Teaching for Interdisciplinary Understanding: A Framework for Design

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I. What is Interdisciplinary Understanding?

On our project, we define students' ***interdisciplinary understanding*** generally as:

> the ability to integrate knowledge and modes of thinking from two or more disciplines to generate a new insight.

That is, students build and demonstrate interdisciplinary understanding when they can bring together concepts, methods, or languages from two or more disciplines—for example, to explain a phenomenon, solve a problem, create a product, or raise a new question—in ways that would have been unlikely through single disciplinary means.

Three key qualities of interdisciplinary understanding follow from this definition

(1) The integration of disciplinary perspectives is ***purposeful***. Integration is intended to deepen student understanding for reasons that they and their teachers find compelling. Use of multiple disciplines is not a goal in itself but rather a means of achieving a valued learning outcome. There is a need for interdisciplinary understanding, where the potential limitations of a single-discipline approach to a topic are overcome by drawing on the resources of other disciplines.

(2) Interdisciplinary understanding is ***disciplined.*** *S*tudents use particular disciplinary concepts and methods in ways that echo relevant disciplinary standards of experts working in the discipline (for example, creating artistic representations that are aesthetically powerful, attending closely to the text in literary interpretation, or developing evidence-based accounts of the past).

(3) Interdisciplinary understanding ***integrates*** disciplinary perspectives. Disciplinary perspectives are not merely juxtaposed. Rather, elements of different disciplines are put into productive relationship with one another, allowing students to accomplish something cognitively that they might not with the tools of only one discipline. For example, students might integrate disciplinary insights into a comprehensive explanation of why an environmental problem persists, or they may create a provocative visual metaphor to represent and interpret a past event.

II. How Can We Teach for Interdisciplinary Understanding?

Five dimensions to consider in teaching designs

Teaching designs (interdisciplinary or not) involve making thoughtful decisions about what we should teach, what exactly students should do to learn, and how we might assess and support students' progress. When our goal is to foster students' deep interdisciplinary understanding (understanding that is purposeful, disciplined and integrative), answering these fundamental questions entails a unique set of considerations.

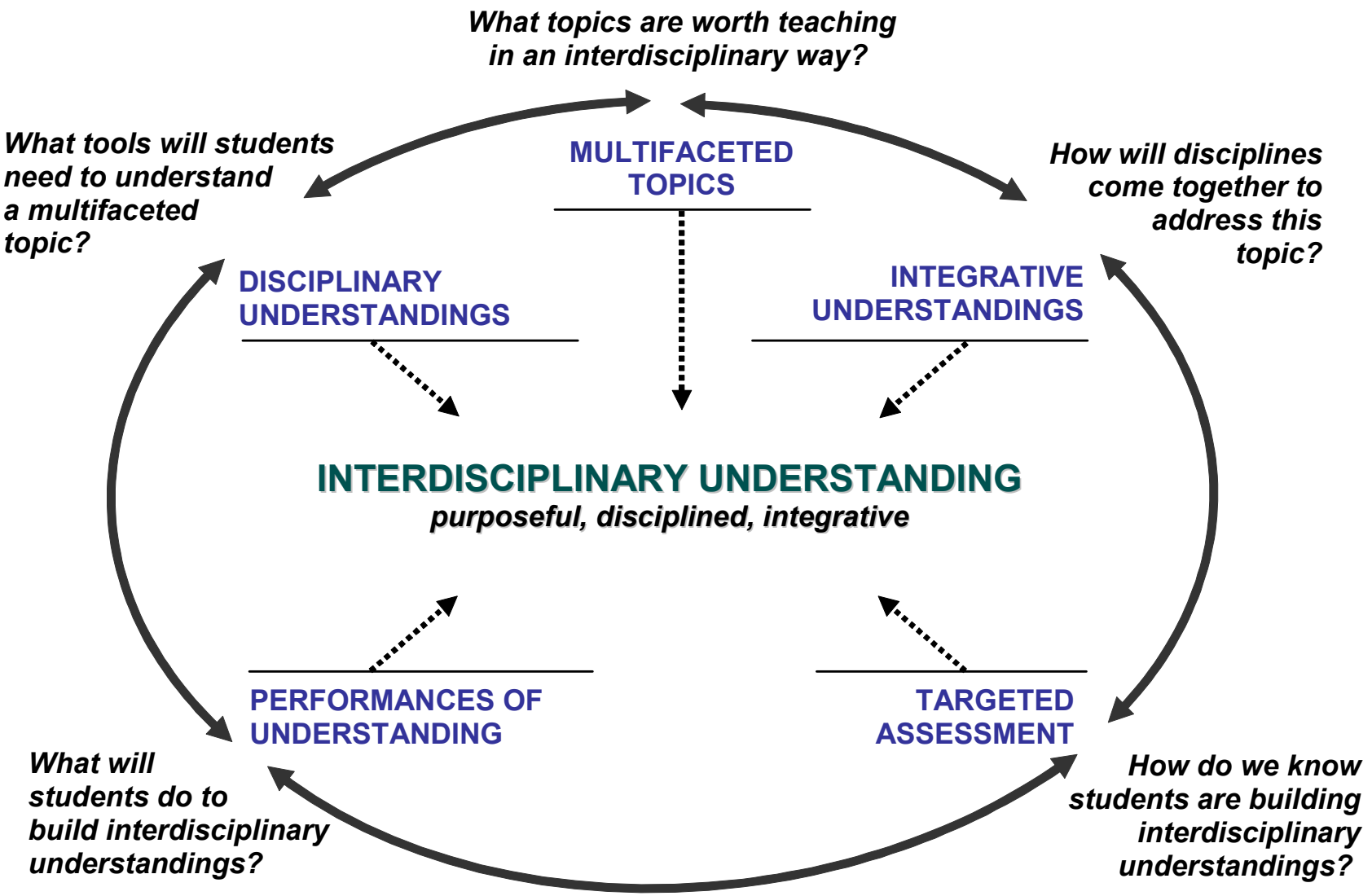
The *Teaching for Interdisciplinary Understanding* framework is a tool designed to support teachers in the practice of designing quality interdisciplinary instruction—i.e., deciding what to teach in interdisciplinary ways and how to organize and monitor students' experience for deep learning over time. The framework focuses our attention on five aspects of design —i.e., the development and use of:

- **multifaceted topics,**
- **disciplinary understandings,**
- **integrative understandings,**
- **performances of understanding,** and
- **targeted assessment**

For each aspect of design, the framework offers criteria to inform teachers' decisions. In designing units, sets of lessons, or courses, teachers may move among elements in any way they feel comfortable. They may also emphasize different elements in different designs, and in practice, the framework dimensions are interrelated and mutually informing. In the end, what matters is that students leave a learning experience with an understanding that is *purposeful* (students clearly understand why studying the issue matters and demands an interdisciplinary approach); *disciplined* (understanding that is informed by two or more disciplines) and *integrative* (and understanding that is enriched by the combination of disciplinary perspectives).

In what follows we share a graphic representation of the framework and a brief description of each dimension.

INTERDISCIPLINARY TEACHING FRAMEWORK



III. Five Dimensions of the Interdisciplinary Teaching Framework

❋ What topics are worth teaching in an interdisciplinary way?

MULTIFACETED TOPICS

Multifaceted topics are topics that address aspects of the world that can be productively studied by two or more disciplines. For example an issue such as "How do societies reconcile after human rights violations?" involves understanding of how mass violations affect the development of individuals, groups, and societies, as well as the legal recourses available for reconciliation (e.g., trials, truth commissions). The topic invites us to consider and borrow from among the work of psychologists, sociologists, historians, and experts in law. When we define the multifaceted topic in our interdisciplinary teaching, we are also conveying the purpose of our inquiry.

In quality interdisciplinary designs, multifaceted topics are:

Relevant to students and teachers.

Because interdisciplinary work is challenging, it is especially important that the topics be meaningful and engaging to students and teachers. Topics should be developmentally appropriate for students.

Feasible with regard to students, context, teacher expertise and resources.

Multifaceted topics invite multiple connections sometimes beyond teachers' existing expertise and available resources, which is why considerations of feasibility matter in how we define a multifaceted topic.

Clearly framed in a way that invites students to purposeful inquiry.

For example, we might focus students' attention on "how to reduce greenhouse gas emissions" or on "whether globalization is a good or bad force once its various effects are considered." A careful framing of the topic for study conveys why students are learning what they are in the unit (e.g., developing knowledge needed to solve a pressing societal problem). Such a framing goes beyond naming a broad concept being studied (e.g., global warming) but gives students a sense of why a given topic matters and why an interdisciplinary approach is warranted.

❋ What tools will students need to understand this multifaceted topic?

DISCIPLINARY UNDERSTANDINGS

Disciplinary understandings involve the particular concepts, methods, findings, theories, or modes of thinking in two or more disciplines that students will need to master as they address the multifaceted topic under study.

Understanding a discipline involves more than simply recalling isolated bits of information or techniques. It requires that students become able to use the ***knowledge base*** of the discipline—moving flexibly from general concepts to detailed examples; the ***methods*** by which knowledge is produced in the domain—e.g., designing experiments, interpreting historical sources; and the ***forms of communication*** that are typical in the discipline—e.g., a research report. Especially relevant in interdisciplinary understanding is that students come to grasp the kinds of broad questions and problems a discipline is best suited to address. Understanding the ***purposes and uses*** of disciplinary inquiry—e.g., history helps us reveal past causes and antecedents of a current event or dilemma—can inform students (or their teachers) as they select which disciplines best inform the topic studied. When students master relevant disciplinary understandings, their interdisciplinary understanding is well-grounded.

Building disciplinary understanding does not require a comprehensive, survey-like "mastery" of each discipline involved but an accurate and flexible understanding of the particular aspects of a discipline that will inform students' capacity to address a multifaceted topic productively.

In quality interdisciplinary designs disciplinary understandings are:

> ***Strategically selected*** — in terms of ***which disciplines*** are included in a unit or course and ***which specific insights*** from each discipline are borrowed.
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> ***Selecting disciplines***: In effective designs teachers select which disciplines will be included weighing the particular ways in which disciplines might contribute to student understanding of the topic. For example, a unit on climate change and emissions reduction may invite insights from the physical sciences (chemistry, atmospheric science, physics) and social sciences (psychology, economics, political science, law). Not all disciplines must be included, nor must each included discipline represent the same proportion of a unit's time. A teacher may decide that only economics will be called upon in a design to explore the kinds of incentives needed to limit oil dependency while maintaining economic growth. She may choose not to explore the psychology of consumption, nor to analyze particular legal frameworks already in place.
>
> ***Selecting insights within a discipline.*** Teachers must, for feasibility, select which particular concepts, theories, examples, methods or techniques they will borrow from each discipline. For instance, to understand climate change and emissions reduction, students may need to understand how greenhouse gases trap heat in the atmosphere (chemistry/physics), how climate scientists make projections about future temperature change (statistics), and how different types of incentives affect human behavior leading to harmful emissions (economics).

❋ How will disciplines come together to address this topic?

INTEGRATIVE UNDERSTANDINGS

Integrative understandings are insights that deeply and meaningfully connect elements from different disciplines. That is, a student has an integrative understanding when he or she can act upon, generate, or describe a productive relationship of ideas across disciplines. There are multiple ways in which concepts and modes of thinking in different disciplines connect, and one unit or course may draw on multiple forms of integration. So far, we have identified several forms of productive integrative understanding, as summarized below. The list is not meant to be exhaustive:

Analogy-based connections — when elements across disciplines are *analogous,* and students see that similar concerns, tools, and concepts can operate across or be translated across multiple domains:

(a) Aesthetic synthesis. Students examine a scientific, historical, or social problem in depth and distill its meaning or significance in a work of art.

(b) Crossover tool. A concept, instrument, or skill (e.g., observational drawing technique, designing experiments) is used in a variety of disciplinary contexts, resulting in a deeper understanding of the tool itself and its broad applications.

(c) Resonance. Similarly, an idea (e.g., the experience of immigration) is explored in multiple disciplinary contexts (e.g. poetry, film) seeking personal resonances that will deepen one's understanding of the idea at hand.

Complementary connections — when elements from different disciplines *complete or augment* one another. Here, disciplinary elements are not analogous. Instead, they are different complementary pieces of a larger puzzle:

(a) Complex explanation. An explanation of a phenomenon in which multiple factors (such as those represented by economic, physical-science, and psychological concepts) interact causally, typically rendering the patterns of cause and effect under study more textured, nuanced, and visibly multidimensional (e.g., the study of how economic incentives may lead to reductions greenhouse-gas emissions and thereby slow climate change).

(b) Contextualization. When elements in one discipline are placed in their broader historical, social, philosophical, or cultural contexts.

In quality interdisciplinary designs, integrative understandings are more than superficial connections between disciplinary ideas. Rather, they deepen students' understanding. Two considerations should inform teachers' attention to integrative understandings. Integrations are:

Tied to the purpose of the unit. Integrative understanding advances students' understanding of the unit's multifaceted topic. For example, if the unit is intended to

engage students in solving a pressing societal problem like global warming, the unit might relate knowledge that helps students understand the nature of the problem (e.g., through physical science) to knowledge that offers *options for addressing* the problem (e.g., through social science). The physical sciences may inform students about how much greenhouse-gas emissions reduction is necessary, while informed policy solutions tied to those emissions goals may be rooted in economic reasoning about altering consumption patterns.

Clearly described — The integrative understanding should be identifiable and readily represented and communicated to one's colleagues and one's students. Ideally, multiple strategies for representing the nature of the integration—verbal descriptions, visual models, reference to exemplars (examples of experts doing similar interdisciplinary work), etc.—should be available to help students see how perspectives come together to create richer explanations, find viable solutions or craft new products.

❋ What will students do to learn?

PERFORMANCES OF UNDERSTANDING

Performances of understanding are opportunities for ***flexible thinking with knowledge in novel situations***. Such experiences allow students both to build and demonstrate their understanding and are premised on the theory that understanding is not something we *have*—like a set of facts we possess—but rather is something we *do*. (By using the term performances, we are not emphasizing stage performances, like plays or concerts; rather, we refer to the fact that understanding is performed or enacted, whether it results in a group presentation, an essay, or other genre of communication.) Performances place throughout a unit or course—e.g., as introductory experiences, as guided work midway, or as synthetic final projects. A defining characteristic of performances of understandings in interdisciplinary designs is that they ***address aspects of interdisciplinary understanding and build toward interdisciplinary understanding***—i.e., helping students to appreciate the *purpose* of their inquiry, build *disciplinary grounding*, develop productive *integrations* across disciplines, and *reflect* about their learning.

Performances of understanding may take several different forms. In particular, ***integrative performances*** may happen at different points in a unit or course. Introductory integrative performances give students a preview of the larger topic in its potential complexity.

> One such ***introductory integrative performance***, a group reflection about a scene from the popular film *The Day After Tomorrow,* might serve as a productive beginning to a climate change unit, setting the stage for why attending to climate matters to society, revealing students' own preconceptions on the topic, and promoting students' development of a sense of purpose in their inquiry.
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> By contrast, a ***synthetic final performance*** allows students to bring disciplines together in a way that shows mastery of the kind of integrative understandings at the heart of the unit or course. For example, in a course on climate change, students' ability to take account of economic, scientific, and political thinking to negotiate the U.S.'s participation in a global greenhouse-gas reduction framework allows them both to demonstrate what they can do with their learning about climate change and to solidify and extend their understanding about the topic.
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> Finally, performances can also focus more narrowly on grounding students in a particular discipline, what we call a ***disciplinary performance***. These can appear where appropriate in a unit, when teachers turn their focus to deeper understanding of particular discipline-specific learning. For example, an assignment requiring students to design a policy solution to pollution in their community or region might be a disciplinary performance that caps teaching of core concepts of economics relevant to a larger unit on climate change: the "problem of the commons" and negative externalities.

In quality interdisciplinary designs, understanding performances are:

sequenced to advance interdisciplinary understanding of the topic Whether teachers begin their planning with a very clear articulation of desired interdisciplinary learning outcomes or with a good definition of an area for open exploration, quality interdisciplinary units and courses sequence performances in ways that move toward progressively deeper interdisciplinary understanding.

well-supported by rich experiences and resources. Not all experiences in the classroom are undertaken as performances in their own right. Presentations, films, readings, visits, discussions, and other activities and resources inform students' performances and provide added opportunities for students to advance understanding.

❋ How do we know students are learning?

TARGETED ASSESSMENT

Targeted assessment refers to assessment practices that focus particularly on core dimensions of interdisciplinary understanding—(a) the degree to which the work is well-grounded in the disciplines, (b) the degree to which it integrates disciplines productively, (c) the degree to which it exhibits students' clarity of purpose and a reflective stance about their work.

> For example, toward the end of a unit, a teacher may assess a student's understanding of climate change by examining a selection of journal entries, a final paper, and an oral presentation on strategies for greenhouse-gas reduction. The teacher would ask: Is this student using concepts and modes of thinking in science and economics flexibly and appropriately to explain the phenomenon and propose viable solutions? Is she integrating disciplines in her approach to curtailing global warming–e.g., using scientific findings to determine reduction targets for economic policies? Is she clear about the purpose of her paper and presentation and the degree to which she has achieved her aims? The teacher could then share her observations with the student, pointing to effective aspects of the work in detail and suggesting areas for future growth as needed.

In quality interdisciplinary teaching targeted assessment:

> ***Draws on a representative selection*** of student work (e.g., a disciplinary paper, an integrative presentation, and a series of journal entries). Representativeness is less about evaluative "fairness" of assessment than about considering all relevant aspects and indicators of student understanding, since each piece of work will offer evidence to inform an overall picture of how well students are understanding the multifaceted topic at hand.
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> ***Is ongoing.*** Assessment may begin with a diagnostic assessment of student baseline understanding, beliefs and dispositions early in the unit or course (even if very informal). Assessment is not limited to grading a final project but seeks to support students (and inform instruction) along the way.
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> ***Is informative*** to students, offering explicit, productive feedback as they progress through the unit or course—feedback that will allow them to modify and fine-tune successive performances.