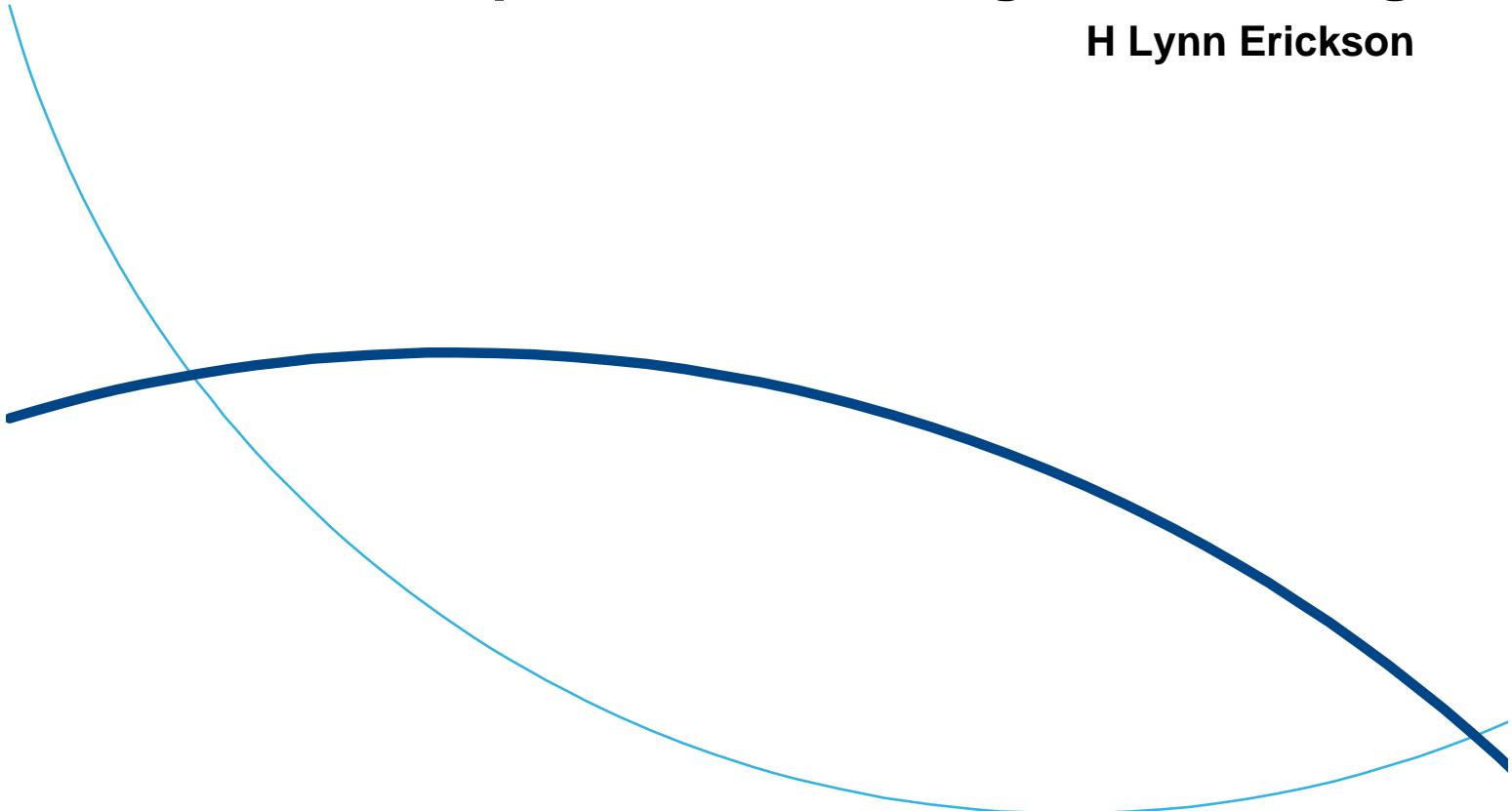




Concept-based teaching and learning

H Lynn Erickson



A large, abstract graphic element consisting of two intersecting curves. A dark blue curve starts at the bottom left, rises to a peak in the center, and then slopes downward to the bottom right. A light blue curve starts at the top left, descends to a minimum in the center, and then slopes upward to the bottom right, crossing the dark blue curve. The two curves intersect at their respective midpoints.

Introduction to IB position papers

This paper is part of a series of papers, written by IB practitioners and endorsed by the IB. Each paper addresses a topic or issue related to the IB's philosophy or its educational practices.

Other papers in the series

Allan, M. May 2011. *Thought, word and deed: The roles of cognition, language and culture in teaching and learning in IB World Schools.*

Davy, I. July 2011. *Learners without borders: A curriculum for global citizenship.*

Hare, J. July 2010. *Holistic education: An interpretation for teachers in the IB programmes.*

Marshman, R. July 2010. *Concurrency of learning in the IB Diploma Programme and Middle Years Programme.*

Walker, G. October 2010. *East is East and West is West.*

Abstract

This paper examines the characteristics of concept-based curriculum and instruction models and identifies the International Baccalaureate (IB) programmes as a three-dimensional, concept-based model. A discussion of the benefits of concept-based instruction supports the majority of attributes in the IB learner profile. Concept-based instruction requires an understanding of synergistic thinking, transfer of knowledge and social construction of knowledge. This paper addresses these areas and discusses them in the context of the required IB pedagogy. It concludes with a review of the challenges in implementing a concept-based model and a summary of the rewards.

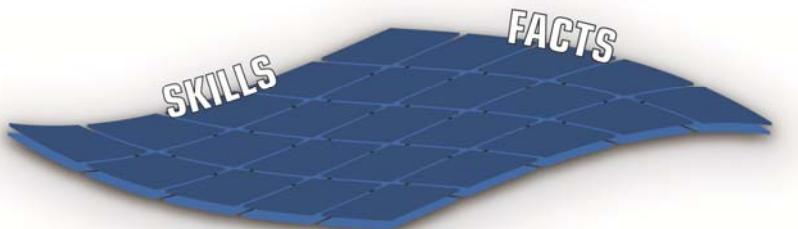
Introduction

The International Baccalaureate programmes offer a design for curriculum and instruction that is more challenging than traditional models, but which can produce deeper intellectual and emotional engagement in learning. The concept-based design is fully supported by cognitive and learning research. When information today is a click away on a computer keyboard, the use of classroom time must shift focus from covering and memorizing information to thinking with and applying knowledge at both the factual and conceptual levels. Thinking deeply with factual knowledge and concepts to communicate ideas and solve problems, transferring knowledge across distinct global contexts and situations, and seeing patterns and connections between concepts, ideas and situations are at the heart of concept-based teaching and learning. Less factual coverage can open the door to deeper thinking and understanding.

What is concept-based curriculum and instruction?

Concept-based curriculum and instruction is a three-dimensional design model that frames factual content and skills with disciplinary concepts, generalizations and principles. Concept-based curriculum is contrasted with the traditional two-dimensional model of topic-based curriculum which focuses on factual content and skills with **assumed** rather than deliberate attention to the development of conceptual understanding and the transfer of knowledge (see Figure 1).

**2D CURRICULUM/INSTRUCTION
TOPIC/SKILL-BASED MODEL**



3D CURRICULUM/INSTRUCTION CONCEPT-BASED MODEL

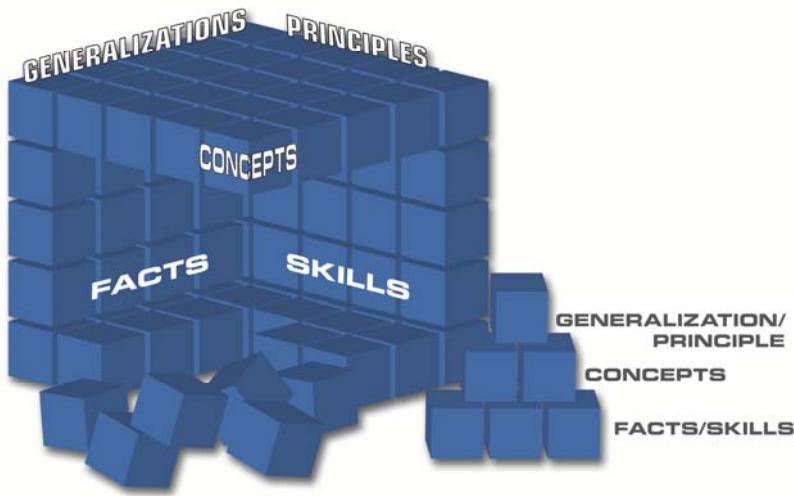


Figure 1. Two-dimensional and three-dimensional curriculum and instruction (taken from Erickson 2008).

Two-dimensional curriculum models focus on facts and skills with the goals of content coverage, analysis and the memorization of information. Three-dimensional models focus on concepts, principles and generalizations, using related facts and skills as **tools** to gain deeper understanding of disciplinary content, transdisciplinary themes and interdisciplinary issues, and to facilitate conceptual transfer through time, across cultures and across situations. Three-dimensional models value a solid base of **critical** factual knowledge across the disciplines, but they raise the bar for curriculum and instruction by shifting the design focus to the conceptual level of understanding. This focus necessarily requires a supporting role for factual knowledge.

A corollary goal of concept-based instruction that is seldom stated overtly is development of the intellect. In a concept-based instruction model teachers use the facts in concert with concepts and generalizations to effect higher order, synergistic thinking. Facts provide the foundation and support for deeper, conceptual thinking and understanding. Three-dimensional concept-based curriculum models value student inquiry and constructivist learning to support personal meaning-making.

The research and agreement on the importance of conceptual understanding is undeniable. From the National Council of Teachers of Mathematics (NCTM) (2009) we hear the call:

Any national mathematics curriculum must emphasize depth over breadth and must focus on the essential ideas and processes of mathematics (p 1).

...research on the learning of complex subjects such as mathematics has solidly established the important role of *conceptual understanding* in the knowledge and activity of persons who are proficient (p 2).

One of the strongest research summaries supporting the importance of conceptual understanding can be found in *How People Learn: Brain, Mind, Experience and School* (Bransford et al 2000), published by the National Academy of Sciences and the National Research Council.

Experts' knowledge is connected and organized around important *concepts* (eg, Newton's second law of motion) (p 9).

To develop competence in an area of inquiry, students must: a) have a deep foundation of factual knowledge, b) understand facts and ideas in the *context of a conceptual framework*, and c) organize knowledge in ways that facilitate retrieval and application (p 16).

... organizing information into a *conceptual framework* allows for greater transfer; that is, it allows the student to apply what was learned in new situations and to learn related information more quickly (p 17).

Anderson and Krathwohl's book (2001) updated Benjamin Bloom's *Taxonomy of Educational Objectives* (1956), and further supports the need to teach for deeper conceptual understanding.

By separating factual knowledge from conceptual knowledge, we highlight the need for educators to teach for *deep understanding of conceptual knowledge*, not just for remembering isolated and small bits of factual knowledge (p 42).

Students *understand* when they build connections between the “new” knowledge to be gained and their prior knowledge. More specifically, the incoming knowledge is integrated with existing schemas and cognitive frameworks. Since concepts are the building blocks for these schemas and frameworks, *conceptual knowledge* provides a basis for understanding (p 70).

Beyond the research, the importance of conceptual structures for disciplinary content just makes logical sense.

In what ways are IB programmes concept-based?

The Primary Years Programme (PYP), Middle Years Programme (MYP) and Diploma Programme (DP) are three-dimensional and concept-based because, by deliberate design, they require students to process factual knowledge through the conceptual level of thinking.

The DP values deeper critical thinking and conceptual understanding. The required theory of knowledge course examines different ways of knowing and challenges students to think beyond the facts as they analyse complex questions and issues in interdisciplinary inquiries. The extended essay and a variety of internal assessment tasks also engage the critical thinking of students as they independently plan, research, write and defend a significant question drawn from one of the subject areas (IB 2009b).

DP teachers ensure that students know the attributes and meaning of the subject area concepts. At times, however, teachers express a concern over the tension between a heavy curriculum load and the time to teach for deeper conceptual understanding and the transfer of knowledge. This tension can sometimes result in implicit rather than explicit demonstrations of understanding. As the DP continues to develop, this tension might ease if key concepts and disciplinary related concepts were used to explicitly state the important conceptual relationships to guide instruction. This would focus the teaching and learning on the most significant conceptual understandings, and strengthen the bridge between the PYP, MYP and DP. I am sensitive to the curricular demands for university recognition but I also feel strongly that less is more when the student synergistically processes factual information through the conceptual level of thinking. Building the conceptual structures for deep understanding and the transfer of knowledge supports autonomous learners who maximize their learning by seeing patterns and connections between new knowledge and prior learning. New courses based on conceptual frameworks such as global politics will continue to emerge that will support teachers in helping students learn to do meta-analyses of complex systems, but traditional discipline-based courses also need a concept-based curriculum and instruction design for deep understanding.

The DP, like the PYP and MYP, supports international-mindedness and understanding of other cultures. Identifying key and related concepts and framing critical subject area content with a central idea and additional “supporting ideas” (which will be introduced later in this paper) can strengthen the transfer of knowledge across global contexts as new examples of previously learned concepts arise. Concept-based curriculums can support teachers in moving deliberately to idea-centred instruction. I know that DP teachers value deeper conceptual thinking and understanding. An idea-centred curriculum of important conceptual understandings supported by relevant content would help teachers meet these goals.

The PYP is **transdisciplinary** in nature. The identification of transdisciplinary themes (for example, who we are, how the world works) frame the concepts, skills, attitudes and actions linked to what is real and relevant in the world through the design of programmes of inquiry. The transdisciplinary themes ensure that curriculum and instruction move beyond factual coverage in discrete subject areas to an integrative synthesis of knowledge and conceptual understandings to better understand our world and our place within the world (IB 2010). The MYP is developing a set of “global contexts” to use in their unit designs that will facilitate transcendent thinking, similar to that driven by the transdisciplinary themes of the PYP (IB 2012).

In the PYP and MYP the key concepts draw thinking beyond the facts. This is significant for three main reasons.

1. The use of key concepts prevents an overreliance on memorization of facts as the end goal. In a concept-based model students must process the facts through their personal intellect—the conceptual mind. The key concept provides focus to the topic under study, acting as a conceptual draw for personal engagement and mental processing. The focus shifts from memorization—or a lower form of mental engagement—to deeper, personal inquiry as students consider connections between the facts and the key concept(s). Key concepts are macro-concepts that transcend disciplines such as change, interdependence, system and relationships. The PYP has identified eight macro-concepts as key concepts to use for the programme. The choice of just one or two key concepts for a unit planner can prevent the conceptual focus from becoming too diffuse. The MYP is also working to identify a set of key concepts. Key concepts integrate thinking at the conceptual level.
2. Key concepts facilitate the transfer of knowledge through time, across cultures and across situations. The IB position paper *Thought, word and deed: The role of cognition, language and culture in teaching and learning in IB World Schools* (Allan 2011) cites research undertaken in schools in the United States, Australia and Germany that found when students are exposed to abstract concepts apart from context, learning is difficult.
3. Intercultural understanding depends on the ability to see the commonalities and differences in terms of concepts and their expressions across global contexts, whether they be social, political, economic or geographical/environmental. When students develop understanding of key concepts and central ideas (statements of conceptual relationship) they become aware that these concepts and ideas can be applied across cultures.

I believe it is critical that all IB programmes attend to both the key concepts and the more discipline-specific related concepts to ensure that students develop breadth **and depth** of conceptual understanding. The transferability of key concepts such as system, change and order help students recognize the many permutations of each concept from body systems, to economic systems, to environmental systems. The related concepts, however, ensure that instruction builds depth of understanding by attending to, and adding to, the language of each subject area—the discipline-specific concepts and their important relationships from year to year. In the PYP, these related concepts can be taught in the context of the transdisciplinary units of instruction developed for the programmes of inquiry. Identifying the related concepts in these units ensures that disciplinary depth is included in the inquiry. When I use the term “related concepts” in my work with concept-based curriculum design, I am referring to the concepts related to specific disciplines within the unit, rather than specific concepts related to various key concepts. The reason for this is I want to identify the more specific concepts to build disciplinary depth.

At this time the PYP and the MYP ask teachers to use a key concept and a more discipline-specific related concept to state a central idea and concept statement respectively. To reinforce idea-centred teaching and conceptual thinking I recommend consideration of additional conceptual understandings crafted with the more discipline-specific related concepts to be added to each unit. I will call these understandings “supporting ideas” for the purposes of this discussion. In the MYP and PYP if a year-long course of instruction was framed under five or six units of instruction, I would think five to eight supporting ideas per unit—in addition to the central idea/concept statement—would be reasonable to guide the formative work.

Another reason I suggest that the PYP and MYP use the more specific related concepts to write additional supporting ideas for their unit planners is to continually build disciplinary schemata in the brain, so students are prepared for the conceptual rigour of the DP, as well as for lifelong learning and

work. It is through the conceptual structures of knowledge that the PYP, MYP and DP can be further aligned and articulated on the IB programme continuum.

Aligning the terminology through the different levels of the IB programmes and articulating central and supporting ideas using key and related concepts at all three levels of the IB would provide the structure for a continuous and coherent concept-based scheme of instruction. A concept-based curriculum is idea-centred. Central and supporting ideas facilitate a pedagogy requiring synergistic thinking which means guiding students, through inquiry, to realize the deeper conceptual understandings supported by factual content. In the PYP, a suggestion could be to write more specific disciplinary supporting ideas to serve as the lines of inquiry. Developing critical central and supporting ideas for the different subject areas (referred to as “subject groups” in the MYP) across all levels of the IB continuum would provide clear understanding of targets for the teachers, and would facilitate a truly idea-centred pedagogy. This would also allow the breadth of curriculum content to be compacted and focused.

How is a concept-based curriculum beneficial to student learning?

Concept-based curriculum and instruction is essential to the IB educational paradigm. The critical elements that require a concept-based model are intercultural understanding and international-mindedness, the ability to transfer knowledge and a rigorous intellectual model that is emotionally engaging and motivating.

There are many benefits to a concept-based model.

- Thinking—It requires thinking students who draw on critical, creative, reflective and conceptual thinking abilities.
 - Facilitates “synergistic thinking”—the cognitive interplay between the factual and conceptual levels of thinking.
 - Requires deeper intellectual processing as students relate the facts to key concepts and principles.
 - Develops conceptual structures in the brain (brain schemata) to relate new knowledge to prior knowledge, and to illuminate the patterns and connections of knowledge.
 - Facilitates the transfer of knowledge at the conceptual level.
 - Provides opportunities for personal meaning-making through processes of thinking, creating and reflecting.
- Intercultural understanding—It develops intercultural understanding and international-mindedness through conceptual transfer.
 - Facilitates the transfer of learning across global contexts as students engage with concepts and conceptual understandings as reflected across unique and varied cultures.
 - Encourages inquiry into global issues of concern that draw out the multiple perspectives and situations of different cultures and nations.
- Motivation for learning—It recognizes that intellectual and emotional engagement are essential to the motivation for learning.
 - Increases motivation for learning by inviting students to think about the facts through a relevant and personally engaging key concept. The unit topic and the key concept have an iterative relationship—each reinforces the other, for example, considering the facts about “Global conflicts in the 21st century” through the conceptual lens of perspectives, or considering facts about “Our land and people” through the lens of identity.

- Values and respects the thinking of the individual by “drawing understandings from” rather than “telling understandings to”.
 - Encourages constructivist learning experiences that are relevant and important.
 - Values collaborative thinking, discussions, and problem-solving with the belief that the social construction of meaning not only leads to a quality product, but is motivating to participants as well.
- Fluency with language—It increases fluency with the languages of cultures and the disciplines.
 - Illuminates the conceptual structures of “meta-language” to facilitate multilingual learning and communication across cultures.
 - Builds increasing fluency with disciplinary language as students explain and support their conceptual understanding with relevant factual knowledge.
 - Reinforces a common conceptual vocabulary and set of critical conceptual understandings in the different disciplines which can help alleviate language barriers in global labour contexts when students enter the workforce.

These benefits are inherently supportive of the majority of the characteristics outlined in the IB learner profile (IB 2009a, p 5):

- inquirers
- knowledgeable
- thinkers
- communicators
- open-minded
- reflective.

What are the required pedagogical shifts?

Synergistic thinking

I believe that **synergistic thinking** (Erickson 2007; 2009b) is essential for intellectual development. Synergistic thinking is a cognitive interplay between the factual and conceptual levels of mental processing. Synergy can be defined as two interacting agents providing a greater effect than either agent acting alone. Thinking without this factual/conceptual interaction can be shallow. Without a deliberate curriculum design that mandates this intellectual interplay, we may confuse memorized knowledge with deeper understanding. Just knowing the definitions of concepts is not sufficient. Just knowing facts is not sufficient.

Transfer of knowledge and skills

Facts do not transfer. They are locked in time, place or situation. Knowledge transfers at the conceptual level as concepts, generalizations and principles are applied across global contexts and situations. The ability to use the conceptual level of thinking to relate new knowledge to prior knowledge, to see patterns and connections between different examples of the same concept or conceptual understanding, and to pattern and sort the expanding information base is a critical skill for the 21st century. The transfer of processes and skills across multiple disciplines and contexts to deepen understanding and enhance performance is another mandatory facet of IB programmes. The approaches to learning (ATL) in the MYP continue to be developed along with the transdisciplinary skills in the PYP. Work is underway to organize ATL skills across all levels of the IB related to five skill clusters: social, research, thinking, communication and self-management.

Social construction of meaning

Quality thinking is hard work. Concept-based models encourage collaborative group work to enhance thinking and problem-solving. Different minds working together scaffold each other and generate new ideas and solutions. The social construction of meaning and collaborative groups work is a significant aspect of all IB programmes. School days filled with teacher-dominated lectures to passive students, locked into parallel rows of desks, are hopefully a relic of past pedagogies.

Effective concept-based teachers in IB programmes understand the principles of synergistic thinking, the transfer of knowledge and socially constructed meaning-making. They have at some point made the following pedagogical shifts in their instruction if they began their teaching career in a traditional two-dimensional model. (Please also see the appendix for an example.)

From two-dimensional instruction*	To three-dimensional instruction
The goal is increased factual knowledge and skill development.	The goal is increased conceptual understanding supported by factual knowledge and skills, and the transfer of understanding across global contexts.
Teacher relies heavily on lecture to disseminate factual knowledge.	Teacher facilitates student inquiry into important interdisciplinary and disciplinary topics and issues using one or two key concepts as the conceptual draw.
Instruction and learning experiences focus on factual examples and definitions of concepts with assumed conceptual understanding.	Instruction and learning experiences utilize concepts along with factual content to ensure synergistic thinking. Teacher deliberately uses concepts to help students transcend the facts.
Teacher posts objectives for each lesson as required.	Teacher posts questions of different kinds (factual, conceptual, debatable) to engage interest and to facilitate synergistic thinking.
Students face the teacher in straight rows to ensure order and attention to the teacher's instruction.	Students often work in groups to facilitate shared social inquiry, collaboration, synergistic thinking and problem-solving. Students may work independently, in pairs or groups, or across global contexts using the internet or other communication tools.
Teacher verbally summarizes the learning related to the objectives at the close of the lesson.	Teacher uses inductive teaching to draw the statement of conceptual understanding from students near the end of a lesson and posts the central or suggested supporting ideas for later connections to future topics in the curriculum. Students support their understanding with accurate facts as evidence of quality synergistic thinking.
Assessments measure factual knowledge and skills.	Assessments of conceptual understanding tie back to a central (or supporting idea) by incorporating specific language from the idea in the task expectations.
Teacher focuses on covering the required curriculum.	Teacher focuses on student thinking and understanding. He/she is cognizant of each student's ability to think synergistically.

*The two dimensional model is exaggerated in this paper to provide a clear contrast with the three-dimensional model.

Challenges and summary

There are challenges to the development and implementation of a concept-based, three-dimensional curriculum. But challenges indicate opportunities. The IB has the opportunity to meet the challenges to

refine the IB programmes so they are truly the most effective and engaging in the world. The greatest challenges centre around curriculum development and programme articulation, teacher training and assessment.

Fundamental to success in meeting each of these challenges is a solid understanding of concept-based, three-dimensional curriculum and instruction.

1. Curriculum development. Quality teaching is supported by quality curriculums. The curriculum must be concept-based to meet the goals of transfer of knowledge, deep conceptual understanding, synergistic thinking, intercultural understanding and personal intellectual engagement. The IB continuum can be articulated and coordinated through the development of common terminology and a common curricular framework of key concepts, related concepts, and central and discipline-based supporting conceptual understandings. Unit planners can help ensure that a concept-based teaching plan will be developed.
2. Teacher training. This challenge is critical to the success of a concept-based model. If teachers do not understand the concept-based model and required shifts in pedagogy they will fall back on traditional teaching methods and fail to effect transfer of knowledge and deep understanding. As new schools and teachers are continually joining the IB family, creative ways of delivering the teacher training need to be developed. Regional training centres around the world that certify IB trainers after a rigorous training programme of one or two weeks with materials that teach the concept-based model along with the other facets of the IB programmes could be part of the solution. The critical point is that anyone training teachers on the concept-based model must understand the model completely and be able to convey that understanding to others effectively. (Administrators also need to be well trained on the meaning of a concept-based curriculum, what to look for in instruction and how to support teachers in the implementation of the IB model.)
3. Assessment—The challenge here is to assess to the conceptual level of understanding, rather than just to the factual level. The design of the classroom assessments must be part of the teacher training programme. The IB external assessments also need to assess to the conceptual level of understanding, while allowing schools to use local content to support the understandings.

Many nations lament the academic progress of their students year after year. Government officials institute “solutions” and throw money at the problem but the “solutions” usually centre around increased objectives to ensure topics are covered fully and more testing to make certain the curriculum is taught as defined. However, the focus is on the content rather than on the development of the whole child—social, emotional, intellectual and physical—a terrible mistake.

The IB is on the correct path to prepare citizens of the future for living, learning and working in global environments, and for addressing the complex problems and issues that will undoubtedly arise. The IB community is a family of passionate educators who will continue to develop common understandings in curriculum and pedagogy to keep the ship on course. This journey could not be more important.

About the author

H Lynn Erickson is the author of three bestselling books: *Stirring the Head, Heart and Soul: Redefining Curriculum and Instruction*, 3rd edition January 2008; *Concept-based Curriculum and Instruction: Teaching Beyond the Facts*, 2002; and *Concept-based Curriculum and Instruction for the Thinking Classroom*, 2007, all published by Corwin Press. Erickson is a recognized presenter at national conferences in the areas of concept-based curriculum design, teaching for deep understanding and standards alignment.

Erickson was born and raised in Fairbanks, Alaska. She graduated from the University of Alaska in 1968 and taught at North Pole, Alaska before moving south. She taught various grade levels in California and moved to Missoula, Montana in 1976, earning master's and doctorate degrees in curriculum and instruction and school administration. She has worked as a teacher, principal, curriculum director, adjunct professor and educational consultant over a 42-year career.

References

- Allan, M. 2011. *Thought, word and deed: The role of cognition, language and culture in teaching and learning in IB World Schools*. Cardiff, UK. International Baccalaureate.
- Anderson, LW and Krathwohl, DR. 2001. *A Taxonomy for Teaching, Learning and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. New York, USA. Addison Wesley Longman.
- Bloom, BS. 1956. *Taxonomy of Educational Objectives*. Boston, Massachusetts, USA. Allyn and Bacon.
- Bransford, JD, Brown, A and Cocking, R. 2000. *How People Learn: Brain, Mind, Experience and School*. Washington, DC, USA. National Academy of Sciences and the National Research Council.
- Erickson, HL. 2007. *Concept-based Curriculum and Instruction for the Thinking Classroom*. Thousand Oaks, California, USA. Corwin Press.
- Erickson, HL. 2008. *Stirring the Head, Heart and Soul: Redefining Curriculum and Instruction*. 3rd edition. Thousand Oaks, California, USA. Corwin Press.
- Erickson, HL. 2009a. *Concept-based Curriculum and Instruction for the Thinking Classroom Multimedia Kit*. Thousand Oaks, California, USA. Corwin Press.
- Erickson, HL. 2009b. *Stirring the Head, Heart and Soul: Redefining Curriculum and Instruction, Facilitator's Guide*. Thousand Oaks, California, USA. Corwin Press.
- IB. 2007. *Making the PYP happen: A curriculum framework for international primary education*. Cardiff, UK. International Baccalaureate.
- IB. 2008. *MYP: From principles into practice*. Cardiff, UK. International Baccalaureate.
- IB. 2009a. *The IB learner profile booklet*. Cardiff, UK. International Baccalaureate.
- IB. 2009b. *Diploma Programme: From principles into practice*. Cardiff, UK. International Baccalaureate.
- IB. 2010. *The Primary Years Programme as a model of transdisciplinary learning*. Cardiff, UK. International Baccalaureate.
- IB. 2012. *MYP coordinator's notes*, May. Cardiff, UK. International Baccalaureate.
- NCTM. 2009. *Guiding Principles for Mathematics Curriculum and Assessment*. Reston, Virginia, USA. National Council of Teachers of Mathematics.

Appendix

Nevine Safire teaches the MYP. She has developed a concept-based unit around the central question “When does population growth become ‘overpopulation’?” To focus this unit she has chosen the key concepts of interactions and change from the MYP subject group guides. She is facilitating inquiry into the central idea “human/environmental interactions can become unbalanced, leading to changes with unintended consequences”.

Ms Safire has identified related concepts from science and the humanities to use in developing some supporting ideas to facilitate greater conceptual depth and understanding throughout the inquiry. Some of these concepts she found in the MYP subject group guides; others she extrapolated from the content she will be teaching:

Migration	Environments	Overpopulation
Location	Scarcity	Climate change

Population	Equilibrium	Conflict
Population density	Endangered	Adaptation
Natural resources	Trade	Sustainability

Ms Safire developed five or six supporting ideas to guide the formative unit work. One of her supporting ideas for this unit was “overpopulation can lead to conflict over scarce natural resources”. Within the lesson Ms Safire asks students to analyse both local and global contexts for population density. We will identify aspects of concept-based pedagogy as we follow some of Ms Safire’s thoughts during a concept-based lesson related to this supporting idea.

Classroom actions	Ms Safire's thoughts
Ms Safire: We have been learning about population growth in our unit. In this lesson we are going to think about the effects of overpopulation . What does the term “overpopulation” mean to you?	I want to check students’ prior conceptions of the term and draw out a clear definition that we can build on.
Students view the video “World Population” by Population Connection.	This world map, adding the points of light representing increasing population growth over time, is an unforgettable visual of the growing problem.
Students work in table groups using a graphic organizer to predict the possible effects of rapidly increasing population density on the following: land, animal populations, plants, natural resources.	I wonder if students can foresee the potential problems that may be caused by rapidly increasing populations.
Analyse the graphic organizer and discuss the question “At what point might population growth be considered ‘overpopulation’?”	This provocative question requires students to articulate the destructive effects of an imbalance between the human and natural world.
View and discuss the video “Overpopulation and Its Effects on Our World”. http://www.youtube.com/watch?v=mWHo_ega0RU	This video supports, and further extends students’ understanding of the effects of overpopulation.
<p>Teacher questions:</p> <p>Factual: Does our state (country, region) have areas of dense population? What issues in our region would suggest the danger of overpopulation? What areas of the world have very dense population centres?</p> <p>(Note: Ms Safire engages students with a research activity on overpopulation in different parts of the world and uses guiding questions to develop understanding.)</p> <p>Conceptual: Why do nations develop concentrated “population centres”? What would indicate that a population centre is “overpopulated”? How do increasing human/environmental interactions change the environment? How might these interactions lead to scarce natural resources? How do communities with scarce natural resources meet their survival needs? How can scarce natural resources lead to conflict between groups of people or nations?</p> <p>Provocative/Debatable:</p> <ul style="list-style-type: none"> How can governments ensure that their citizens have the 	I will ask students to bring their questions to the inquiry, but I also developed some factual, conceptual and provocative, debate questions for the lesson. I want to move students’ thinking beyond the local examples to the global perspective so that students can see the parallelism between local and global issues of concern. I want students to know which areas of the world have the greatest and least availability of natural resources; and to understand that scarcity of natural resources can lead to conflict.

<p>necessary natural resources for survival?</p> <ul style="list-style-type: none"> • Should nations with plentiful natural resources be required to share with nations who have scarce natural resources? <p>Be prepared to defend your position.</p>	
<p>We have been inquiring into the idea of overpopulation. The following concepts have entered into our discussion. In your table groups see how many concept statements you can develop by showing relationships between the concepts below. Remember that these concept statements must transfer through time and across situations.</p> <ul style="list-style-type: none"> • Environment • Interactions • Change • Overpopulation • Natural resources • Conflict • Cooperation • Scarcity <p>Be ready to cite specific factual examples to support your understandings.</p>	<p>I know that students will necessarily use synergistic thinking in this learning experience as they use the factual examples to support the construction of their conceptual understandings. I will be interested in seeing the relationships they find.</p>
<p>Assessment task:</p> <p>You are the leader of a task force that has been commissioned by the city council to propose solutions to the problem of scarce water supplies caused by severe droughts in your area. A neighbouring area, which has also been affected by the drought, has blocked the downstream flow of water from a major source to ensure that all of their agricultural and industrial uses of water can be met. This blockage of water to your area has led to a heated conflict. You are to make a presentation to the city council that describes the water problem, and suggests creative and viable solutions—including a way to work with the neighbouring area to collaboratively develop a win-win solution. You can choose your mode of presentation.</p>	<p>This authentic performance task will help students learn to collaboratively problem solve using a local issue that has global implications. The task connects back to the supporting idea that scarce natural resources can lead to conflict and supports the IB aim of taking principled action to solve a community problem.</p>

As we read Ms Safire's thoughts during the lesson we can see her attention to concept-based pedagogy through the following:

- checking for prior understanding of concepts
- encouraging predictions
- using different kinds of questions (factual, conceptual, debatable) to move thinking beyond the facts
- engaging synergistic thinking
- assessing for conceptual understanding as well as facts and skills.