

Conceptual understanding

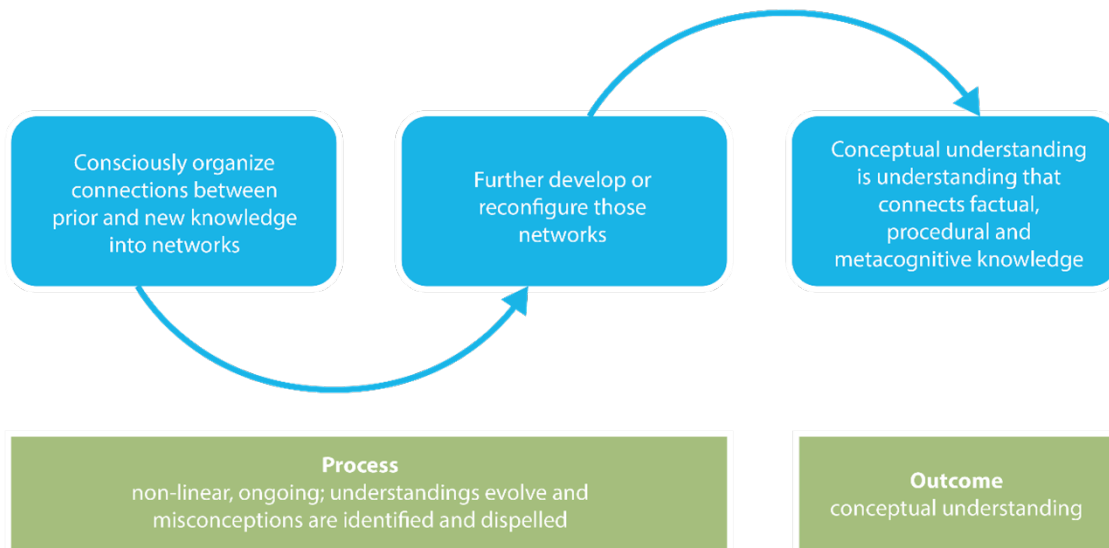
Conceptual understanding in the PYP

Summary

- Conceptual understanding is key to an IB education.
- Conceptual understanding creates opportunities for learners to make connections, transfer and apply skills, knowledge, and understanding across, between and beyond subjects.
- Concepts are fundamental, abstract ideas and play a critical role in organizing, designing and planning curriculum and learning.
- In the PYP, concept-based inquiry is a powerful vehicle for learning that promotes meaning and understanding, and challenges learners to engage with significant ideas.

What is conceptual understanding?

- The IB defines conceptual understanding as understanding that connects factual, procedural and metacognitive knowledge.
- It results from a process in which one **consciously** organizes connections between prior and new knowledge into networks, then further develops or reconfigures those networks.
- This is a non-linear, ongoing process throughout which understandings evolve and misconceptions are identified and dispelled.



The importance of conceptual understanding

- Conceptual understanding enables learners to be **aware** and **critical** of their own knowledge and understandings.
- It allows them to apply skills, knowledge, and understandings to new or different contexts in generative, autonomous, dynamic ways.
- Conceptual understanding supports the IB mission because it enables learners to:
 - conceive of multiple solutions to a problem
 - imagine multiple perspectives on issues
 - understand more deeply how ideas change in different contexts.

A concept-driven curriculum

Concept-based inquiry is a powerful vehicle for learning that promotes meaning and understanding, and challenges learners to engage with significant ideas. This is central to the Primary Years Programme (PYP) philosophy. Purposeful inquiry is supported by a concept-driven curriculum (Wiggins, McTighe 2005).

A concept-driven curriculum is the means through which learners develop their conceptual understandings. Learners co-construct meaning and mental models about how the world works

based on their experiences and prior learning. They connect and integrate new knowledge with their existing knowledge and apply these understandings in a variety of new contexts. They learn to recognize patterns and see the connections between discrete examples to strengthen conceptual understandings.

Learners bring varying degrees of prior knowledge and differing cultural and personal perspectives and experiences to the inquiry. These differences may result in a range of conceptual understandings. Whereas knowledge is locked in time and place, the rich and fluid context of the learners and the learning community renders conceptual understandings that are changeable and may be elaborated or reinterpreted (Milligan and Wood, 2010). For this reason, Milligan and Wood (2010: 492) suggest that “conceptual understandings are better understood as transition points rather than endpoints”.

Defining concepts

Concepts are fundamental, abstract ideas (often encapsulated in one word) which support the development of conceptual understanding.

They can vary in terms of their level of abstraction and/or universality, can be used at different levels of generality and complexity, and serve different purposes in the learning environment.

Concepts can:

- mean different things in different curriculum areas and to different age groups
- impact pedagogy and drive conceptual understanding: both at the curriculum level and the content level
- function as curriculum organizers or content organizers.

Differentiating concept- and fact-based learning

Compared to simply learning or memorizing isolated facts that are locked in place and time, conceptual understandings are changeable, contextual, and may be elaborated or reinterpreted (Milligan, Wood 2010). Exploring concepts distinctly differs from exploring facts in the following ways.

Facts	Concepts
<ul style="list-style-type: none"> • Knowledge-based • Content-heavy • Skills-related • Supported by evidence • Frequently topical • Encourage recall and comprehension 	<ul style="list-style-type: none"> • Open-ended • Enable exploration of complex issues • Highlight opportunities to compare and contrast • Explore contradictions • Lead to deeper disciplinary and transdisciplinary understandings • Promote transfer to familiar or less familiar situations, issues, ideas and contexts • Encourage analysis and application

Figure CO02 *Facts versus concepts*

The role of concepts

Designing for conceptual understanding

Designing for conceptual understanding requires appreciating what is meant by a concept and how concepts can be used to design and teach for conceptual understanding.

Teaching for conceptual understanding is supported by the approaches to teaching. In particular, **collaboration and inquiry activities support the development of a learner's conceptual understanding**. In turn, teaching for conceptual understanding enhances the process and outcomes of inquiry.

Concepts as content organizers

- Concepts are used to organize prescribed content, are used as prescribed content, or are used to establish connections across content, e.g. multiple lessons or units.

- This is what learners will learn: it will therefore directly affect the aims, objectives, assessment and learning activities. Concepts are part of the delivered teaching and assessment.

Concepts as curriculum organizers

- Concepts are used as a rationale for all aspects of curriculum and assessment. They can directly shape a coherent curriculum and many learner experiences.
- They help determine the methodologies used in areas such as unpacking learning, timetabling, teacher roles, collaboration.
- For example, in the Primary Years Programme (PYP), transdisciplinary themes are an example of using concepts to organize the entire curriculum. See for example the online workshop “Learning in a transdisciplinary world”.

Concepts and the unit of inquiry

Within each transdisciplinary theme, educators develop unit of inquiries with central ideas and lines of inquiry. Creating units of inquiry using concepts enables learners to develop conceptual understanding across, between and beyond the transdisciplinary themes. Units of inquiry begin with the central idea. The central idea is a platform from which learners explore the transdisciplinary themes. Written in a neutral voice, the central idea should be substantial and open-ended enough to support learners’ understanding of the transdisciplinary theme. It also provides educators with a structure to introduce concepts that span across national, cultural and subject boundaries to support learners’ understanding of a transdisciplinary theme.

Carefully-developed central ideas invite learners to:

- think critically about opportunities and challenges of local and global significance
- recognize patterns
- make generalizations, predictions and connections across their learning
- transfer understanding to different contexts.

This can be demonstrated in the following example.

Transdisciplinary theme	Central idea	Specified concepts	Additional concepts
Who we are	People's relationships have an impact on health and well-being.	Function Connection Responsibility	Cooperation Friendship Balance

Figure CO03 *Unit example*

Development of central ideas that are broad and extend learners' conceptual understandings within, between and beyond subjects requires time, careful thought and collaboration among members of the teaching team.

Specified concepts

The PYP identifies seven specified concepts (table CO04) that facilitate planning for a conceptual approach to transdisciplinary and subject-specific learning. Together, these concepts drive the educator- and/or learner-constructed inquiries that are situated at the heart of the PYP curriculum.

Specified concepts	Questions	Definition
Form	What is it like?	The understanding that everything has a form with recognizable features that can be observed, identified, described and categorized.
Function	How does it work?	The understanding that everything has a purpose, a role or a way of behaving that can be investigated.
Causation	Why is it as it is?	The understanding that things do not just happen; there are causal relationships at work, and that actions have consequences.
Change	How is it transforming?	The understanding that change is the process of movement from one state to another. It is universal and inevitable.
Connection	How is it linked to other things?	The understanding that we live in a world of interacting systems in which the actions of any individual element affect others.
Perspective	What are the points of view?	The understanding that knowledge is moderated

		by different points of view which lead to different interpretations, understandings and findings; perspectives may be individual, group, cultural or subject-specific.
Responsibility	What are our obligations?	The understanding that people make choices based on their understandings, beliefs and values, and the actions they take as a result do make a difference.

Figure CO04 *Seven specified concepts*

Specified concepts are a starting point. They help to frame a unit of inquiry and drive learning experiences. When these concepts are explored as through questions, the inquiry is purposeful and manageable. The questions associated with the specified concepts represent an introduction to a way of thinking about learning and teaching. They can be used in any order and as regularly as the learners and educators require. There can be more than one specified concept in an inquiry.

As an example, consider a unit under the transdisciplinary theme “How the world works” with the central idea “Over time, living things adapt to their unique environments” (unit example 1).

- The concept of “form” could focus the unit on classification and geographical descriptions.
- The specified concept of “connection” could focus the unit on how the characteristics of the species connects to features of the environment to ensure survival.
- The specified concept of “perspective” could focus the unit on the theories of evolution and adaptation.

In this example, learners may choose particular geographies, species or human-initiated change that are significant, relevant, challenging and engaging within this inquiry. Concepts place no limits on breadth of knowledge or on depth of understanding, and therefore provide opportunities for every learner to participate, regardless of particular background or interests.

Additional concepts

Alongside the specified concepts, additional concepts are explored within and outside of units of inquiry. For example, all subjects have concepts that reflect the nature of the subject. In science, “adaptation” could be a concept connected to the specified concept of “change”; in individuals and societies, “sustainability” could be a concept associated with “change and responsibility”.

Figure CO05 provides some examples of specified and additional concepts. Further examples of concepts can be found in the PYP subject guidance. However, there are an unlimited number of concepts that may be drawn from state/provincial/national curriculums to support the inclusion of those requirements into the units of inquiry.

Specified concepts	Guiding questions	Examples of additional concepts
Form	What is it like?	Properties Structure Similarities Differences Pattern
Function	How does it work?	Behaviour Communication Pattern Role Systems
Causation	Why is it as it is?	Consequences Sequences Pattern Impact
Change	How is it transforming?	Adaptation Growth Cycles Sequences Transformation
Connection	How is it linked to other things?	Systems Relationships

		Networks Homeostasis Interdependence
Perspective	What are the points of view?	Subjectivity Truth Beliefs Opinion Prejudice
Responsibility	What are our obligations?	Rights Citizenship Values Justice Initiative

Figure CO05 *Examples of additional concepts*

Concepts and the single subjects

Learners and educators also use specified concepts, associated questions and additional concepts to guide inquiries in subject-specific learning and teaching. In this way, learners and educators are using concepts as content organizers. The PYP phase-based learning continuums for the subjects provide many examples of concepts and conceptual understandings.

PYP learning and teaching, including subject knowledge acquisition, is implemented through concept-based inquiry. As PYP educators become familiar with concepts and conceptual understandings, they identify authentic links between different subjects, and within the programme of inquiry. Single-subject and support educators connect learning through the programme of inquiry's

central ideas wherever connections are authentic. At other times, single-subject educators plan their own conceptual inquiries to explore concepts relevant to the subject.

For example, an inquiry may be developed around the specified concept of change. An art educator explores how art aesthetics have “changed” over time and a PE educator inquires into the skills needed to “change” from an offence to a defence position in a team sport. Learners transfer their understanding of how to inquire into “change” from one context to a new one. By exploring a similar concept in different contexts, learners come to appreciate, and develop, new understandings and ideas that transcend subject boundaries. Educators collaboratively plan, reflect and make adjustments as a teaching team throughout the year to ensure a coherent learning experience.

Designing learning experiences to develop conceptual understanding

When designing for learning, educators select the most effective strategies based on their context and learner needs. Common strategies include classification, representation, generalization, concepts-in-use, internalization and near-and-far transfer. These strategies can be employed in the design and planning process to intentionally embed the development of conceptual understanding into learning experiences. The strategies draw on different theoretical frameworks and are supported by academic literature. They do not imply a linear progression.

Classification: Connecting physical objects or phenomena to a conceptual category.

Examples

“This is not a mammal because ...”

“This is an ecosystem because...”

“This is a polygon because...”

Representation: Using multiple modes to represent ideas (e.g. visualization, formulas) which apply across various problems, contexts or situations.

Examples

“The same representation can show how to split a dollar into quarters and how to divide 100 by 4.”

Using graphs to look at trends.

Using number frames to represent a number in different ways, such as dots, cubes, beads.

Generalization: Connecting and moving from facts, to concepts, to generalizations. Concepts interact with each other to create wider generalizations.

Examples

Learners explore different conflicts and determine common causes.

Learners explore their own community and make generalizations about the wider community.

Concepts-in-use: Concepts are explicitly modelled and linked together. They are learned and assessed within conceptual models, then applied in different contexts.

Examples

Educators combine two or more concepts in a visual model that creates a path showing how the concepts are connected.

The relationships between characters in a book are explored through a concept map.

The relationships between government systems are explored through a concept map.

Internalization: Transforming an individual physical or material activity into other mental and conceptual forms of that same external activity, to acquire new understandings.

Example

Near-and-far transfer: The application of concepts across different aspects of a knowledge domain (near), or across other knowledge domains (far), to develop skills and understandings across physical and social contexts.

Practising sports techniques and tactics and connecting them to broader strategy.

Learners deconstruct how they practise a piece of music to improve the whole piece.

Examples

Near transfer: Understanding the process of mixing primary colours to create secondary colours to create a painting of a rainbow.

Far transfer: The understanding of mixing color to then transfer understanding to experiment with prisms and light.

Figure CO06 *Strategies to support the development of conceptual understanding*

Additional learning and teaching strategies

Sketch the concept: On a blank piece of paper, learners create a sketch that visually represents their understanding of the central idea. They use symbols and/or pictures only—no words.

Concept map: Learners use a concept map to show connections and relationships that develop through the inquiries. These concept maps provide an ongoing representation of the central idea as learners add ideas and adjust their thinking.

Exit cards: Learners develop questions that they still have about the central idea.

Observation: Educators observe learners as they explore an idea or task, and engage the learners in conversation about their current understandings of the central idea. Observations may be recorded as anecdotal notes, audio recordings or by using a checklist or rubric.

Self-assessment: Learners make entries in their journals or discuss what they have learned about the central idea/ conceptual understanding being explored. They analyse their thinking and plan for how they might further investigate the central idea.

Bus stop: The concepts being explored in the unit are presented on separate sheets. In groups, learners creatively think about, and record, their ideas about the connection to the central idea using

symbols and words. Each group moves around each sheet and reads what others are thinking, adding new ideas to the original ideas presented.

This list is not exhaustive and schools are encouraged to explore other ideas.

Provocations

The use of provocations as a learning and teaching strategy to develop conceptual understanding is prevalent in the PYP. Throughout an inquiry, educators and learners initiate, stimulate, challenge and extend learning through activities or artifacts that invite (and provoke) new thinking about the central idea. Provocations can include posing questions and wonderings for discussion, making a change to the physical or social learning.

Carefully crafted provocations:

- stimulate critical-thinking skills by:
 - providing opportunities to build on prior knowledge and experience
 - expanding beyond factual knowledge
 - stressing the importance of the “how” and “why” of learning
 - sparking learners’ curiosity and engaging them to think conceptually
 - inviting investigation
 - inviting learners to justify their answers
 - wording questions in ways that are accessible to learners
 - asking open-ended questions to allow for personal interpretation
 - encouraging pattern-finding in learner thinking
- expand thinking by:
 - generating further questions and inquiries
 - seeking clarification and deepening understanding
 - opening up possibilities for collaborative dialogues
 - emphasizing breadth and depth of understanding

- facilitating the co-construction of meaning and engaging learners in their reasoning
- connect learning and support the transfer of knowledge by:
 - encouraging the application of prior knowledge and skills
 - creating opportunities to reflect on concepts across, between and beyond subjects
 - ensuring relevance to learners' experiences inside and outside school
 - opening up possibilities for further inquiry
 - offering opportunities to revisit concepts over time
 - encouraging application and transfer of learning in different contexts
 - linking prior understanding to current inquiry and current understanding to future inquiry.

Additional considerations

- How might evidence of conceptual understanding be documented?
- How does the design of learning spaces continually promote and provoke learner questions and wonderings?
- What resources might engage learners in thinking about the central idea? (For example, artifacts, experts, field trips, literature, and multimedia).
- How might multimodal communication strategies be available to express conceptual understanding?
- What connections can be made to the local environment to ensure authentic learning engagements?
- How might learning engagements lead to deepening conceptual understanding as the unit progresses?

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