Chapter 6 What disciplinary tools will students need?

Overview

This chapter outlines how successful interdisciplinary teaching in the MYP is informed by teaching in the disciplines. Specifically this chapter examines two questions.

- What constitutes quality learning in a discipline or subject?
- How can teachers select and craft disciplinary understandings?

Quality disciplinary understanding in the MYP is characterized. It indicates how disciplines differ from factual information and explains why disciplinary understanding is often difficult to acquire. Using an interdisciplinary unit on the Pak Sha O river in Hong Kong as an example, this chapter offers an overview of the MYP aims and objectives and points out two criteria that teachers must keep in mind in order to ensure a quality disciplinary grounding of interdisciplinary work.

What constitutes quality learning in a discipline or subject?

Whether they teach history or biology, mathematics or visual arts, MYP teachers strive to nourish students’ deep understanding of key ideas, theories, and modes of thinking in their subjects or disciplines. Teachers recognize that understanding a concept in depth is more than merely knowing about it. MYP students are encouraged to use such concepts effectively in new contexts and situations demonstrating deep understanding. Understanding is a capacity. It involves being able to employ concepts, skills and information to produce explanations, offer interpretations, create products, or solve problems in workable ways. Disciplinary understanding, in turn, involves students’ ability to employ concepts and modes of thinking developed by experts in domains such as geography, biology, physics, mathematics, language or the visual arts. To nurture it, MYP teachers must understand what disciplinary understanding is and why it is difficult for students to acquire.

All disciplines embody distinct ways of thinking about the world. Scientists hold theories about the natural world that guide their particular observations: they make hypotheses, design experiments to test them, revise their views in light of their findings and make fresh observations. Artists, on the other hand, are less constrained by empirical demands. They seek to shed new light on the object of their attention, depict it with masterful technique, stretch and provoke themselves and their audiences through deliberate ambiguities in their work. Becoming a better artist does not make students better historians, scientists or mathematicians, or vice versa.

Of course, it is unreasonable to expect MYP students aged between 11 and 16 to become expert scientists, historians and artists. Rather, a quality MYP education in the subject areas should ensure that students become deeply acquainted with the fundamental perspectives on the world that each subject group offers. Teachers prepare to nurture disciplinary understandings by reflecting about their disciplines themselves. Why do I teach science, history or the arts? What about these disciplines matters most for my students to learn? Perhaps most importantly, what constitutes deep understanding in my subject or discipline?
Disciplinary understanding defined

A discipline like biology or geography is clearly not a list of items to be “covered” during a given class period three times a week. Instead, disciplines are best described as dynamic networks of concepts, theories and examples, produced through the use of agreed methods and techniques to answer relevant questions about particular aspects of the world. By inviting students to use the perspective of the biologist, the geographer, the historian, the scientist, the artist or the poet to make sense of the world around them, MYP teachers open the door to the most important cognitive achievements of our era—achievements that students may come to share only through dedicated and carefully designed instruction. In the MYP model disciplines are grouped in eight subject groups. The subject aims and objectives offer teachers an overview of important understandings to be nurtured in each subject group.

Building on such aims and objectives experienced teachers seek to nurture four key capacities among young people. They involve understanding:

1. the purpose of disciplinary inquiry
2. an essential knowledge base
3. disciplinary inquiry methods
4. forms of communication.

These capacities are described below and illustrated with examples of aims and objectives in humanities, science and arts.

1. Understanding the purpose of disciplinary inquiry

Commonly, students ask a question that all teachers ought to be able to address genuinely: “Why do we have to learn this?” Responses such as “because it is important that you know this”, or “because it is part of the course syllabus, test or state mandates” or even “because you will need it next year” miss the point if what we seek is students’ true involvement in disciplinary understanding. Addressing the question of why a particular disciplinary topic is to be learned invites a broader reflection about the nature of disciplinary inquiry. Why do historians, scientists and artists dedicate their lives to their quests? How do our societies use (or dispute) the findings of biology and history or the works of visual arts and dance? Why does disciplinary understanding matter?

Disciplinary knowledge stems from our human need to understand and predict, express a point of view, create products and tools, and/or solve complex problems. Disciplines inform the contexts in which students live. Supply-and-demand principles determine the products that line the shelves of supermarkets. In recent years, a renewed interest in the study of industrial revolution has been sparked by our experience of the digital revolution—the rapid growth of computing and communication capacities transforming the planet. “Biological interdependence” shapes the life of animals and plants at the local park and in the rainforest. Environmental artworks call society’s attention to the importance of preserving our ecosystems. Therefore, by inviting students to see how disciplinary knowledge informs human pursuits and everyday life—by nurturing their “disciplined mind”—teachers are preparing them to be more informed and discerning participants in their world.

The MYP aims and objectives highlight this aspect of learning. In the humanities students are expected to develop decision-making skills and inform their actions with knowledge. In science students examine the role of science in society and the purposes that drive us to inquire. Scientific understanding includes our responsibility to the living and non-living environment and the capacity to apply science to solve local and global problems, or discussing how science and its applications interact with social, economic, political, environmental, cultural and ethical factors. In the arts too students are encouraged to appreciate the arts as a form of expression and critique as a means to reflect, comment upon and transform our world.
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To reflect on the purpose of disciplinary inquiry with their students, teachers may ask:

- Why does this disciplinary topic, concept or theory matter?
- How can we apply what we learn about this concept, topic or theory?
- Why do individuals dedicate their lives to study in this discipline?

2. Understanding an essential knowledge base

Each discipline embodies innumerable concepts, examples and ideas. Educators are challenged to select those that are most significant for students to learn. An essential knowledge base embodies concepts and relations that are central to the discipline, and applicable in multiple contexts. For example, in a unit on the Industrial Revolution, students must understand social and economic forces that set the stage for industrial advancements in 18th century Britain: widespread Protestant ethics, growing entrepreneurial spirit among artisans and labourers, accumulated capital, largely accessible raw materials and markets, and technological innovation. In a unit on ecosystems, biology students must understand how living organisms relate to their physical environment in a particular place, examine the cycling of nutrients and the factors that enable or disrupt the balance of an ecosystem. Understanding of this kind enables students to link particular incidents of the Industrial Revolution or observation during a field trip with more general interpretations. In other words, a rich knowledge base enables students not only to “know” but also to “make sense” of the information they receive.

An essential knowledge base is central to the MYP aims and objectives in each subject group. In the humanities students are expected to know and use humanities terminology in context and demonstrate understanding of elements of history, geography, economics and sociology in their descriptions and explanations of our social and cultural world. Students are expected to think deeply about matters of time, space, change, systems and the global sphere, moving flexibly between big ideas and relevant examples. In the sciences too, students are challenged to recognize and recall scientific information, explain and apply it to solve problems in familiar and unfamiliar situations. In the arts, students are encouraged to demonstrate knowledge and understanding of the theoretical basis of the art forms studied, as well as a variety of styles, developments and ideas that have shaped the arts across time and cultures.

To reflect on the knowledge base in a discipline with their students teachers may ask the following.

- What are the big ideas, key concepts, or theories that students must learn in this discipline?
- What are examples, cases and findings that illustrate the big ideas in this discipline?
- Are there important connections among ideas in the discipline?

3. Understanding inquiry methods

In contrast to naive beliefs or elementary information, disciplinary knowledge emerges from a careful process of inquiry and vetting of claims. The disciplined mind considers forms of evidence, criteria for validation, and techniques that render trustworthy our knowledge of the past, nature, society or works of art. In the arts students develop habits of visualization, observation, critique, technical mastery and perseverance in the study of a subject. In history students exhibit their understanding of inquiry methods when they compare competing accounts to assess their acceptability, when they are wary of simple explanations, when they consider the sources used, and when they attend to how actors’ perspectives are selected and portrayed. In science students learn that experiments require carefully designed controls and that the coexistence of two phenomena does not mean that one is causing the other. By beginning to learn about the ways in which experts do their work, students come to humanize the disciplines.

In the MYP aims and objectives students are strongly encouraged to learn humanistic and scientific inquiry skills. In the humanities students learn to plan, carry out and present investigations; identify key questions and issues; observe, select and record relevant information; evaluate the values and limitations of sources; engage in fieldwork in order to complement an investigation. In science too, they are taught to define a problem or research question to be tested by a scientific investigation; collect and record data using
appropriate units of measurement; organize and transform data into numerical and diagrammatic forms (mathematical calculations, tables, graphs and charts). In the arts students engage in artistic inquiry; they plan and organize effectively to define and set goals, solve problems, experiment and explore through spontaneous and structured activities.

To reflect about the methods of a discipline with their students teachers may ask the following.

- What are the methods that students must learn to understand how knowledge is constructed in a discipline?
- What tools and instruments are helpful to use in the discipline?
- How can we best explain, describe or express our interpretation of an event or phenomenon?
- How can we discern between trustworthy and less trustworthy claims in the discipline?

4. Understanding forms of communication

Finally, disciplines communicate their expertise in preferred forms and genres. Historians see narratives as the best fit for their work while scientists opt for data-heavy research reports. To become proficient communicators, MYP students are encouraged to understand these differences. In science students are encouraged to write (and recognize) a well-crafted scientific report where clear testable hypotheses, methodology, results and discussion are made public for readers to weigh up. They are invited to use a range of scientific languages. In history, they appreciate vivid and well-footnoted narratives as well as well-curated museum exhibits, monuments and documentary films. Humanities students are also expected to organize information in a logically sequenced, clear and concise manner, to use appropriate language, style and visual representation, as well as referencing and a bibliography to clearly document sources of information, using appropriate conventions. In the arts students are invited to use multiple media to explore aesthetic options in depth.

To reflect about the modes of communication of a discipline with their students, teachers may ask the following.

- What are the languages and symbols that we can use to share what we learn in this discipline?
- What are the main genres in which we can communicate what we know in this discipline (essays, scientific reports, poster presentations, videos)?
- How do we take into account our audience and context when we communicate with others about what we know?

In summary, MYP teachers are required to draw on the MYP subject aims and objectives as well as their local school curriculum to select the concepts and modes of thinking that matter most to teach in their subject. By encouraging teachers to do this the MYP model fosters not only students’ ability to master particular concepts, theories and examples that are central to these disciplines but also to employ disciplinary methods, apply disciplinary insights and communicate effectively with others. Experienced MYP teachers know that for students disciplinary understanding is not always simple to construct. Often, it involves transforming intuitive or naive views of the world with which students arrive in our classrooms.

The challenge of building disciplinary understanding

Building disciplinary understanding is a challenging task for students. Even the most experienced disciplinary teachers describe their dismay when, by the end of what they thought was an outstanding unit, students’ initial beliefs and misconceptions seem to have remained untouched. Why is this so? Psychologists explain that, early in life, students develop intuitive beliefs about the world that are sometimes at odds with disciplinary ideas.

Before entering the elementary school students develop intuitive ideas about how nature works, how people think, what is beautiful and what is not, and how narratives unfold. Many of these ideas, extensively documented by developmental psychologists, are powerful precursors of sophisticated disciplinary
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understandings. For example, by the age of 5, children understand that narratives have beginnings, turning points, and ends and that the succession of events in them must “make sense” for the story to work. Historians also organize their accounts of the past in the form of narratives. They must establish when their stories will begin, and when they will end, and select turning points and actors’ perspectives that will make their accounts intelligible.

Unfortunately not all initial ideas are equally auspicious. Young children also tend to believe that stories are always about “the good guys versus the bad guys”—a belief that leads to easy stereotyping of historical actors and oversimplifications of their experience. Young students are inclined to believe that events are always the result of intentional actions—especially in the case of leaders. They find it more difficult to understand the unintended consequences of actions in the past. Most strikingly, students often project contemporary values and world views onto the minds of actors in the past, a misconception known as “presentism” that is difficult to correct even with good instruction.

In science, students often hold the belief that experiments are successful when their results match the one in the textbook. Students confuse “theories” with unfounded beliefs (as opposed to well-founded conceptual systems) or believe that hypotheses are claims to be proved right (as opposed to tested). Even after years of schooling, youngsters hold mistaken beliefs about how the solar system works, how electricity functions, how evolutionary changes come about. In mathematics, students are often inclined to detach numbers from their meanings, filling in equations mechanically. In the arts, they find it difficult to understand that a “good” painting does not have to be “beautiful” but could be provocative or suggestive, inviting deep aesthetic exploration. Because the task of addressing and transforming students’ early misconceptions may seem daunting, the MYP curriculum design offers a repertoire of clear aims and objectives to guide teaching in the subjects and support even the youngest children to develop more informed understandings.

Reflection point

Consider the following statements produced by teachers in different schools. In what ways do they reflect the concept of “disciplines” similar to the one presented above? Which one seems closer to your own sense of your subject?

In teaching history, the biggest obstacle is always time. Teaching history itself is not that difficult. I have a list of people and important events that I need to cover. I expect students to know these by the end of the year.

I teach history because I want students to understand how events in the past help us understand who we are and where we come from. I want my students to become able to think about the past and how we come to know it critically. I want them to think about the options that people had then which are different from the ones we have today.

How can teachers select and craft disciplinary understandings?

Clearly, when designing interdisciplinary units of instruction teachers must decide which disciplines will best address the multifaceted topic under study. Quality interdisciplinary learning requires deep disciplinary grounding. Designing interdisciplinary units presents teachers with an important challenge: how much expertise in a discipline will their students need to develop in order to accomplish the unit’s overarching goal? Indeed some teachers wonder if it is necessary for students to master the disciplines fully before they can integrate them in any meaningful way. Questions of this kind are important because they reveal teachers’ commitment to quality work. Interdisciplinary learning builds on disciplinary expertise—it does not replace it. To illustrate the MYP approach to interdisciplinary teaching, consider the following unit on river studies.