CHAPTER 2

Concept-Based Inquiry

Why Concept-Based Inquiry?

"I'm very passionate about a Concept-Based curriculum because I think there's something in the agency it gives students through them seeing knowledge and understanding as something that they have control over. When you deal with knowledge at a surface level, and students are able to simply parrot it back to you, they're just reproducing what it is that you're teaching, and they have no agency in that process. When they're engaging deeply with underlying understandings and constructing them for themselves, they come out of that process with the deep empowerment that allows them to think creatively and engage creatively in new thinking circumstances."

—Ian Tymms
Head of Middle School English, United World College South East Asia

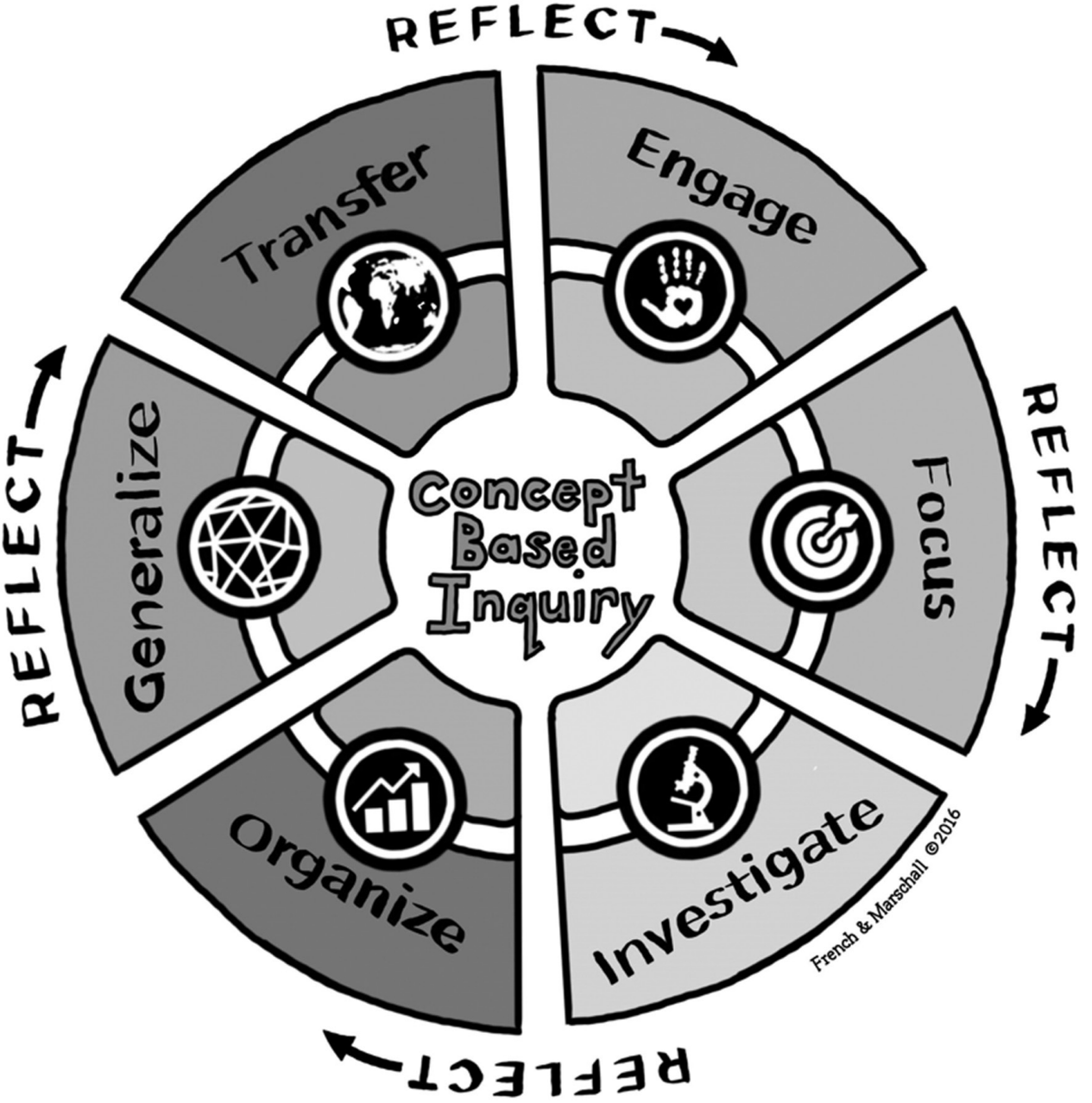
"Delving more deeply into conceptual learning with such young children has proved to me that we must have high expectations of what they are capable of. I have been impressed with the clear generalizations they have formed. In just a short amount of time, they are building conceptual understandings that they will be able to transfer to different situations."

—Melanie Smith
Grade 2 Teacher, International School of Amsterdam

A Model of Concept-Based Inquiry

Several strong models of inquiry-based learning have already been developed and have indeed shaped our thinking about the purpose and features of each phase of Concept-Based Inquiry (Dewey, 1938; Murdoch, 1998; Short, 2009). The intent of our model is to help educators reflect on how concepts and conceptual understandings form through inquiry-based learning and the role of the teacher in **scaffolding** this process. Our model of Concept-Based Inquiry, seen in Figure 2.1, describes a process that can be applied to both disciplinary and interdisciplinary teaching and learning. A brief description of each phase of Concept-Based Inquiry is found in Table 2.1.

FIGURE 2.1 THE CONCEPT-BASED INQUIRY MODEL



NOTE: A color version of this model is available for download via our membership site, **www.connectthedotsinternational.com/members-only**

TABLE 2.1 THE PHASES OF CONCEPT-BASED INQUIRY

Phase of Inquiry	Purpose
Engage 	• To engage children emotionally and intellectually in the unit • To activate and assess students' prior knowledge • To invite initial student questions
Focus 	• To develop a shared understanding of the unit's driving concepts using concept formation strategies • To introduce relevant factual examples that may be explored further in the Investigate Phase of inquiry
Investigate 	• To explore factual examples, or case studies, and connect these to unit concepts • To expand student understanding of unit concepts by providing case studies that introduce complexity and/or raise additional questions • To acquire disciplinary and interdisciplinary skills
Organize 	• To organize thinking at both the factual and conceptual level • To represent concepts and ideas using different materials, media, and/or subject areas • To recognize and analyze skills in context
Generalize 	• To form connections and locate patterns across factual examples • To articulate, justify, and communicate generalizations
Transfer* 	• To test and justify the validity of generalizations • To apply generalizations to new events and situations • To use experiences and understandings to form predictions and hypotheses • To take meaningful action on one's learning
Reflect** 	• To build students' sense of personal agency • To enable students to plan and monitor their learning process • To individually and collectively evaluate learning progress during and at the end of an inquiry

*Often extends beyond the time spent on a unit in the classroom

**Embedded into all phases of inquiry

The Phases of Concept-Based Inquiry

Engage

Fundamental to an inquiry approach is engaging student interest in a topic and connecting with learners' own experiences and prior knowledge. This phase of inquiry sets the stage, defining the scope of learning that follows. During the Engage Phase, the topic of study and unit concepts are introduced in a manner designed to spark student interest. The goal is to engage students emotionally and intellectually, so they feel invested in the inquiry and want to find out more. By activating their prior knowledge, students are able to make initial connections to a particular topic or set of concepts. This includes sharing questions they may already have. Learning experiences that provoke students' thinking and curiosity are employed for this purpose, providing teachers with an opportunity to step back, observe, and gather valuable assessment information. Chapter 4 considers what emotional and intellectual engagement looks like in the Engage Phase of inquiry.

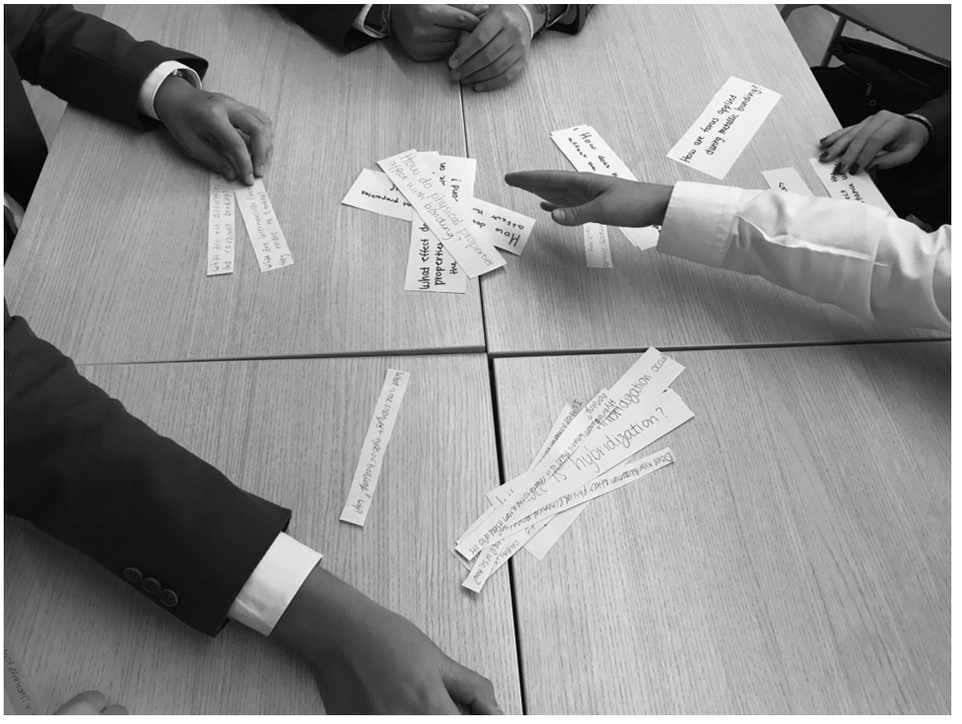


Photo 2.1 The Engage Phase in Action

Students sort, group, and name questions in their IB Higher Level Chemistry class during the Engage Phase of inquiry (see Chapter 4, p. 116).

SOURCE: Julia Briggs

Focus

Once students are engaged in a unit, concept formation strategies are employed to develop an understanding of the unit's **conceptual lens** and **driving concepts.** Addressing concept formation early in a unit has multiple benefits. First, it ensures that all children have a shared understanding of the unit's driving concepts. This prepares students for thinking to come. As students work with knowledge and skills in the Investigate Phase, they stretch and expand their initial understanding of unit concepts.

Second, focusing on concept formation allows teachers to address misconceptions uncovered in the Engage Phase that may hinder the development of generalizations later in the unit. In a unit on forces, for example, if some students think that movement must occur for a force to act on an object, this could hamper their ability to create an accurate generalization. As Concept-Based practitioners, we need to be explicit about the essential attributes of unit concepts and use appropriate examples and non-examples to help students shape their thinking.

Lastly, but just as important, by being clear about our unit concepts and addressing these through our instructional strategies, we can ensure alignment between our concepts, our factual examples, and the generalizations we would like children to develop. By being reflective and working backward from our generalizations, we can plan learning engagements that take children to the conceptual level of thinking. Chapter 5 provides an in-depth look at the Focus Phase of inquiry.

Photo 2.2 The Focus Phase in Action

Students take part in a Spectrum Sort using a clothesline to understand the concept of repeated addition in the Focus Phase of inquiry (see Chapter 5, p.128).

Investigate

After ensuring a common understanding of the conceptual lens and driving concepts, children are ready to conduct their own research. The Investigate Phase invites students to explore a range of factual examples or skills, which connect to unit concepts. This research phase of the inquiry may involve individual, small-group, or whole-class investigations. Depending on the amount of structure within a unit, investigation may take different forms. At times, the class may collectively examine the same **case study**. During other inquiries, students may choose their own to research within the context of the broader topic. As students learn about a particular topic, teachers maintain a dual focus on the both acquiring factual knowledge and the development of skills and strategies to ensure

Photo 2.3 The Investigate Phase in Action

Students use microscopes to learn about the formation of crystals in substances during the Investigate Phase of inquiry (See Chapter 6, p.154).

SOURCE: David French

the research process is successful for students. Chapter 6 describes ways to organize and support student research in the Investigate Phase of inquiry.

Organize

The Organize Phase gives students the chance to structure their thinking at both the factual and conceptual levels, while beginning to explore patterns in their findings. During this stage of inquiry, students organize data gathered in the Investigate Phase. This is an important step for students, as making sense of information using tools such as graphs, charts, or maps enables children to start seeing commonalities across case studies. Organizing findings allows the class to access content more easily and reduces cognitive load. This step supports the development of generalizations in the next phase of inquiry.

At the same time, students are given the opportunity to represent concepts acquired in the Focus Phase through different media and/or subject areas. This enables students to

Photo 2.4 The Organize Phase in Action

Following an investigation, students organize materials based on their properties using a Venn Diagram.

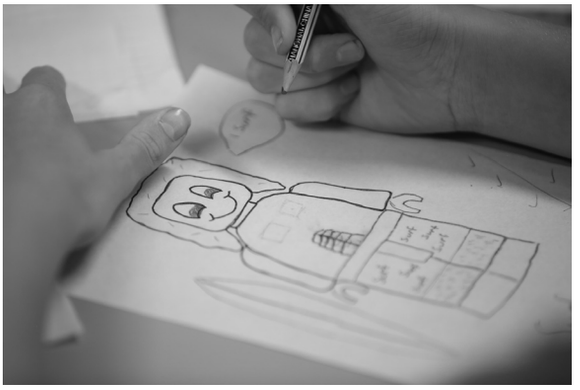
SOURCE: Gayle Angbrandt

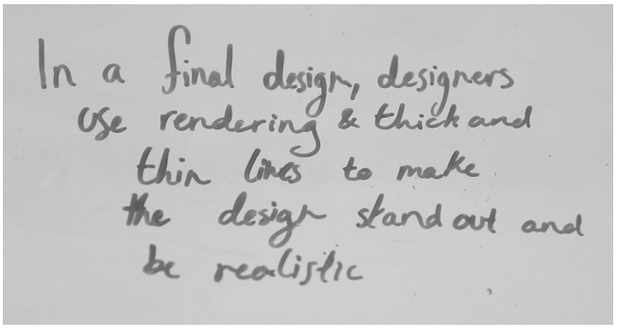
consolidate their thinking about unit concepts. For example, a third-grade unit on multiplication may provide children with experiences to represent the concept of an *array* through drawing or with objects. Opportunities to represent findings encourage students to reflect on a concept's essential attributes and how these can be depicted in divergent ways. Chapter 7 explores in detail how teachers can help students organize and represent their thinking in the Organize Phase.

Generalize

In the Generalize Phase, students draw on facts or skills to articulate statements of conceptual understanding. Using **organizers** developed in the previous phase, students recognize patterns and make connections. Students then identify relationships between concepts and state their conclusions as generalizations. As detailed in Chapter 1, generalizations are statements of understanding, which describe the relationship between two or more concepts. For example, a generalization connecting the concepts of *voice* and *audience* may be "Writers use voice within their writing to communicate effectively to an audience."

As generalizing leads to transferable understanding, we believe that this is the *most critical* phase of the inquiry process. Without this phase of inquiry, we cannot be sure that children will be able to apply their thinking to new situations or contexts they may encounter. The Generalize Phase provides the foundation for various types of transfer that occur during and after a unit, including student-initiated action. Chapter 8 examines ways that teachers can scaffold student thinking to develop conceptual understandings in the Generalize Phase.





Photos 2.5 and 2.6 The Generalize Phase in Action

Students in Carl Waugh's Middle School Design and Technology class generalize about the role of rendering in a final design.

SOURCE: David French

Transfer

After our students have formed generalizations, we allow time for the application and transfer of these to new factual examples within an inquiry. During the Transfer Phase, students are encouraged to "test out" their conceptual understandings, ensuring they are valid and accurate. Teachers plan learning engagements to help children assess and refine the transferability of their generalizations. We ask questions related to different types of transfer such as:

- Is this understanding *always true*, given the case studies we researched?
- How can we adjust the wording of our understanding, so it better reflects all our factual examples?
- How does this understanding relate to current events and issues in the world today?
- Can we relate our understanding to new situations and predict how it will "fit"?
- Can we apply our understanding to create new ideas, products or projects?

Although the Transfer Phase exists as part of the Concept-Based Inquiry process, it often extends beyond the time spent on a unit in a classroom. Students continue to transfer their understandings when they encounter current events and new learning that relate to an inquiry. When these situations arise, we can highlight them in discussions to reiterate how our understandings apply to the world outside the classroom. As educators, we can also choose to revisit this phase of inquiry long after a unit is complete, especially when "teachable moments" arise that help children consolidate or extend their understanding. Chapter 9 examines types of transfer and how these can be encouraged during the Transfer Phase of inquiry.

Reflect

Reflection is not a phase in itself, but embedded into all parts of our model of Concept-Based Inquiry. Using metacognitive thinking, students consider how knowledge, skills, and understandings gained in a unit may have changed one's mindset, perspective,

Photo 2.7 The Transfer Phase in Action

Jessica Humble-Crofts' students at the American School of Bombay hypothesize about ways to minimize thermal energy transfer and develop models to test their ideas in the Transfer Phase of inquiry.

SOURCE: Jessica Humble-Crofts

or behaviors. We encourage individual and class reflection on learning throughout a unit to plan for success, monitor progress, and evaluate the outcomes of an inquiry. Making reflection a regular practice in our classrooms promotes a strong sense of agency, as students are motivated and invested in the learning process. By modeling reflective talk as a class community, we create the expectation that all students *actively* use their learning. In this respect, reflection may integrate seamlessly with the Transfer Phase, especially at the end of an inquiry. Chapter 10 looks in depth at the role of reflection throughout the Concept-Based Inquiry process.

The Complexity of Inquiry

One of the inherent risks in articulating a model of Concept-Based Inquiry is that it becomes a series of rigid steps to be followed in a prescribed order. Although models can support sense-making, we recognize that authentic inquiry is messy and complex. For this reason, our model of Concept-Based Inquiry should be viewed as *recursive* rather than linear, as phases do not always follow one another in sequential order. For instance, it is common for students to synthesize their findings and form generalizations multiple times in a unit, returning to the Investigate and Organize phases each time to do so. In this regard, units of inquiry may appear to have "mini-inquiries" nested within them. Inquiry is certainly a complex process, but this model provides a common language to discuss and strengthen the conceptual understandings we seek to develop in students.

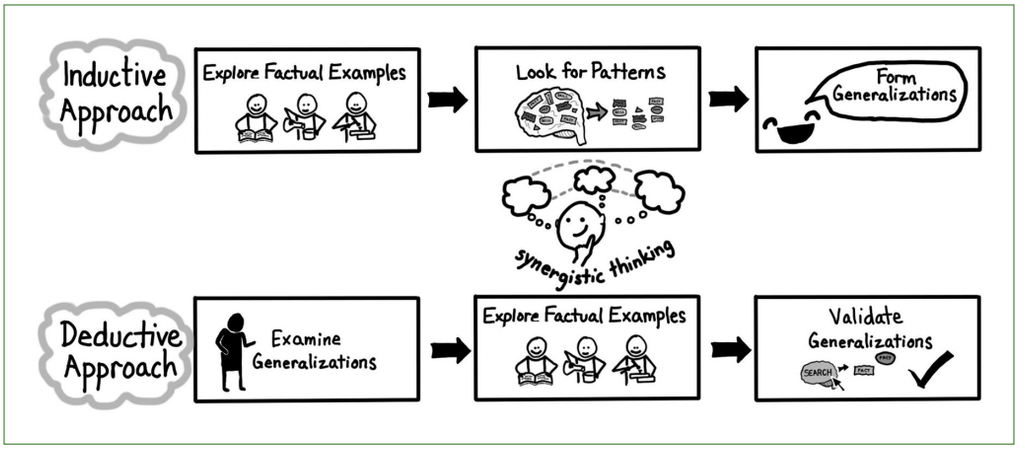
Concept-Based Inquiry and the Inductive Approach

As explored in Chapter 1, inquiry-based approaches can be viewed as sitting on a continuum ranging from structured to open inquiry. Across all approaches, we use active questioning as one of our main vehicles to drive learning engagements, guiding students toward transferable understandings. For this reason, the **inductive approach** is central to the Concept-Based Inquiry model.

What does inductive learning entail? In an inductive approach, students explore factual examples, look for commonalities across them and then form generalizations to synthesize their findings. Students look for patterns in order to articulate *their own* generalizations (see Figure 2.2). In the inductive approach, students are responsible for and own their thinking.

This contrasts to a **deductive approach** to developing understanding, where teachers tell students what they will understand in a study, followed by the investigation of factual examples that support this generalization. Student investigation results in the validation of the *teacher's understanding* shared with the class. In both inductive and deductive methods, **synergistic thinking**—the interaction between factual and conceptual levels of thinking—is required to induce deep understanding (Erickson & Lanning, 2014, p. 10).

FIGURE 2.2 INDUCTIVE AND DEDUCTIVE TEACHING FOR UNDERSTANDING



So why do we promote an inductive approach? If we give students generalizations before relevant factual examples are explored, we do the thinking for our students. This suggests a belief that children do not have the intellectual capacity to construct their own understandings and devalues their thinking. If we want to create thinking classrooms, we must trust that our students are both capable and competent conceptual thinkers. Although teachers create their own set of generalizations to use in planning, we do not share or "unpack" these generalizations with students. We allow them to construct and articulate their own conceptual understandings.

If we want to create thinking classrooms, we must trust that our students are both capable and competent conceptual thinkers.

Creating a Culture of Concept-Based Inquiry

As teachers, we often notice that some children are naturally strong at conceptual thinking. These students make rich connections, share insightful comments, and transfer understanding from one study to another with little to no teacher support. Our experiences with these students may lead us to believe that some children can think conceptually, while others simply cannot. This is untrue; *all students* can be conceptual thinkers. If we want to develop classrooms where rich discussion and meaning-making take place, we need to reflect on how we build a culture of Concept-Based Inquiry. Such classroom spaces create high expectations for students, while simultaneously championing collaboration and supportive relationships.

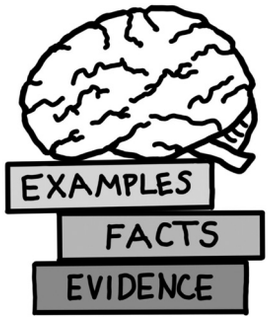
All students can be conceptual thinkers.

The attitudes modeled and promoted in our classrooms are of vital importance to creating a culture of Concept-Based Inquiry, where students view themselves as *able* conceptual thinkers. To think abstractly and connect concepts in meaningful ways, we encourage students to adopt the following frames of mind (adapted from Geertsen, 2003):

- *Open-mindedness*: The willingness to consider multiple viewpoints and alternate ideas.
- *Evidence-mindedness*: The ability to withhold judgment and act objectively until proper evidence is examined.
- *Persistent-mindedness*: The determination to exhaust possibilities, persist through cognitive challenge, and ask questions to inquire deeply into a topic.

These three dispositions work together in the classroom to support the sharing of ideas and development of conceptual thinking. Without *open-mindedness*, students can maintain misconceptions or overgeneralizations. By refusing to examine evidence fully and contrast it with their beliefs, students are unable to change their current thinking. Without *evidence-mindedness*, students can form inaccurate or oversimplified generalizations. Instead of looking across multiple examples to see if an idea holds true, students may jump to conclusions without proper consideration. Lastly, without *persistent-mindedness*, students can flit between ideas and struggle to extend a train of thought. Teachers should be cognizant about how they encourage students to embody these three dispositions and reflect on ways to model them throughout the inquiry process. Table 2.2 outlines a number of suggested behaviors we can adopt as teachers to promote a culture of Concept-Based Inquiry in the classroom. Anchor charts for promoting these frames of mind in the classroom can be found on our membership site.

TABLE 2.2 STRATEGIES TO PROMOTE A CULTURE OF CONCEPT-BASED INQUIRY

Disposition	Classroom Strategies
Open-mindedness 	**Create Classroom Norms With Students:** Promote being open-minded and embracing diversity and multiple perspectives by including these as norms. **Design Activities That Rely on Collaboration:** Students understand the limits of their own perspective, while working with others. **Use Questions to Promote Perspective-Taking:** • What evidence could you use to either support or disprove your idea? • How could you combine that idea with another from our class? • How might _____ view your idea? Why do you say that?
Evidence-mindedness 	**Model the Vocabulary of Thinking in Discussions:** Model how ideas such as *assumption* or *bias* can help us express our reasoning. **Invite Student Use of Notebooks or Retrieval Charts During Discussions:** Students routinely bolster their thinking using evidence from prior learning. **Use Probing Questions to Highlight Reasoning:** • What makes you say that? • Can you provide some examples to support your thinking? • Can anyone else think of an instance where that is true/untrue?
Persistent-mindedness 	**Present Rich Activities That Encourage Risk-Taking and Struggle:** Students engage in challenging, yet safe activities that build their focus, persistence, and resilience. Invite students to share their strategies to manage challenge. **Encourage Growth Mindset:** In discussions and interactions, promote an incremental view of intelligence, where individuals can get better at something over time through practice (Dweck, 2012). **Use Wait Time:** Provide time for students to collect their thoughts. Stick with a student until their thinking is clarified. **Use "No Hands Up" Name Sticks or Name Randomizer**: All students are encouraged and expected to have a go at articulating their thinking. **Use Questions to Encourage and Redirect:** • I see you are starting to form some initial ideas. Can you go back to our case studies and extend your thinking? • What about . . . ? How might that change your idea? • What additional evidence might you need to support your idea?

The teacher is *vital* to creating a culture of Concept-Based Inquiry. We act as role models and facilitators of conceptual thinking, nudging students to suspend judgment until critical analysis and discussion have taken place. In the Concept-Based Inquiry classroom, we value *sustained thinking* over quick thinking. Recognizing that we often have an "overcrowded curriculum" without the time to teach it thoughtfully, this last point can be challenging to internalize. However, if we truly value **constructivism** as a pedagogical approach, we must be willing to give students an opportunity to work through their thinking. In the Concept-Based Inquiry classroom, the teacher designs a space for deliberation and perspective-taking where the sharing of ideas leads to individual and class understanding. Note that in Concept-Based Inquiry, this often takes place within the context of a structured or guided inquiry, as we generally work toward a set of particular generalizations with students that align with curricular outcomes.

In this chapter, we have explored the model of Concept-Based Inquiry as an approach to teaching and learning that encourages inductive understanding. Making links to the role of the teacher in promoting thinking and reasoned discussion, we have highlighted the importance of classroom culture in building students' sense of agency. Concept-Based Inquiry encourages students to take ownership over their thinking, so they can become true critical thinkers.

In Chapter 3, we will think practically about how our planning process can facilitate Concept-Based Inquiry. Examining planning steps and strategies to support these, we will explore how we can create conceptually rigorous units that scaffold student thinking. The role of the phases of inquiry in the planning process will be considered in relation to lesson and unit planning.

Pause and Reflect

Before considering the planning process in Chapter 3, take a moment to pause and reflect using the following questions:

- How does our model of Concept-Based Inquiry resonate with you? What's familiar and unfamiliar based on your experiences in the classroom?
- How might an inductive model of understanding promote the development of thinking skills? What opportunities exist for this in your classroom?
- In what ways does your classroom culture promote open-mindedness, evidence-mindedness and persistent-mindedness? Explain.