solve for "the answer." This environment, a significant shift from their previous experiences, may seem overwhelmingly challenging to students unfamiliar with how to navigate this kind of environment.

Key:

Acknowledge the atypical classroom environment early in the semester as you engage with the *Frameworks* content.

Use specific mathematics references and examples within the *Frameworks* course that support the ways of thinking (not necessarily the mathematical content) that students are learning in the *Foundations* course.

How:

The following *Frameworks* activities are good examples to reference:

☐ Lesson 4: Getting ahead with better note taking: all activities

☐ Lesson 11: Build a better memory part 1: Attention and deep processing; Activities 1 (our complex brains), 2 (the difference between deep and shallow processing) and 3 (making information meaningful)

☐ Lesson 12: Build a better memory part 2: Elaboration and organization strategies; Activities 1 (elaboration and organization strategies), 2 (practice using think-alouds), and 3 (creating flash cards)

Build a sense of community within the classroom and across campus	**Veteran *Frameworks* faculty say**
Context: Learning is a social endeavor. Thus, high-quality interactions among members of the learning community across campus are essential to helping students learn. There is a growing body of evidence demonstrating the effects that other campus community members have on students' persistence and academic achievement in college. For example, student persistence is related to the extent to which students interact with supportive adults on campus, both inside and outside the classroom (Kuh, 2003). Thus, the *Frameworks* curricular materials encourage the fostering of trusting relationships between students and faculty—and with campus personnel outside the classroom. **Key:** Plan for a combination of informal (e.g., visiting offices across campus very briefly to get a feel for the resources available on campus) and formal (e.g., presentations from the academic advisor, career counselor, research librarian) inclusion of specific campus personnel in class activities over the course of the semester. **How:** The *Frameworks* lessons include multiple opportunities for students to engage with faculty and staff from across campus. Some opportunities are more informal (e.g., visiting offices across campus very briefly to get a feel for the resources available on campus) and some are extended work sessions with individuals with whom students should continue working throughout their college careers (e.g., academic advisors, career counselors, research librarians). Experienced *Frameworks* instructors report customizing the following lessons by having some of the interaction via video presentations and some interactions via in-class presentations.	*I shortened the scavenger hunt. Our campus is not that big and too much was spent on it.* ***** *Instructors must customize the scavenger hunt to those resources available on the individual campus. Students respond positively to visits from campus personnel.* ***** *The most beneficial activity was an actual visit to the Career Center and combined presentation from an advisor and a career counselor. Students were confused about their respective roles (advisor and counselor) so this was great! Unfortunately, not all campuses have an actual Career Center. I think it was extremely beneficial for my one class that is*

☐ Lesson 2: Finding the support to be successful: Activity 3 (Introduction to the scavenger hunt) ☐ Lesson 6: Meeting an academic advisor and a career counselor: Activities 1 – 4 ☐ Lesson 10: Metacognition and financial advisor visit; Activity 3 (Visit from financial aid office representative) ☐ Lesson 20: Site visit: Library Resources; Activities 1-3 ☐ Lesson 21: Using library resources and group presentation preparation: Activities 1-2	*held on a campus with a fully functional Center.*

Support students as they gather evidence to support their mathematics pathway decision

Context:

A defining feature of the DCMP model is that all students enroll in and complete a common developmental-level mathematics course (*Foundations of Mathematical Reasoning*) and subsequently enroll in a college-level mathematics course that best serves their career goals.

During this crucial first semester, then, DCMP students will register for a college-level mathematics course. As research shows, students often need help identifying their career goals and gathering information to inform their choices so that they progress in a pathway aligned with their program of study.

Key:

Provide opportunities for students to set goals and gather data about themselves and about possible career paths to inform their pathway selection. It is essential that *Frameworks* students complete a career project.

How:

Some of this discussion happens within the *Foundations of Mathematical Reasoning* mathematics course, but the *Frameworks* course provides many activities to help students identify and become really specific about their beliefs and goal. *Frameworks* also includes activities in which students gather information about academic major and career options.

Specifically, these activities happen in the following *Frameworks* lessons:

☐ Lesson 7: Identifying your impact on the world; Activities 2 (Value of goals) and 3 (Nine boxes)

☐ Lesson 8: Creating motivating goals and the career project; Activities 1 (ensuring that your goals motivate you) and 2 (introduction to the career project)

☐ Lesson 23: Career Project Sharing, Course Planning, And Guest speaker: Activity 2: Planning what courses to take next semester

☐ Career Project*

* In a survey of veteran *Frameworks* faculty, the career project was reported to be one of the

most beneficial activities of the course.

Faculty members have expanded components of the career project to include campus-specific resources (e.g., career-finder applications available for student use).

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About the Dana Center

The Dana Center develops and scales math and science education innovations to support educators, administrators, and policy makers in creating seamless transitions throughout the K–14 system for all students, especially those who have historically been underserved.

We focus in particular on strategies for improving student engagement, motivation, persistence, and achievement.

The Center was founded in 1991 at The University of Texas at Austin. Our staff members have expertise in leadership, literacy, research, program evaluation, mathematics and science education, policy and systemic reform, and services to high-need populations.

For more information

- about the Dana Center Mathematics Pathways, see **www.dcmathpathways.org**
- about the Texas Association of Community Colleges, see **www.tacc.org**

About this *Essentials* document

This document is designed as an additional tool for faculty teaching the Dana Center Mathematics Pathways *Frameworks of Mathematics and Collegiate Learning* course.