

The Five Dimensions of TRU

Dimension 1: The Content

The extent to which classroom activity structures provide opportunities for students to become knowledgeable, flexible, and resourceful disciplinary thinkers. Discussions are focused and coherent, providing opportunities to learn disciplinary ideas, techniques, and perspectives, make connections, and develop productive disciplinary habits of mind.

Students' understanding of a discipline is shaped in fundamental ways by their classroom experience of it. If, for example, a reading class is focused on decoding text, a history class on memorizing dates of major events, or a mathematics class on memorizing procedures, there is little chance that the students in that class will emerge from it with either an appreciation of the discipline or the understandings they need.

Learning to “think like a historian,” or like a scientist, or a practitioner of any discipline, means coming to grips with the concepts and practices of that discipline – approaching phenomena through a disciplinary lens, with a broad spectrum of knowledge and tools at one’s disposal. Historians “place themselves in context” to understand the motivations and actions of historical figures. Writers having a sense of purpose and a sense of audience when writing, as well as relevant factual and grammatical knowledge. Scientists and mathematicians inquire into “what makes things tick,” using reason, equations, representations, and models in the service of sense making. This combination of disciplinary orientations, knowledge (including concepts and tools), practices and habits of mind is what we refer to in shorthand as the “content” of the discipline. Students need to experience that content in its full richness if they are to become disciplinary thinkers.

Every major discipline has produced one or more sets of standards – statements regarding the essential understandings that students should develop. This is not the place to review such documents, but simply to note that if the activities in a classroom do not live up to the relevant disciplinary standards, it is hard to imagine that the students who emerge from that classroom will have a deep sense of the discipline or be able to use their knowledge effectively.

The tools section of this document provides descriptions of tools such as the TRU Conversation and Observation Guides, which offer ways to inquire into and reflect on the richness of the disciplinary content offered to students.

Rich content, however, is just a beginning. The primary idea behind TRU is that what counts in instruction is how students encounter the content – how they are or are not positioned to take advantage of the riches the discipline has to offer. We have all been in classes where, for example, the content was “over our heads” or we failed to connect to it for some reason; no matter how beautiful it may have been, we were lost. That is why dimensions 2 through 5 of the TRU framework – how students themselves experience the discipline – are so important.

Dimension 2: Cognitive Demand

The extent to which students have opportunities to grapple with and make sense of important disciplinary ideas and their use. Students learn best when they are challenged in ways that provide room and support for growth, with task difficulty ranging from moderate to demanding. The level of challenge should be conducive to what has been called “productive struggle.”

If students are given work that is too easy, there is little for them to learn – and, they are likely to be bored or frustrated. If students are given work that is too distant from their current understandings and they can see no pathways to progress, then there is no pathway to learning; they are likely to be bored or frustrated as well. As Stein and Smith (1998) put it, “Tasks that ask students to perform a memorized procedure in a routine manner lead to one type of opportunity for student thinking; tasks that require students to think conceptually and that stimulate students to make connections lead to a different set of opportunities for student thinking.” The challenge is to find tasks and classroom activities, in every discipline, that are framed in ways that provide students with meaningful opportunities for learning and that support their growth through active engagement with the content.

Researchers use the term “cognitive demand” to describe the level of difficulty, relative to what they know, of the work that students are asked to engage in. The goal is to find a middle ground, where students have opportunities to build on what they know and stretch their current understandings. In order to make sense of rich content, students need to engage in “productive struggle” (Stein and Smith, 1998; Hess, 2006). One broad schema for thinking about different levels of challenge is Webb’s (1997, 2002) Depth-of-Knowledge (DOK) framework, which identifies four levels of DOK: Recall & Reproduction, Skills & Concepts, Strategic Thinking & Reasoning, Extended Thinking (see also Hess, 2013). At various times, students need to engage at all of these levels.

When students experience difficulty dealing with complex issues there is a tendency for teachers to reduce cognitive demand, and thus to deprive the students of opportunities for productive struggle and sense making (Henningesen and Stein, 1997). The challenge for instruction in all disciplines is to provide clarifications and other support (e.g., heuristic advice, raising issues, suggesting approaches) without telling students precisely what to do. This is by no means easy (but see Dimension 5, *formative assessment*).

There are many ways that teachers can initiate cognitively demanding activities in the classroom, and work to maintain appropriate levels of cognitive demand. For example,

- In designing and selecting tasks, teachers can avoid providing detailed step-by-step instructions for solving problems, repetitive exercises, or detailed “recipes” for completing tasks that allow little room for students to build on their current understandings.
- Teachers can actively support students in individual work, group work, and whole class discussions by asking clarifying questions and providing scaffolds, instead of moving directly to suggesting overly specific ways to go about assigned tasks.

- Teachers can employ a range of techniques to support students in “getting their ideas on the table” and working through them. See, for example, SERP (2016) on academically productive talk.
- Teachers can encourage students’ productive struggle in a general way by discussing ideas of malleable intelligence and a growth mindset (Dweck, 2007), making it clear that learning is not a matter of memorization, and that one gets better at any discipline by working hard at it.

See the “tools” section of this document for access to resources related to cognitive demand.

Here we note briefly connections to the other dimensions of TRU. As noted above, “productive struggle” is the mechanism for developing deep understanding of the content (Dimension 1). It is essential for all students (Dimension 3), not only for meaningful participation but so that students engage with the content in ways that they come to “own” it and develop positive disciplinary identities (Dimension 4). And, the best way to arrange for students to be working at the right levels of challenge is to make their thinking publicly accessible, so instruction can “meet them where they are” in order to support their moving forward (Dimension 5).

Dimension 3: Equitable Access to Content

The extent to which classroom activity structures invite and support the active engagement of all of the students in the classroom with the core disciplinary content being addressed by the class. Classrooms in which a small number of students get most of the “air time” are not equitable, no matter how rich the content: all students need to be involved in meaningful ways.

Equitable classrooms provide *all* students access to meaningful disciplinary concepts and practices, supporting those students in developing their own understandings and building productive disciplinary identities.

This dimension, *Equitable Access to Content*, focuses on the question of whether, within the classroom, there is differential access to the content being addressed. There may be rich discussions or other productive activities taking place – but, who participates in those discussions or activities?

There is a long history of differential achievement by students from varied racial, ethnic, and economic backgrounds, which, it has been argued, can be tied to differential access to opportunities to learn (Oakes, Joseph, & Muir, 2001). While one obvious source of this differential access is tracking, which is outside of the scope of a classroom improvement efforts, another is the pattern of discourse within classrooms. Do all students have frequent opportunities to discuss important ideas? In *How Schools Shortchange Girls* (American Association of University Women, 1992), for example, research revealed a pattern of boys being called upon far more often than girls. Moreover, when girls were called upon, they were often asked questions that were less conceptually oriented than the questions that were asked of boys. What opportunities do English language learners have, or students from differing demographic or racial groups? Do multiple opportunities exist for students to engage with the content, to develop and display competence (Cohen 1994), and to build understanding based on the knowledge they bring with them into the classroom (see, e.g., Moll, Amanti, Neff, & Gonzalez, 1992)?

Research indicates that effective teachers encourage participation by all students in the intellectual community of the classroom (Boaler, 2008; Cohen & Lotan, 1997; Schoenfeld, 2002). They select and utilize tasks that enable all students to engage in challenging content, and they establish and reinforce expectations for various ways to participate in and contribute to classroom activities.

There are numerous ways in which students can be supported in access to disciplinary content and practices.

- In choosing and designing activities, and in launching activities, teachers can provide multiple access points to the relevant material, supporting the expectation that *all students* are able and expected to participate.
- Tasks that can be approached in multiple ways or from multiple perspectives, and in which approaches can be compared and contrasted, provide access to students who choose different pathways into the activity. In addition, they provide opportunities for making connections between student approaches.

- Teachers can encourage the generation and refinement of ideas rather than mainly critiquing or ignoring comments that are only partially correct.
- Teachers can support the use of multiple language registers by, for example, asking one student to restate another's contribution in more precise academic language, or, perhaps, in more informal language.
- During discussions, teachers can use a variety of strategies to encourage broad participation, for example: choosing to call only on students who have not yet spoken; allowing time to talk to a partner before responding publicly; and randomly selecting students to contribute.
- Teachers can use tasks with language and contexts that connect to students' lived experiences and provide windows into unfamiliar experiences, being mindful of power and privilege.

See the tools sections of this document for a deeper discussion and pointers to further resources.

Dimension 4: Agency, Ownership, and Identity

The extent to which students are provided opportunities to “walk the walk and talk the talk” – to contribute to conversations about disciplinary ideas, to build on others’ ideas and have others build on theirs – in ways that contribute to their development of agency (the willingness to engage), their ownership over the content, and the development of positive identities as thinkers and learners.

Dimension 4 focuses on the extent to which students have the opportunity to generate and share ideas, both in whole class and small group settings; the extent to which student contributions are encouraged, recognized and supported as part of regular classroom activity; and the extent to which student ideas are built upon as the classroom constructs its collective understandings.

People’s dispositions and identities – e.g., “I am a reader,” or “I’m just not a history person,” – are derived from experiences with the discipline. Such dispositions and identities, often formed in the classroom, shape the ways in which people relate to the discipline for the rest of their lives. Many students develop counterproductive beliefs about themselves and a discipline, e.g., that they are “bad at science,” or that history has nothing to do with contemporary events, or that only geniuses can create mathematics. But it need not be this way.

One fundamental aspect of disciplinary identity is *agency* – an individual’s willingness to engage in the discipline, which comes from the perception that she or he make can progress on challenging issues by working away at them, and trust in the conclusions that he or she draws. Engle (2011) writes,

Learners have intellectual agency when they ... share what they actually think about the problem in focus rather than feeling the need to come up with a response that they may or may not believe in, but that matches what some other authority like a teacher or textbook would say is correct.

Ownership refers to the sense that one has control of disciplinary ideas, rather than parroting or memorizing those of others. It is the difference between saying “I’ve reasoned this through and I’m confident it makes sense” and relying on external authority.

A key issue is the extent to which a learning environment provides students with opportunities to develop these aspects of their disciplinary and personal identities. Effective teachers recognize and capitalize on the strengths of each student, finding ways to help individual students enter into the learning community when they do not easily enter it on their own (Boaler, 2008; Cohen & Lotan, 1997). There are multiple ways to do this. Teachers can create opportunities for public recognition of students’ contributions to disciplinary discussions, help students work together in small groups, and attend to students who are struggling by building on the strengths in their thinking. For example, Resnick, O’Connor, and Michaels (2007) identify powerful talk moves by teachers such as revoicing (repeating, paraphrasing, or summarizing a student contribution for the whole class to react), asking students to restate others’ reasoning, to build on what other students have said, and prompting for explanations.

Above and beyond teacher moves, however, is the very nature of the classroom environment. Do students feel safe making contributions to classroom conversations? Have norms been established for making contributions? For building on contributions from others? For critiquing contributions from others?

There is a large literature on “accountable talk,” the kind of classroom discourse that supports students in responsibly and respectfully co-constructing ideas. For a large portfolio of resources, see, Institute for Learning (2016).

To give one example, a technique for shaping classroom discourse productively is the use of “sentence stems” aimed at promoting accountable talk:

- I disagree (or agree) with that, because _____
- I still have questions about _____
- This is the same, because _____
- I observed _____
- I’m confused by _____
- To expand on what _____ said _____

(see http://www.ces.rcs.k12.tn.us/web_uploads/203_accountable_talk_toolkit_10-09.pdf)

Only in climates where students feel comfortable contributing to the development of disciplinary ideas will they have opportunities to develop a sense of academic and disciplinary agency, ownership of the ideas discussed, and positive disciplinary identities.

See the tools sections of this document for further discussion.

Dimension 5: Formative Assessment

The extent to which classroom activities elicit student thinking and subsequent interactions respond to those ideas, building on productive beginnings and addressing emerging misunderstandings. Powerful instruction “meets students where they are” and gives them opportunities to deepen their understandings.

Formative assessment involves orchestrating classroom activities that reveal the current state of student understanding *during the learning process*. Revealing the ways in which students are making sense of the content as they learn provides the teacher and the students opportunities to build upon the understandings that students have developed, and to address emerging misunderstandings. Formative assessment may involve quizzes or tests, but it involves much more. It often includes informal information gathering, e.g., posing questions that may bring out into the open incorrect assumptions or ideas that need to be challenged, or that help students realize that they need to dig more deeply into the content. The use of formative assessment contrasts strongly with the use of summative assessment – the formal end-of-unit or end-of-year tests that can reveal what students know and can do, but provide that information too late for it to be useful in helping students develop deeper understandings as they are learning.

In formative assessment, the information gathered about student reasoning and understanding gathered plays a major role in shaping the classroom activities that follow (Black et al., 2003; Shepard, 2000). This may seem challenging at first – who knows what students will say, given the chance? – but it is essential in order to meet students where they are. Once one starts providing students opportunities for students to engage openly in the discipline, it becomes an easily sustained habit. There are large literatures on student misconceptions, or “alternative conceptions,” that document the kinds of partial understandings students typically develop in specific content areas. Knowing about these typical patterns of student reasoning can help teachers to be prepared to deal with them⁴. For more detail in mathematics, see the Formative Assessment Lessons described in the tools section of this document.

Through deliberately attending to student reasoning and understanding, and then shaping instruction in response, teaching “becomes clearer, more focused, and more effective” (National Research Council, 2001, p.350). In addition, hearing student reasoning provides the information that allows teachers to adjust the level of cognitive demand, so that students are positioned to engage in meaningful sense making. That is, Dimension 5 (formative assessment) provides the support structure for Dimension 2 (cognitive demand).

Black and Wiliam’s (1998 a,b) widely cited reviews document the substantial learning gains that result from teachers’ use of formative assessment. When assessment becomes an integral and ongoing part

⁴ Of course, teachers develop such knowledge (part of what is called “pedagogical content knowledge”) over time. The point here is that the process can be accelerated if one goes about it self-consciously.

of the learning process, as opposed to an interruption of classroom activities, student thinking takes on a more central role in determining the direction and shape of classroom activities (Shepard, 2000; Shafer & Romberg, 1999; de Lange, 1999).

Of course, formative assessment is only useful if there is something interesting and important to assess – namely, meaningful disciplinary understandings and the ability to apply those understandings in powerful ways. Thus, Dimension 1 (the content) is implicated in establishing the disciplinary context for Dimension 5 (formative assessment).

In every discipline, multiple cycles of writing (pre-writes, outlines, drafts, revised drafts, etc.) provide students with opportunities to refine their ideas *and* to improve their writing. Sharing and critiquing ideas with other students places all students within a zone of productive thinking, as well as providing opportunities for the refinement and ownership of ideas. Thus, effective formative assessment (and the use of classroom structures to support student interactions) supports the right levels of cognitive demand for students (Dimension 2) and opens up opportunities for the development of student voice (Dimension 4). If supportive classroom norms are established, and the tasks have multiple entry points (which supports rich disciplinary conversations), then the major goal of equitable access (Dimension 3) is served as well.

It is important to note that the teacher is not necessarily responsible for addressing all of the issues that emerge when student thinking is solicited. When groups or the whole class work on rich tasks, students can serve as powerful resources for each other, in eliciting and building on each other's thinking. The Mathematics Assessment Project's Formative Assessment Lessons, described in the next section of this document, provide numerous examples of how this can be done, with tasks that invite student collaboration and critique.