

# 11

## KNOWLEDGE AS PERSPECTIVE

### From Domain Perspective Learning to Interdisciplinary Understanding

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#### ABSTRACT

This chapter introduces the construct of domain perspective learning as a mechanism for preparing students for later interdisciplinary learning and problem solving. Domain perspective learning involves (a) recognizing that the information presented by an author is, in part, a result of their domain perspective, or the objects of focus, methods of inquiry, and evaluative standards that characterize the domain that they are a part of; and (b) conceptualizing, comparing and evaluating, and integrating multiple domain perspectives for interdisciplinary learning and problem solving. In addition to introducing domain perspective learning and identifying the processes that this involves, this chapter concludes with a description of three strategies that may be used to enhance domain perspective learning in the classroom.

**Key words:** domain perspective learning, domain, knowledge, domain perspective, epistemic beliefs

Many complex problems facing society today, such as food insecurity, global migration, and automation, are multifaceted, complex, and *interdisciplinary* in nature; that is, addressing these issues requires knowledge and expertise from multiple fields. Correspondingly, among the trends in education reform, aiming to meet the demands of the 21st century, have been efforts to engage students in interdisciplinary learning and problem solving (Ivanitskaya, Clark, Montgomery, & Primeau, 2002; Jones, Rasmussen, & Moffitt, 1997). Interdisciplinary learning is defined as the integrative, rather than additive, process of contrasting and connecting different disciplines to

achieve benefits for learning or *interdisciplinary understanding* (Spelt, Biemans, Tobi, Luning, & Mulder, 2009). At the same time, interdisciplinary learning has been identified as a process that is quite complex and demanding for learners, particularly those not yet in college and having little expertise in any domain, hampering their abilities to engage in interdisciplinary problem solving (Jones, 2010; Nariman & Chrispeels, 2016).

While engaging students in interdisciplinary learning and problem solving remains an important goal, such learning may be too demanding a process for novice learners who are only beginning to understand the characteristics of and differences between different academic domains. Instead, a distinct but related approach, that of domain perspective learning (DPL), is introduced in this chapter as a mechanism for supporting novice learners to develop an understanding of different domains and to draw on this understanding to think critically and to solve interdisciplinary problems. DPL is first defined in reference to the literature on perspective-based learning to describe how teaching students about domain perspectives may provide them with rich, coherent, and multidimensional lenses through which to understand and evaluate information. In addition to defining DPL, this chapter describes the processes that may be involved in domain perspective learning, including how domain perspectives may be conceptualized, compared and evaluated, and integrated. Finally, it closes with describing the functions or benefits of domain perspective learning and how these may be achieved in the classroom.

## DEFINING PERSPECTIVE

Perspectives may be defined as “frames of reference” (McCrudden & Schraw, 2007, p. 116), orientations, or lenses on the world, generally; and lenses on information in texts, more specifically. In part, perspectives delineate what information is attended to or deemed to be important and what information is ignored, as well as how information is interpreted and evaluated, and what information is retained. Although a variety of factors, among them our attitudes (i.e., positive and negative judgments of objects) and epistemic beliefs (i.e., beliefs about knowledge and knowing, Buehl & Alexander, 2001), contribute to the perspectives on information that readers may hold (see McCrudden, Chapter 12), perspectives have commonly been operationalized as task goals assigned to students prior to reading (McCrudden & Schraw, 2007). For instance, a classic study by Pichert and Anderson (1977) asked students to read a text about a house from the perspective of either a burglar or a home-buyer. Assigned perspectives were found to result in differences in students’ ratings of text-based statements importance and in differential text recall. Goetz, Schallert, Reynolds, and Radin (1983) asked students to read the same house passage from the perspective of a police officer, real estate agent, or education student. They found students to rate perspective-relevant, rather than perspective-irrelevant, sentences as more important, to spend more time reading these, and to better recall these after reading. Kaakinen, Hyönä, and Keenan (2002) confirmed these results using behavioral data from eye tracking. In particular, they found students’ reading of relevant vis-à-vis irrelevant text passages to be marked by longer fixation times at both first-pass and second-pass reading. Thus, perspectives such as these, referred to as role-based, act as filters that students use to understand the world and sift through the information within it.

Rather than focusing on role-based perspectives (e.g., home buyer, police officer) assigned to students prior to reading, this chapter instead focuses on one specific type of perspective, *domain perspective*, that may be an especially powerful lens for students to use in information processing and during reading. Domain perspectives (DPs) are distinguishable from the role-based perspectives commonly examined in prior work (Goetz et al., 1983; Kaakinen & Hyönä, 2008; Pichert & Anderson, 1977) in the depth of knowledge, grounded in academic domains, that these demand of learners and ask them to apply to understanding information. While reading like a police officer asks that students have only a superficial conception of this role, reading like a criminologist or asking students to recognize a criminological perspective reflected in text, requires learners to have a considerably deeper understanding of criminology as a domain and the epistemic practices (i.e., how knowledge is developed, substantiated, and evaluated) within it. Moreover, while role-based perspectives have commonly been examined as externally assigned to students prior to reading, domain perspectives may be expected to be more personal in nature or more characteristic of individuals. As such, domain perspectives are reflected both when learners read from particular DPs as a function of their prior knowledge, interests, and beliefs (e.g., biology majors reading from a biological perspective) and when expert authors write texts from a DP (e.g., biologists writing from a biological perspective).

## DEFINING DOMAINS

Although sometimes used interchangeably (e.g., Paulsen & Wells, 1998), in defining domains, it is first helpful to distinguish these from the broader disciplines from which they derive. Disciplines, characterized by their historical roots and generalizability (Foshay, 1962), are relatively few in number; identified by Alexander (1998) as including history, literature, science, and mathematics. Domains, then, constitute more specific and, typically, more applied areas of study (Biglan, 1973; Schommer-Aikins, Duell, & Barker, 2003). Rarick (1967) describes domains as originating from the scientific practice of “classify[ing] like things together for systematic and detailed study,” which, over time has resulted in the domains or “segments of knowledge” that we have today (p. 49).

Schwab argues that disciplines, and therefore the domains that they perpetuate, can be thought of as having two components: “the body of imposed conceptions” and “its inquiry,” thereby making reference to the declarative or conceptual knowledge that characterize a particular domain and to the processes and activities associated with its acquisition (i.e., procedural knowledge). Becher and Parry (2005) describe these latter processes as encompassing “techniques of inquiry,” “established research methods,” and a “set of required resources” (pp. 133–134). Drawing on these conceptualizations of disciplines and domains, in this chapter, domains are viewed as defined by and distinguished from one another in the (a) objects or subjects that they investigate, (b) the methods of inquiry that they use, and (c) the evaluative standards that they apply. Throughout this chapter, I refer to these objects and subjects of focus, methods of inquiry, and evaluative standards as *domain characteristics*, for the sake of conciseness. Objects and subjects of focus refer to the target(s) of investigation within domains or what may count as evidence, more specifically. Methods of inquiry refer to the domain-specific processes of how evidence is gathered, analyzed, and interpreted

to formulate conclusions. Finally, standards for evaluation pertain to how determinations of evidence quality, appropriateness of processes, and the relative substantiation of conclusions and claims are made within domains. For instance, history may be defined, in part, by the study of documents and artifacts (i.e., objects), using techniques like corroboration and contextualization (i.e., Wineburg, 1991, methods), to achieve coherent interpretations that robustly account for the evidence available and conceptualize such evidence in a historically appropriate fashion (Lee & Ashby, 2001). Biology, as a contrast, maybe thought of as focused on the study of organisms (i.e., subjects), using techniques of observation and scientific experimentation (i.e., methods), to achieve discernible categorization or replicable results (i.e., evaluative standards, Hauslein, Good, & Cummins, 1992; Reindl, Strobach, Becker, Scholtz, & Schubert, 2015).

Beyond these domain-specific examples, Goldman et al. (2016) provide a comprehensive framework of the overarching concepts (i.e., similar to objects of inquiry), inquiry practices (i.e., similar to methods), (c) epistemologies (i.e., including evaluative standards), (d) forms of information representation (e.g., texts), and (e) discourse structures (i.e., language use) that define the disciplines of literature, history, and science. This chapter primarily focuses on domains, rather than disciplines, as more narrow and accessible fields of study. Nevertheless, to use Goldman et al.'s terminology (2016), in this chapter, overarching concepts, inquiry practices, and epistemologies are used to define domains. Later in this chapter, in the section on instructional implications to promote DPL, introducing domain-specific forms of information representation and discourse structures in the classroom are recommended as mechanisms for fostering DPL. Nevertheless, prior to identifying the processes involved in DPL and the instructional strategies that may be used to foster such learning, domain perspectives are first defined.

## **DEFINING DOMAIN PERSPECTIVES**

Domain perspectives are lenses on the world, generally, and on information, more specifically. These perspectives are informed by an understanding of the objects of focus, methods of inquiry, and standards for evaluation that characterize a particular domain. Consistent with Goldman et al. (2016), domain perspectives can be further conceptualized as epistemic in nature. That is, such perspectives are distinct from role-based perspectives (e.g., reading like a home buyer) in that they specifically draw on domain-specific conceptions of what knowledge is and how knowledge may be developed and substantiated. For example, while reading from a role-based perspective may help students determine what information is relevant or not, reading from a domain perspective may further encourage students to ask critical questions and suggest to students the standards to apply in evaluating information. As such, simply directing students to read like an architect may draw students' attention to the design features of a home; however, teaching students about the domain of architecture and then encouraging them to read from an architectural perspective may prompt students to analyze and compare the features of a home to known architectural styles and question choices made in design. Domain perspective learning includes both students' adoption of a particular domain perspective during reading (e.g., read from the perspective of an economist) and their abilities to recognize and reason about

domain-specific perspectives reflected in text (e.g., a text written from an economic perspective), with both of these approaches to DPL requiring students to have somewhat sophisticated conceptions of domain characteristics. That is, both reading from and recognizing and reasoning about domain perspectives require a deep and systematic knowledge base, as compared to the more limited and superficial knowledge required when students read from a role-based perspective.

Although both approaches to domain perspective learning (i.e., students reading from a domain perspective and recognizing and reasoning about domain perspectives in text) may require similar types of processing and information evaluation, this chapter focuses to a considerably greater extent on the latter of these two (i.e., learners recognizing domain perspectives in text). This is the case for at least two reasons. First, in a K-12 context, where students may be expected to be domain novices (Alexander, 2003a, 2003b; Kuhn, Cheney, & Weinstock, 2000), if they are aware of domains and domain characteristics at all (Brozo, Moorman, Meyer, & Stewart, 2013; Shanahan & Shanahan, 2008, 2014), it is unlikely that students may readily assume a domain perspective during reading. That is, elementary school students, in contrast to undergraduate biology majors or biology experts, are unlikely to automatically or deliberately read texts from a biological perspective. Moreover, assigning elementary or middle school students to “read like a biologist,” with no deep-level understanding of what biology is as a domain or its domain characteristics, may result in students adopting the same superficial, role-based perspective, like asking students to “read like a homebuyer.” Indeed, we may expect learners’ assumption of domain perspectives during reading, as grounded in their understanding of domain characteristics, to only emerge at the undergraduate level, in the absence of specific instruction to the contrary (e.g., Alexander, 2003b; Goldman et al., 2016).

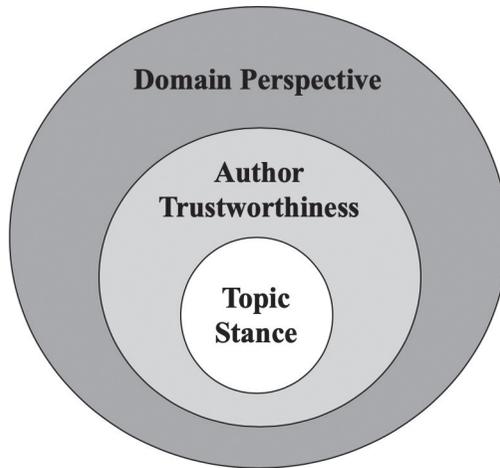
Second, while K-12 students may not readily adopt domain perspectives of their own during reading, they are certainly likely to encounter authors’ domain perspectives, reflected in texts, when learning about complex or controversial topics. In part, such topics may be defined as requiring interdisciplinary understanding. Boix Mansilla and Duraising (2007) define interdisciplinary understanding as learners’: “capacity to integrate knowledge and modes of thinking in two or more disciplines or established areas of expertise to produce a cognitive advancement ... in ways that would have been impossible or unlikely through single disciplinary means” (p. 219). This means that understanding complex, interdisciplinary problems, like resource scarcity or cultural globalization, requires that learners draw on information from diverse domains or areas of study, including texts written from economic, political science, historical, and geographic DPs. That is, students working to understand and potentially solve interdisciplinary problems need to recognize that experts from different domain perspectives are working to address these, understand how such problems are conceptualized and approached from different DPs, and compare, evaluate, and integrate DP-based information in determining possible solutions. As such, recognizing and reasoning about a variety of DPs is likely to be a much more necessary and fruitful endeavor for learners working to understand and solve interdisciplinary problems, more so than adopting a single domain perspective for reading. As such, students’ abilities to recognize and reason about different domain perspectives represented in text constitute the focus of the remainder of this chapter. Nevertheless, understanding how students’ own DPs, developed through their gradually increasing participation in

domains as communities of practice (Goldman et al., 2016), shape the nature of their reading, problem solving, and information processing remains an important area for future work.

## ORIGIN OF DOMAIN PERSPECTIVES IN TEXT

In addition to defining what is meant by a domain perspective, it is important to determine where domain perspectives come from. As discussed previously, students may develop the ability to adopt domain perspectives as a virtue of their knowledge building and advancement within particular domains or fields of study (e.g., majoring in biology). At the same time, at the K-12 level, such individual development of a robust domain perspective is unlikely to occur (Alexander, 2003b). But, students, even at the K-12 level, may be expected to much more commonly encounter domain perspectives through text, whether students are aware of these or not. These domain perspectives, represented through text, may be considered to be an attribute of source. Source refers to the features of text that pertain to text origin or reason(s) for being created. While a variety of features associated with source have been investigated in prior research (e.g., currency, publisher, Bråten, Strømsø, & Britt, 2009), author and author trustworthiness has received the greatest degree of attention in the literature (Bråten, Strømsø, & Salmerón, 2011; Reisman, 2012; Rouet, Favart, Britt, & Perfetti, 1997; Stahl, Hynd, Britton, McNish, & Bosquet, 1996). Author trustworthiness has been understood as based on author's benevolence and expertise (Stadtler & Bromme, 2014). *Author benevolence* refers to author intention to provide quality and accurate information and has often been conceptualized by students as an author's freedom from bias. *Author expertise* refers to an author's qualifications and knowledge and abilities to speak as an authority on a given topic. Investigated widely in prior work (Macedo-Rouet et al., 2019; Salmerón, Macedo-Rouet, & Rouet, 2016), such attributes may be viewed as reflective of the author as an individual. This chapter expands this view of author to further encompass the domain perspective(s) that the author holds and expresses in writing.

In particular, author may be defined by three interrelated dimensions (see Figure 11.1). The first of these dimensions refers to an author's topic stance. This dimension occurs at the intersection of an author's knowledge and beliefs and the topic that they are writing about and, generally, reflects whether an author stands in support of or in opposition to a particular issue or proposal. The second dimension captures an author's relevant individual characteristics, pertinent to their stance on a particular topic and the information that they provide about this topic. Chief among these characteristics are author's benevolence (i.e., motivation or intent for writing) and expertise (i.e., knowledge and authority). The third dimension, of particular interest in this chapter, reflects author's domain perspective or positioning within larger areas of study. While benevolence and expertise may be viewed as individual author characteristics, author's domain perspective necessarily connects them to a broader, domain community, holding shared epistemic orientations, practices, and values for knowledge-building. For instance, a report discussing the effects of deforestation in the Amazon may be said to reflect an author's particular position on this issue, the author's expertise and motivations for writing, as benevolent or not, and the author's domain perspective (e.g., in the domain of forestry). Jointly, author



**Figure 11.1** Representation of text's source.

benevolence, expertise, and domain perspective dictate the evidence that they draw on in formulating a topic stance and the information they elect to feature or exclude in their writing, as well as how this information is presented. More generally, the three author-related dimensions identified in Figure 11.1 and their inter-relations are important for students to consider when evaluating information in texts and the extent to which this information is credible, comprehensive, and convincing. As such, teaching students to recognize and reason about domain perspective is fundamentally asking them to attend to source. In this way, teaching students to engage in DPL aligns with broader intervention efforts aimed at teaching students to attend to source during reading and to use source in evaluating information (Brante & Strømsø, 2018; Pérez et al., 2018).

The depiction in Figure 11.1 is intended to convey at least three insights about author characteristics, as they are conceptualized in this chapter. First, Figure 11.1 represents an author's specific stance on a given topic as nested within the domain perspectives that they hold. In this way, Figure 11.1 makes the point that domain perspective does not necessarily dictate author's specific stance on a particular topic or issue. That is, authors within the same domain may be for or against particular proposals. As such, domain perspective only serves to determine the objects of analysis, methods of inquiry, and standards for evaluation that authors use in formulating a specific topic stance. Second, the representation in Figure 11.1 makes clear that the nature of authors' expertise comes from the domain communities of which they are a part. This specific aspect of Figure 11.1 may be said to reflect the "social" dimension of domains, identified by Becher and Parry (2005) as reflecting their organizational structure (e.g., within universities), their induction of new members, their social values, and their reciprocal recognition of experts by other experts. These, alongside the epistemic characteristics of domains (i.e., their objects of focus, methods of inquiry, and the evaluative standards that they apply for knowledge establishment), are encapsulated in the domain perspective that authors bring to various topics.

Finally, the third insight introduced in this representation reflects a distinction between author benevolence or potential bias, and author's domain perspective. Although research on how learners define bias and perceive author bias during reading is scant, the distinction between author bias and author's DP is essential to draw. Bias, when it is exhibited, may take the form of authors selectively or incompletely presenting information. This selective presentation of information for reasons of bias (i.e., personal motivations, reflecting a lack of benevolence) can be distinguished from the selective presentation of information for reasons of domain perspective. To underscore this point, an ecologist focused on the environmental, rather than on the economic, impacts of a particular proposal, should not be viewed as biased (i.e., not benevolent) or personally motivated to present information selectively (e.g., for financial gain). Rather, this ecologist should be viewed as epistemically motivated to describe an issue based on the characteristics of his or her domain. The information provided by such an author should be viewed as offering a domain-bound, rather than biased, perspective. As such, it should be distinguished from incomplete information provided by a property owner in the area, who may have a personal or financial motive (i.e., a lack of benevolence) for selective information presentation. With domain perspectives defined and positioned as stemming from characteristics of author or source, the section that follows describes the processes involved in DPL. These processes include conceptualizing individual domain perspectives as well as comparing and evaluating these and integrating them to solve problems.

## PROCESSES INVOLVED IN DOMAIN PERSPECTIVE LEARNING

### *Conceptualizing a Single Domain Perspective*

When students are presented with only one domain perspective (e.g., an economic argument for building a new shopping mall), the processes that are involved are those related to DP *recognition* and *construction*. Recognition and construction occur both when authors explicitly identify their DPs, allowing students to use this information in making inferences about the content provided in text, and when authors are not explicit in identifying their DPs, requiring students to instead deduce these based on the information provided (e.g., the type of evidence cited or the methods described).

#### *Recognition*

Recognition refers to students' attendance to explicit and implicit cues likely to signal a domain perspective. These cues may stem from features of the content included within a text (e.g., the type of evidence that is introduced), from author characteristics (e.g., credentials), or from features of text format (e.g., document types, like journal articles or policy briefs). These cues may further explicitly identify a domain perspective or may implicitly suggest it through the content that is introduced or how such content is presented.

#### *Construction*

Construction involves the definition and elaboration of a domain perspective according to its domain characteristics (i.e., the objects of focus, methods of inquiry, and evaluative standards that define that particular domain). Construction involves not

only instantiating these various characteristics in association with a particular domain perspective but also applying these to understand what information may be presented by a specific, domain perspective-bound author and why. For instance, construction is involved in students recognizing that an economist predicting job growth in association with new shopping mall construction is introducing such predictions based on financial modeling (i.e., method of inquiry), aiming to maximize data fit (i.e., evaluative standard applied). As such, construction refers to students' cognitive representation of the domain perspective(s) reflected in a particular text and how these are associated with the information presented within it.

### *Inferential and Deductive Recognition and Construction*

Conceptualizing a domain perspective, including both recognition and construction, may be viewed as either an inferential or a deductive process. It is sometimes the case that an author or source may explicitly identify themselves as offering a particular domain perspective on an issue. In such an instance, students may be expected to use this explicit positioning to make inferences about the domain characteristics that a particular author drew on to compose the information presented within a specific text.

Conversely, it is oftentimes the case that authors do not explicitly position themselves according to the domain perspective(s) that they are drawing on or represent. In such an instance, students are required, instead, to deduce an author's DP leanings, based on the objects of investigation that they discuss, the methods of inquiry that they use, and the evaluative standards that they apply. For instance, reading a text introducing projections and stress-tests of the traffic flow and congestion likely to result from shopping mall construction, should lead students to conclude that a particular text is written from an urban planning perspective, with this deduction allowing for further inferencing regarding the information that is included within a particular text. At the same time, this type of deduction may be expected to be considerably more challenging for learners to construct when they are unfamiliar with or unaware of different domains, as compared to when authors explicitly identify their domain perspective(s). In summary, students' conceptualization of a specific domain perspective requires both recognition and construction. Together, these processes result in students understanding the specific information included within a particular text as the result of author's domain perspective, defined by the characteristics of the domain(s) that they represent. The next section describes the processes involved in students' reasoning across multiple domain perspectives, as is required for interdisciplinary understanding.

## **REASONING ABOUT MULTIPLE DOMAIN PERSPECTIVES**

At the outset of this chapter, engaging students in DPL was identified as a method for facilitating interdisciplinary understanding. For DPL to lead to such understanding requires students to do more than to conceptualize individual domain perspectives; rather students need to reason about multiple domain perspectives during learning and problem solving. Two key processes, namely (a) comparison and evaluation and (b) integration, are required for students to reason about multiple domain perspectives. These processes may be expected to take place after students have conceptualized

a number of individual domain perspectives on a common topic. For instance, this may involve students individually considering the economic ramifications, social opportunities, and ecological costs of constructing a new shopping mall, as conceptualized across distinct domain perspectives. Once a number of domain perspectives on a common topic have been conceptualized, the processes of comparison and evaluation and of integration may ensue.

### *Comparison and Evaluation*

Because domain perspectives are defined by distinct domain characteristics, it is difficult, if not impossible, to directly draw comparisons across these. That is, it is difficult to compare the economic effects of constructing a new shopping mall to its possible ecological harms. This is because economic vis-à-vis ecological domain perspectives are defined, in part, by differences in the objects and subjects of inquiry that they focus on. As such, because their objects of focus, alongside other domain characteristics, are distinct from one another, these DPs are impossible to directly compare. So, while we may expect an economic DP to analyze the effects of shopping mall construction on the local economy and an ecological DP to consider the constructions' environmental effects, direct comparing these DPs provides us with no mechanism for evaluating the relative importance of economic (e.g., more jobs) vis-à-vis environmental (e.g., increased pollution) impacts. As such, diverse domain perspectives on common topics, for the most part, can only be compared indirectly. Such indirect comparisons can occur through one of three means, through: (a) endogenous evaluation, (b) the comparison of conclusions drawn across domain perspectives according to universal values or ideals, or through (c) the personal weighing of DPs. All three of these approaches to the comparison of domain perspectives are intertwined with their evaluation. That is because the goal of comparing DPs, as described in this section, is to allow for competing conclusions, drawn across DPs, to be balanced and prioritized through learners' judgments of their relative merits and limitations.

### *Endogenous Evaluation*

When presented with information from multiple DPs, one method for comparing these or selecting from among them is to compare the quality of the information included within them. This involves evaluating the arguments included in texts or judging the quality of the evidence introduced by specific authors, representing particular DPs, and the fidelity and robustness with which this evidence was analyzed, interpreted, and marshalled in support of claims. Such argument evaluation, however, is most likely to occur in accordance with evaluative standards that are endogenous to particular domains, or domain-specific, rather than domain-general, in nature. That is, evidence introduced in association with an economic analysis favoring shopping mall construction is likely to be evaluated according to economic-specific standards for evidence and methods quality (e.g., number of observations, identification strategy or estimation approach used), rather than according to the evaluative standards used in other domains (e.g., distinguishing primary and secondary sources in history). When evidence is analyzed and interpreted and resulting conclusions are evaluated in a domain-specific fashion, learners are able to determine the overall quality of

DP-specific arguments and position these along a continuum of strength and convincingness. Then, when arguments forwarded by different DPs diverge or conflict with one another, learners are able to use their endogenous or domain-specific evaluations of argument strength to compare and select from among these. That is, across arguments forwarded by different DPs, students may be expected to select the stronger argument over its weaker counterpart.

Nevertheless, there are three important caveats to such endogenous evaluation and its facilitation of DP comparison and selection. First, when comparing DP-based arguments according to their relative strength, this comparison is typically based on domain-specific standards of evaluation. Certainly, there are domain-general evaluative standards. For instance, sample size and representativeness are a concern common across domains. Nevertheless, even these domain general standards still tend to be applied in a domain-specific fashion (e.g., what constitutes an appropriate sample size differs across the domains of economics, sociology, and medicine). As such, even when introduced to domain-general standards for evaluation, students still need specific instruction in how these may be applied to understanding and evaluating domain-specific objects and methods. Second, in the case of endogenous evaluation, perspectives are still compared indirectly, according to their relative strength, rather than directly juxtaposed with one another. Third, while endogenous evaluation may be an effective comparison approach to use when the arguments forwarded by different DPs are of varying quality, this approach provides little guidance in helping students to compare and select from among DPs that are of comparable strength and convincingness. Indeed, this approach is reliant on students being able to accurately identify arguments, introduced across DPs, as comparable or discrepant in their relative strength.

### *Comparing Conclusions Drawn across Domain Perspectives*

Endogenous evaluation is not possible when different domain perspectives introduce arguments that are of similar quality, as determined by domain-specific standards of evaluation. In these cases, arguments presented by competing DPs may need to be compared according to the conclusions that they draw. For example, comparing different DP-based arguments on shopping mall construction, that are comparable in strength, would involve determining whether authors representing different DPs are ultimately in favor of or in opposition to shopping mall construction. In this way, conclusions drawn across DPs act as a kind of common denominator or currency across arguments forwarded by different domain perspectives, allowing these to be compared. This is similar to how argument strength serves a common metric allowing DPs to be compared when an endogenous evaluation approach is adopted.

Once the conclusions that are arrived at via particular domain perspectives are identified, these can be juxtaposed with conclusions stemming from other, potentially conflicting, domain perspectives. At the most basic level, comparing conclusions across domain perspectives may involve determining how many DPs are in favor of a particular course of action, how many are opposed, and electing to decide with the majority. However, oftentimes a more nuanced or balanced approach is needed to evaluate the relative merits and limitations of conclusions forwarded across different domain perspectives.

Such a balanced or systematic approach to conclusion comparison involves evaluating conclusions from different DPs according to their alignment with *universal values* or ideals. The term universal values is used in this chapter to represent evaluative standards that are (a) domain-general in nature, or distinct from the domain-specific evaluative standards that are used to substantiate and evaluate the quality of knowledge claims within domains (e.g., replicability in science, corroboration in history); (b) relatively few in number, (c) exist on a cultural or societal level, rather than within specific domains, and are (d) broadly agreed upon within a particular society. For instance, in the United States, such values may include a respect for individual freedoms, a prioritizing of economic competition, and a commitment to law and order (Clarke & Aram, 1997; Perkins, 2002; Sen, 1999). Moreover, such universal values may be considered to be (e) abstract and (f) asymptotic in nature. This means that universal values, such as tradition or security (Schultz & Zelezny, 1999), can never be fully realized. Rather, such universal values are used as barometers of what specific domain perspective-based conclusions may be seeking to maximize or mitigate, at any given time.

Stated more simply, the benefits to job growth associated with building a new shopping mall can never be directly or meaningfully compared to the environmental harms of increased pollution, stemming from increased traffic to and from the retail core. However, the domain perspective-based conclusions regarding shopping mall construction can be evaluated according to the values they are seeking to maximize (e.g., opportunity) and any harms they may be looking to reduce (e.g., habitat destruction). Important to note is that such values are abstracted from the specific objects of focus that are examined within particular domains. That is, while the number of jobs created are not compared to the metric tons of emissions generated, the universal values that these effects correspond to can be questioned, balanced, and compared. Asking students to compare conclusions from diverse domain perspectives according to the values that they are seeking to maximize or diminish both helps students to apply DPs to real-world problems and better simulates the values-based judgments that often guide decision making in the real world. That is, deciding whether or not to move forward with shopping mall construction is oftentimes a values-based decision regarding what is prioritized and what is dismissed.

### *Personal Weighing*

While comparing conclusions from competing DPs according to universal values may be considered to be the preferred approach to systematically weighing distinct DP-based arguments, it is also the case that such a systematic approach is often not the one adopted. Rather, the final way that students can determine which arguments, from different domain perspectives, they favor or oppose, is by aligning these arguments with a set of personally determined preferences or criteria. Such personal criteria are similar to endogenous evaluations of argument strength and universal values in that they serve as a common measuring stick that can be used to compare different DP-based arguments; but such personal criteria are distinct in that they may not be explicitly stated and, often, are not deliberately arrived at or interrogated. That is, students trying to make a decision on whether they support or oppose shopping mall construction and weighing economic benefits against ecological costs, may simply

decide that they care much more about the environment than they do about any potential economy benefits that may result. While this type of personal weighing, like endogenous evaluation and the comparison of conclusions according to universal values, allows competing DP-based arguments to be compared, such comparison is based on individuals' preferences that may or may not be well-reasoned or systematically applied. Moreover, such individual preferences may or may not be more generally shared or easily communicable to others. As such, the comparison and selection of arguments from competing DPs based only on personally determined criteria, while common, may only constitute a starting point for engaging students in the comparison and evaluation of domain perspective-based arguments during learning.

In examining how DP-based arguments may be compared and evaluated, three possible approaches to such comparison have been identified. These include: (a) endogenous evaluation (i.e., evaluating the strength of arguments proposed by competing DPs using domain-specific standards), (b) the comparison of DP-based conclusion according to universal values, and (c) the weighing of competing DP-based arguments according to personally determined, rather than universal, criteria. Across these three approaches to DP-based argument comparison, the focus or goal of such comparison is to allow for the preferential selection of arguments or conclusions introduced by some DPs over others. At the same time, students' goals may not always be to preferentially select one DP-based argument over another; at times, students may be interested in DP integration or the linking of argument from across domain perspectives for interdisciplinary understanding or problem-solving. Such DP integration may likewise be thought of as involving the processes of comparison and evaluation, to varying extents; however, in the case of integration, such processes are focused on synthesis rather than on selection. The next section outlines the ways that disparate domain perspectives and the arguments that these introduce may be combined or integrated with one another to solve problems or to decide on courses of action.

### *Integration*

Beyond comparison and evaluation for DP selection, students need to be able to connect or integrate different domain perspectives and the arguments that these introduce in order to solve problems. In fact, doing so is considered to be essential for interdisciplinary understanding and problem solving (Boix Mansilla & Duraising, 2007). Like comparison, DP integration is likely to unfold in one of three possible ways. These include selective, transformative, and structural approaches to DP integration. These approaches may be conceptualized as progressing in sophistication, with only the final approach reflecting the type of processing that is emblematic of true interdisciplinarity (Ivanitskaya et al., 2002; Van den Besselaar & Heimeriks, 2001). As a contrast, the first two approaches to DP integration discussed (i.e., selective, transformative), may best be characterized as multidisciplinary in nature, in that they draw on multiple domain perspective-based arguments without fully connecting these, in their entirety, as is required for interdisciplinarity (Van den Besselaar & Heimeriks, 2001). Nevertheless, in focusing on domain perspective learning, generally, rather than on interdisciplinary learning, more specifically, this chapter makes the case that all three of these approaches to DP integration are important and may serve specific learning and instructional aims in the classroom.

### *Selective*

A selective approach to DP integration uses various domain perspectives to generate unique solutions to a common problem and then chooses from among these. As such, a selective approach is one that draws on diverse domain perspectives to create a “menu” of options that students can select from and additively combine to find a resolution to a common problem. For instance, the problem of a lack of accessible shopping options within a particular neighborhood may be solved by changing traffic patterns, increasing communication around existing store options, and offering subscription services, with these solutions potentially recommended by urban planning, communications, and marketing domain perspectives, respectively. Nevertheless, as suggested by the above example, a selective approach to DP integration is dependent on the variety of solutions suggested by different DPs being complementary in nature and amenable to combination. That is, a selective approach to DP integration becomes less effective when the advertisements that are distributed are for stores that are difficult to get to (i.e., when solutions introduced across DPs are incompatible). Moreover, a selective approach to DP integration is particularly unhelpful when the solutions that are offered across DPs are directly in conflict. For instance, while one DP may argue for increasing shopping options, another DP may argue for the same land being used for additional road construction or for a park, to increase foot traffic, more broadly. When solutions offered by different DPs are in conflict with one another these become quite difficult for students to reconcile, particularly when students have limited domain and cross-domain expertise. Indeed, in such instances of conflict students are likely to choose a solution offered by one DP over another for a variety of well-justified or arbitrary and ad-hoc reasons. These include DP selection based on endogenous evaluation or on the comparison of competing DP-based conclusions according to universal values or personal criteria, as is discussed in the previous section. While exercises in this type of comparison, evaluation, selection, and prioritization may be important for students to engage in, transformative and structural approaches to DP integration are further introduced as means of engaging students in more robust domain perspective integration.

### *Transformative*

A transformative approach to DP integration is one that directs students’ attention to the problems that they are seeking to address, rather than to DP-specific solutions, as is the case with a selective approach. A transformative approach to DP integration is one that is used to define, rather than solve, problems. As such, it emphasizes using domain perspectives as lenses on a common topic and looking across the insights originating from these various lenses to jointly specify and define problems in a way that is mutually negotiated and agreed upon, across domains. Thus, in a transformative approach to DP integration, problem definitions may be expected to be clarified, corroborated, and prioritized across DPs, until a joint problem scope is defined. Such comparison and prioritization may be expected to be more systematic or analytic, as compared to a selective DP integration approach, which may be expected to prioritize among DP-based solutions in a more ad hoc manner.

In a transformative approach to DP integration, the problems that students are asked to solve are not only addressed by different domain perspectives but rather are reconceptualized in light of these. For instance, the problem of deciding whether or not to construct a shopping mall may, rather, need to be broadened to consider how to make an area of a city more attractive to its residents and to define what may make an area of a city “attractive” and who may be defined as a “resident” across domains. This broader, analytic approach to question definition may provide a way for different DP approaches to be juxtaposed and put into conversation with one another. Indeed, the emphasis in transformative DP integration is not on the selective or ad hoc picking and choosing among maximally compatible DPs; rather it is on building consensus across domain perspectives by explicitly asking such perspectives to specify key priorities and concerns. In such a way, a transformative approach to DP integration further asks students to consider how different DPs may both define problems around a common topic and conceptualize such problems in terms of universal values or ideals. In contrast to a selective approach to DP integration, a transformative approach may be said to require students to develop a cross-domain understanding of problems, prior to engaging in cross-domain problem solving (e.g., solution generation) *per se*.

Yet, a transformative approach to DP integration is likely not to be considered to be truly interdisciplinary in nature (Van den Besselaar & Heimeriks, 2001). Such an approach nevertheless treats DPs as separate entities and only focuses on defining a shared or common language across these through problem definition. A final structural approach to DP integration is therefore proposed as an instance of true interdisciplinarity.

### *Structural*

A structural approach to DP integration integrates multiple domain perspectives in and of themselves. That is to say that even absent any specific problems or efforts aimed at their resolution, a structural approach to DP integration seeks to connect domain perspectives in an effort to view the world in an enriched and multidimensionally informed way. As such, a structural approach to integrating domain perspectives requires redefining objects of focus, methods of inquiry, and evaluative standards across domains. In turn, this may result in whole novel objects of inquiry being considered, new and interdisciplinary methods being developed, and adaptive evaluative standards being established.

Within the context of structural integration, because it is domains themselves that are integrated, the selection of domains for integration must be especially purposeful or deliberate on the part of learners. Such deliberate selection should be guided by individuals’ deep level knowledge of the to-be-integrated domains. At the expert level, such a structural approach to domain integration may be considered core to the development of interdisciplinary domains of public policy, behavioral economics, human–computer interaction, and gender studies. At the more novice level, such deliberate domain integration may be considered to be the focus of developing students’ interdisciplinary understanding and problem solving only once a fairly advanced level of DPL has been achieved (e.g., once students have experience with selective and transformative DP integration).

*Comparing Selective, Transformative, and Structural  
Approaches to DP Integration*

Selective, transformative, and structural approaches to DP integration may be compared to one another along a number of dimensions. Principally, these differ in the extent to which multiple domain perspectives are truly integrated or simply consulted or combined. That is, selective DP integration adopts a functional view toward DPL, only drawing on multiple domain perspectives to generate a number of solutions without integrating solutions across domains, except in an additive manner. A transformative approach to DP integration is focused on building connections across domain perspectives in how they see the world and the problems they identify with in it. While a transformative approach is focused on analyzing and comparing insights introduced across domain perspectives and evaluating these according to shared standards or universal values, such an approach still does not integrate domains *per se*. Finally, a structural approach to DP integration systematically combines domains, in terms of their domain characteristics, to approach the world in an interdisciplinary, yet unitary fashion.

Further, approaches to DP integration may be considered to differ from one another in the stances toward interdisciplinary problems that they adopt. Selective approaches to DP integration are functional in nature and are focused on generating a number of domain perspective-based solutions to complex problems and choosing from among these. Transformative approaches shift the focus to defining problems in a broad and multiple domain perspective-informed fashion. Finally, a structural approach to DP integration first unifies multiple domain perspectives and then uses these as one common lens to define problems, propose solutions, and examine information in the world, more generally. As such, while selective and transformative approaches to DP integration may be said to view problems in a multidisciplinary (i.e., drawing on multiple domains) fashion, is it only transformative DP integration that is interdisciplinary in nature, or reflective of true cross-domain integration (Van den Besselaar & Heimeriks, 2001).

Finally, these different approaches to DP integration vary in how deliberate they are in the domains that they elect to consult and the criteria they use to select among and compare these. A selective approach to DP integration may be considered to be the most ad hoc. That is, such an approach may be expected to be focused on generating a large number of domain perspective-specific solutions to problems and combining these in ways that are convenient, most of all, rather than deliberately considered. A transformative approach to DP integration may be considered distinctive because, in analyzing and comparing problem conceptualizations across DPs, such an approach is purposeful in setting out the common criteria that may be used to judge or balance varied problem definitions, with these common criteria typically taking the form of universal values or ideals. Finally, a structural approach to DP integration is the most systematic in considering not only the criteria according to which insights from across DPs may be compared (i.e., as is done within a transformative approach to integration) but also in purposefully choosing the DPs that students ought to be asked to draw on. These various approaches to DP integration and the differences among them are summarized in Table 11.1.

**Table 11.1** Comparing Approaches to Domain Perspective Integration.

	What is Integrated?	Method of Integration	Degree of Systemization
<b>Selective</b>	Multiple DP-specific solutions to problems	Additive	Limited
<b>Transformative</b>	Problem definitions across DPs	Corroboration and comparison	Problem definitions are systematically compared and held to common, universal standards
<b>Structuralist</b>	Features of domains (i.e., objects of focus, methods of inquiry, evaluative standards)	Synthetic and generative of new objects of focus, methods of inquiry, and evaluative standards	Highly purposeful in the domains that are chosen for integration

## PURPOSE FOR DOMAIN PERSPECTIVE LEARNING

As is likely evident from the previous sections of this chapter, learning from multiple domain perspectives represents quite a challenging and demanding process for students. This begs the question of why learning from multiple domain perspectives should be an activity that students engage in at all, particularly when students, even at the undergraduate level, have difficulties reasoning even within the bounds of a single domain. In the section that follows, three distinct functions or purposes for teaching students to engage in domain perspective learning are identified. These are to build deeper understanding, enhance problem solving, and foster critical thinking.

### *Build Deeper Understanding*

The fundamental purpose of learning from multiple domain perspectives rests in necessity. Much information in the world, particularly expert information and information written about complex topics, is necessarily written from a domain perspective, regardless of whether such a perspective is explicitly identified by the author or not. As such, meaningfully understanding and evaluating a great deal of complex information requires students to be able to conceptualize domain perspectives or to recognize how the domain characteristics associated with particular DPs inform the specific information included in DP-specific texts.

Engaging students in reasoning about the connection between domain perspectives and the information included in a text fosters their *epistemic cognition*. Maggioni and Parkinson (2008) define epistemic cognition as what individuals *do* when engaged in reflecting on what knowledge is and how it may be justified. For example, students engage in epistemic cognition when evaluating sources during reading to determine whether they are making credible knowledge claims or when corroborating information across texts to confirm its veracity (Barzilai & Zohar, 2012; Bråten et al., 2011). Despite the centrality of epistemic cognition in dictating how individuals view the world and process information, considerable empirical evidence suggests that students do not readily engage in epistemic cognition, rarely evaluating sources, detecting discrepancies, or corroborating information, unless explicitly instructed to do so (Kienhues, Stadler, & Bromme, 2011; List, Alexander, & Stephens, 2017; Mason, Boldrin, & Ariasi, 2010; Stadler & Bromme, 2007; Valanides & Angeli, 2005).

This chapter argues that beyond source evaluation, students' recognition of domain perspectives during reading reflects epistemic cognition or students' reasoning regarding what knowledge is and how it is established, in a domain-specific fashion (Chinn, Buckland, & Samarapungavan, 2011). Such DP-based epistemic cognition may involve inferring the methods of inquiry used to gather data (e.g., understanding that public opinion polls reflect survey data gathered via self-report) or applying domain-specific standards to evaluating information (e.g., questioning how replicable or reliable experimental findings may be). As such, asking students to recognize and conceptualize domain perspectives constitutes a form of epistemic cognition, with greater epistemic cognition associated with benefits for learning and academic achievement (Lodewyk, 2007; Muis, 2007).

### *Problem Solving*

Problem solving is a secondary function served by helping students to conceptualize multiple domain perspectives and compare and integrate across these. Problem solving refers to the novel generation of solutions on the part of the learner (Mayer, 2006). Such solution generation may be achieved by selectively, transformatively, or structurally integrating domain perspectives to, at the most sophisticated level of DP integration, achieve interdisciplinary problem solving. As such, engaging students in domain perspective learning during problem solving results in their generating more domain-specific solutions (i.e., selective approach), reconceptualizing problems and problem spaces from multiple domain perspectives (i.e., transformative approach), and structurally integrating domain perspectives to develop novel methods and approaches to inquiry. This last, structural approach to problem solving and DP integration reflects the argument, introduced across a variety of domains, that some intractable problems that exist in the world today (e.g., inequality, climate change) can only be addressed interdisciplinarily. As reflected in a structural approach to DP integration, this would involve the deliberate and systematic application of novel modes of inquiry, developed based on practices from across disparate domains, to address these.

### *Critical Thinking*

Finally, domain perspective learning may serve as a mechanism for fostering critical thinking. Here, one specific aspect of critical thinking is examined: the evaluation of statements or conclusions according to the information that they are based upon vis-à-vis the information that they ignore or exclude. Examples of this type of critical thinking include students' critiques of media for the stories and characters that it features or fails to portray and represent (Kellner, 1995) and critiques of medicine for its piecemeal focus on isolated ailments, rather than on a person as a whole and their environment, in an anthropologically informed manner (Baer, Singer, & Johnsen, 1986; Gee & Payne-Sturges, 2004). This type of critical thinking, focused on what is represented and what is excluded, may be considered to be an essential part of building interdisciplinary understanding. As explained by Feuerstein (1999): "The educational strategy for multi-dimensional thinking requires pupils to cope with multi-faceted tasks on a single issue. This demands defining the whole gamut of potential aspects which exist in a given situation" (p. 44). Here, Feuerstein defines

multi-dimensional thinking in much the same way that this chapter defines critical thinking, as concerned with the myriad of “potential aspects” of a given situation. DPL may be viewed as a mechanism for helping students to identify and reason about such “potential aspects” or to engage in critical thinking.

Generally speaking, students have been found to struggle with critical thinking and analysis, even when evaluating arguments in only one domain (Marin & Halpern, 2011; Twardy, 2004). This struggle has been attributed, in part, to limitations in students’ reasoning skills, with students lacking a framework to use in evaluating arguments against various standards (Ennis, 1991; Wu & Tsai, 2007). As suggested in this chapter, domain perspective learning may serve as a mechanism for helping students to engage in critical thinking and to apply evaluative standards from across domains to analyzing complex and multidimensional problems. For example, students may have difficulties thinking critically about a proposal to build a new shopping mall and may not question the economic benefits that it promises to deliver. Nevertheless, directing students to consider multiple domain perspectives on this issue may prompt them to both evaluate the promise of added jobs according to domain-specific evaluative standards in economics (e.g., how were job projections identified or estimated) and to further consider the sociological (e.g., who would benefit by having access to jobs and more consumer goods?), geographic (e.g., how would the mall fit into the urban landscape?), and political (e.g., who is involved in the decision making around building a new shopping mall?) ramifications of this plan.

Drawing on different perspectives as a mechanism for fostering critical thinking has been done in work by Kiili, Coiro, and Hämäläinen (2016). Specifically, to help students develop arguments and counterarguments during two-sided argumentation, Kiili et al. (2016) introduced students to a *perspective pallet*, listing educational, political, ideological, judicial, social, ethical, and global perspectives, among others. Once introduced, students were able to use this perspective pallet to generate a variety of arguments or to think critically about a common topic. Applied to DPL, such a perspective pallet may serve as the basis for introducing students to different domain perspectives and their associated domain characteristics. As students come to understand these different domains and their associated characteristics, they can use the DPs represented in a perspective pallet to think critically about complex topics.

Thus far, this chapter has suggested that the benefits of learning from multiple domain perspectives include building deeper level understanding of complex issues, improving problem solving, and fostering critical thinking. Nevertheless, despite these stated benefits, a cautionary note is needed regarding what may be expected of novices engaged in DPL vis-à-vis their expert counterparts.

### **CAUTIONARY NOTE ON NOVICES’ DOMAIN PERSPECTIVE LEARNING**

The goal of this chapter is to describe how domain novices may be engaged in domain perspective learning and, ultimately, in interdisciplinary problem solving. This novice focus is appropriate, first, because the majority of students in K-12 schools are just such domain novices, with no specific domain expertise. Second, this novice focus is appropriate since the domain-perspective reasoning of experts is quite different from that of novices (Grosslight, Unger, Jay, & Smith, 1991; Wineburg, 1991). In part,

this is because an intrinsic aspect of expertise is that, once such expertise is achieved, processing information, including reading and writing, is inherently done from that expert's domain perspective. That is, an expert biologist does not need to be taught or directed to recognize the domain and sub-domain perspectives of their field represented in text or to judge these using domain-specific evaluate standards. A feature of their expertise is that such domain perspective-based reading and reasoning is almost second nature. Likewise, what is meant for an expert in one domain to reason across other domains is different than what may be expected of novices reasoning across domain perspectives. Although experts in one domain are not necessarily experts in another, their efforts to reason across domains may be much more likely to result in the structural integration of domains (i.e., in interdisciplinary understanding), rather than in more selective or transformative DP integration. This is because their expertise in one domain may bolster their understanding of the domain characteristics of another (Bruns, 2013; Schunn & Anderson, 1999). This may especially be the case when the domains that experts are integrating share certain characteristics, as reflected in interdisciplinary fields like biochemistry and political philosophy. Nevertheless, the degree of DP-based, interdisciplinary reasoning ascribed to experts can hardly be expected of novices.

Why, then, is it a worthwhile endeavor to engage domain novices in reasoning using various domain perspectives? As suggested previously, DPL allows novices to draw on and benefit from others' domain expertise (e.g., when reading texts written by experts), without yet having to have developed domain expertise of their own. These benefits extend to allowing novices to learn about the epistemic practices that define different domains and helping them to approach interdisciplinary problems more competently and strategically. At the same time, encouraging students to move fluidly across various domain perspectives, with little to no domain expertise of their own, runs the risk of fostering a kind of artificiality or epistemic ersatz. At worse, such learning may encourage students to treat domain perspectives in a superficial or heuristic fashion. For instance, an economic perspective may be viewed as synonymous with wanting to maximize profit while an ecological perspective may be conceptualized as unidimensionally opposed to development of any kind. Such epistemic ersatz may be especially likely to arise when curricula are not structured to support students' deep exploration of domain characteristics and domain-specific epistemic practices, alongside engaging in interdisciplinary problem solving. To guard against such epistemic ersatz, this chapter closes by identifying three instructional strategies that may be use to foster students' domain perspective learning in the classroom.

## **STRATEGIES TO FOSTER DOMAIN PERSPECTIVE LEARNING**

There are three instructional strategies that can be used to promote domain perspective learning. These strategies are introduced with the recognition that not all tasks, and perhaps not even the majority of tasks, require interdisciplinary understanding. Teaching students to approach and investigate complex problems within, rather than across, domains should continue to be the central focus of instruction. Likewise, not all problems require interdisciplinary resolution. Nevertheless, when an interdisciplinary approach is required, three strategies can be used to promote students' domain

perspective learning. These strategies are (a) making domains and domain characteristics explicit for learners, (b) asking students to read and write domain-specific texts, and (c) engaging students in identifying ill-structured and complex problems.

### *Making Domains and Domain Characteristics Explicit for Learners*

The fundamental challenge associated with engaging learners in DPL and, ultimately, in interdisciplinary problem solving, is that students' DP-specific reasoning may be limited by their relative lack of domain knowledge or expertise. That is, novice learners may be expected to be both limited in their knowledge of domain content (e.g., events in history) and in their knowledge of domains, *per se* (e.g., the methods of inquiry and evaluative standards used in history). As such, a challenge for teachers rests in building these two aspects of domain knowledge simultaneously, when students need to understand domain characteristics to understand how content within domains has come to be determined and substantiated. For instance, teaching students about the causes of the Civil War also requires introducing them to the evidence sources (i.e., objects of focus) that historians examine to determine causality and to causal analysis as a method of historical reasoning.

While teaching domain content to novices can be said to characterize much of the instruction happening in today's schools, teaching students about domains, themselves, occurs to a much more limited extent (Goldman et al., 2016). This fact is underscored by the ease with which it is possible to essentialize domains only according to the content or concepts that they include, rather than considering domains' underlying characteristics. For instance, it is easy to view literature as only the reading of great texts or to view history as a collection of facts about wars and kings. Although domains are, of course, partially defined by the content that they include, the structure and epistemic characteristics of domains should be made more explicit to students. Indeed, DPL requires first and foremost that students come to understand domains and their essential characteristics. This would include helping students to conceptualize domains in terms of the objects and subjects that they study, the methods they use, and the evaluative standards that they apply. Such explicit identification can be done by introducing students to domain-specific, epistemic-related concepts (e.g., defining reliability or hypothesis testing) and by engaging students in the methods of inquiry and epistemic practices of different domains. This may include involving students in data collection in the classroom or helping students to use historical archives for research (Kanari & Millar, 2004; Roff, 2007; Tally & Goldenberg, 2005; Zhai, Jocz, & Tan, 2014). Moreover, such an understanding of domains and their essential characteristics may be fostered by modeling for students the kind of reasoning that characterizes methods in different domains and how to apply domain-specific standards to their evaluation. Collins, Brown, and Newman (1988) refer to this as *cognitive apprenticeship* and prescribe it as an antidote to the problem of "schools ... [being] relatively successful in organizing and conveying large bodies of conceptual and factual knowledge ... [but] render[ing] key aspects of expertise invisible to students" (p. 2).

### *Asking Students to Read and Write Domain-Specific Texts*

An additional mechanism for fostering students' DPL and building their understanding of domains and domain characteristics, is engaging them in domain-specific

reading and writing. Among the features distinguishing different domains or areas of study are their communicative practices, including the text formats and publication practices that may define each domain (Goldman et al., 2016). As such, when students read domain-specific texts this can develop their conceptions of domains, particularly if the communicative practices that are exhibited within each domain are identified and the evaluative standards used to make judgments within each domain are made explicit. For instance, this may include asking students to evaluate sample size and representativeness when reading studies in psychology or asking students to distinguish among primary and secondary sources in history. Likewise, helping students to build rich conceptualizations of domain perspectives may also be done by asking students to create domain-specific texts (e.g., policy briefs, lab reports). Doing so may not only serve as an academic exercise but also constitute a mechanism for engaging students in domain-specific practices. That is, while writing a laboratory report constitutes a common academic assignment, completing such a report can further develop students' understanding of how the structure of a laboratory report serves to meet the domain-specific evaluative standards of knowledge building in science (e.g., precision, replication). Doubtless, at present, this degree and depth of instruction about domain characteristics represents a relatively narrow sliver of US schooling (e.g., in Advanced Placement classes and apprenticeship courses, Bell, Blair, Crawford, & Lederman, 2003; Brophy & VanSledright, 1997). At the same time, sustained efforts aimed at building domain literacy suggest that many more students can be engaged in such learning even at very young ages (Driver, Newton, & Osborne, 2000; Goldman et al., 2016; Taylor, Barker, & Jones, 2003; VanSledright, 2002).

### *Engaging Students in Identifying Ill-Structured and Complex Problems*

Beyond building students' understanding of domains and domain characteristics, engaging students in DPL is often an exercise in problem solving. Such problem solving requires that the focal problem topic or issue be sufficiently complex and multifaceted to warrant examination from multiple domain perspectives. As such, when determining what problems may be fruitful contexts for developing DPL and interdisciplinary problem solving, three standards may be used. First, such problems should be complex. Such complexity may come from problems being fairly abstract or general in nature (e.g., inequality) or consisting of many elements, related to one another in a variety of ways (e.g., shopping mall construction). These many elements may constitute different objects and subjects of inquiry that can be explored across domain perspectives.

Second, such problems should be open-ended or ill-structured in nature. As defined in classic typologies of problem solving (Simon, 1973), ill-structured problems may be characterized in a number of ways. To start, such problems are defined by having an ambiguous or incomplete problem space. This requires learners to define and make inferences about what, specifically, a problem entails and what the boundaries of a particular problem may be. Second, ill-structured problems, due to their ill-defined problem space, have no obvious or evident end-state and no optimal solution path for students to follow. This requires learners to self-determine how a particular problem ought to be solved and what the desired outcomes of a problem should be, with no objectively correct answers involved. This ambiguity in problem space, solution

process, and problem outcomes provide room for each of these elements to be conceptualized differently according to the particular domain perspectives that students draw on. For instance, a selective approach to domain perspective integration may involve students generating a variety of possible solutions to an ill-structured problem, while a transformative approach to DP integration may, rather, involve learners defining problem spaces from a variety of domain perspectives. Although the ultimate goal may be for students to be able to structurally integrate DPs or to engage in interdisciplinary problem solving, such advanced problem solving is undergirded by students' selective and transformative DP integration.

Finally, in looking for problems for learners to address in an interdisciplinary fashion it is important that these be sufficiently important or high-stakes so as to be motivating for learners. Domain perspective learning is a challenging and demanding task. While participating in such a challenging and complex task may be inherently or intrinsically motivating for some learners, for others the value of task completion may need to be sufficiently high to warrant the necessary degree of cognitive engagement required. Such value may come from topic interest or from the importance that learners assign to the issues that they are asked to investigate or the problems that they are asked to solve.

In addition to selecting problems for learners that are complex, ill-structured, and motivating, a necessary approach to fostering DPL may be asking students to generate and define particular problems or topics of inquiry for themselves. As demonstrated in case studies of inter-disciplinary classrooms (Brown, 2002; Springer, 2006), such problem definition and topic generation often takes the form of question specification and serves an essential function for students in both helping them to conceptualize problems in a precise yet multifaceted manner and in motivating the problem solving process. Moreover, engaging students in question specification may result in the generation of problems rooted in students' local, school-based, and neighborhood concerns. Addressing such concerns, alongside more global issues affecting us all, is at the core of interdisciplinary understanding and problem solving.

## CONCLUSION

This chapter introduces the construct of domain perspective learning as a precursor to students' development of interdisciplinary understanding and problem solving in the classroom. In particular, domain perspective learning is defined as students' recognition of information included in text as reflecting the objects of inquiry, methods, and evaluative standards that define particular domains. Moreover, DPL is defined as including students' use of domain perspectives to make inferences about and evaluate information in domain informed ways and their integration of domain perspectives to solve problems. In making the case for domain perspective learning, the benefits of DPL for building deeper understanding, improving problem solving, and fostering critical thinking are discussed. At the same time, DPL is fundamentally positioned not as an alternative to a-perspective or "objective" learning, as such learning does not exist. Rather, to the extent that students' processing of information in the world is always a matter of perspective, this chapter argues for developing students' understanding of domain perspectives as a way of enhancing and systematizing such processing.

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