



Inquiry and Integration in Education May-October 2018

Course Outline

Aims

ThinQ views the purpose of education as collective well-being: personal, social, and environmental. We believe that personal well-being is key to our ability to understand and change the world around us. So our starting point must be to appreciate and satisfy the individual's intellectual, emotional, social, ethical and aesthetic needs. ThinQ's primary concern is **intellectual well-being**.

In order to achieve this goal, IIE-2018 aims to help individuals develop the abilities of inquiry, critical thinking, and integration. If you are an educator, a parent, or someone deeply interested in your own or others' education, the course aims to help you develop the foundations needed to nurture these abilities in those around you.

Becoming a Critical Thinker-Inquirer with Deep Understanding

When we read an article claiming that drinking coffee causes heart attacks, and another article claiming that drinking coffee prevents heart attacks, how do we figure out which of them is more reliable? How do we know if a doctor's diagnosis of a health problem is accurate? Even if the diagnosis is accurate, how do we know if the treatment that the doctor prescribes is going to be effective? Is it morally right to eat meat? Is it morally right to seek employment in a weapons manufacturing company? Who should we vote for? If somebody you love is terminally ill and in extreme pain, is it morally wrong to euthanise them (allow their life to be ended)? What procedure should we use amongst a group of friends to decide which movie to watch? Should you quit a well-paying IT job to become a poet?

During this course, we will *not* be answering any of these questions.

However, we will introduce you to the *thinking tools* needed for responding to situations where such questions arise. You will first see these tools illustrated in areas like elementary mathematics and basic natural sciences. These are areas where it is much easier to come to a resolution than in the questions above. Once you have sharpened your thinking tools, we will gradually move to questions like those above. Initially, it may not be easy to see the connection between questions in mathematics and sciences, and the questions above. But it will become more apparent as we proceed.

Some of you might be uncomfortable with mathematics or the natural sciences. But don't worry. Given the experience of past participants, we can assure you that by the end of the course, you will feel very comfortable in areas that you thought you disliked, and possibly become uncomfortable in areas you thought you liked.

Education Oriented to Inquiry, Critical Thinking, and Integration

There are two central problems that we must deal with, if we are concerned about education.

One has to do with ethical considerations such as *equity*, social justice, and equal access to good education. Some of you may be concerned with this and may have been involved in sustained efforts to make education accessible to all, to remove discrimination, and so on.

The other has to do with the *quality* of education. While we acknowledge that ethical considerations are equally important, this course is dedicated to improving the quality of education provided in schools, colleges, and other educational institutions. Quality of education includes several equally important dimensions, including the physical, emotional, mental, intellectual, societal, material, ethical, aesthetic, and so on. Within this spectrum, **our focus** will be on the **intellectual dimension**.

It is important that school, college, and other curricula aim at:

- i) an understanding of the concepts and statements of knowledge; and
- ii) the ability to apply them to a range of familiar as well as novel problems and situations.

But this is hardly sufficient. We believe that to qualify as ‘high quality’, curricula should go beyond (i) and (ii) to aim at:

- iii) an understanding of (a) the evidence and arguments in support of established knowledge, and against such knowledge, and (b) controversial concepts and statements;
- iv) the ability to think critically about concepts and statements;
- v) the ability to engage in independent inquiry; and
- vi) the capacity for an integrated perspective on (i)-(v).

IIE-2018 aims to help you become capable inquirers, critical thinkers, and integrators with deep understanding, along with the capability to nurture these traits in others.

Strands of the Course

IIE has three strands: *Inquiry*, *Integration*, and *Deep Understanding*.

Inquiry

We know that teachers usually ask questions whose answers they already know; their purpose is to find out if students have learnt the answers. Take, for example, a question like: “What is Ohm’s law?” And when the students ask questions, they usually assume that the teacher knows the answers.

In IIE, teachers ask questions whose answers the learners won't know (and even the teachers may not be quite sure), but which would trigger the process of a collaborative search for answers. Often, teachers and students are co-learners. In this process, learners are nudged to arrive at answers through their own observation, thinking, reasoning, and judgment.

Inquiry is 'rational' when it is in accordance with reason. Rational inquiry is committed to accepting the conclusions that logic leads us to, even when they go against our intuitive sense. It also means constantly questioning ourselves, our peers, our teachers, our textbooks, and other authorities.

The process of inquiry often starts with an idea triggered by curiosity or by a speculation based on experience, and crystallizes into a question during the process.

We then have to:

- identify and formulate the question;
- think through appropriate ways to look for answers;
- arrive at conclusions based on the answers;
- critically evaluate the conclusions (both our own and other people's); and
- justify the conclusions.

The journey of such inquiry may begin with an example from a given area, say biology, but would soon move to examples from across domains such as mathematics, sociology, or philosophy. We would explore the core ideas across the boundaries of these 'subjects', such as classifying, defining, reasoning, justifying, and evaluating, to help us develop an appreciation of inquiry across disciplines.

Integration

Ours is the age of specialization, in society and culture, and in education and research. Such specialization unfortunately results in fragmented knowledge, and prevents ideas from cross-pollinating. Thus, the walls between 'science' and 'social science' prevent an integrated perspective on consciousness in humans, chimpanzees, and fruit flies; and on social patterns in humans, ants, and bacteria. They also prevent the emergence of foundational trans-disciplinary theories, such as a theory of evolution that unifies physical, biological, and cultural evolutions. Current educational culture fragments knowledge into baskets such as 'physics', 'chemistry', 'biology', 'sociology' and 'history'. Countering such fragmentation calls for a foundational trans-disciplinary perspective of knowledge and inquiry, one that cuts across the boundaries of subjects, disciplines, and discipline groups.

Take the concept of 'structure', for example. To explore it, we might deal with atomic structure (physics), molecular structure (chemistry), protein structure (molecular biology), sentence structure (linguistics), organizational structure (management studies), social structure (sociology), the structure of a sonnet (literary studies), and so on; we would also consider what is common to the idea of structure across these discipline-internal notions.

If we want to make connections across ideas, to move freely across disciplinary boundaries, if we want to be creative and innovative by drawing on diverse domains of knowledge, then it is imperative that we adopt a trans-disciplinary approach to learning.

Deep Understanding

We all know that familiarity with terminologies or facts does not count as understanding. Mechanically applying concepts and procedures to solve textbook problems may, at best, involve superficial understanding.

Deep understanding is typically an outcome of committed inquiry: it is a combination of experiential understanding, conceptual understanding, rational understanding, and critical understanding, leading to an integrated understanding.

Experiential understanding is perhaps the most basic form of understanding, rooted in the individual's experience, unmodified by reflection and critical thinking. A child who has bitten into a slice of lemon has an experiential understanding of the concept denoted by the word 'sour'.

Conceptual understanding is an understanding of the concepts and statements of 'knowledge', resulting from reflection and analysis. For example, given the initial position and velocity of a cannon ball, calculating its terminal position needs a rudimentary understanding of the theory of gravity and motion. But applying the concepts and statements of the theory to analyse unfamiliar problems and find solutions requires conceptual understanding. For example, what would happen if you drilled a hole through the centre of the earth and dropped a ball through it?

Rational understanding of concepts and statements requires us to pursue the logical consequences of the definitions of those concepts and of the statements involving those concepts. It calls for deducing the logical consequences of the statements in combination with other statements, and checking if those consequences are logically consistent with other statements.

Critical understanding of concepts and statements results from critical engagement with the evidence and arguments for or against those concepts and statements. Critical understanding calls for an exploration of a question like: "Why should we believe that the earth revolves around the sun?" Critically evaluating knowledge claims requires deep understanding at this level.

Integrated understanding involves the integration of what is currently fragmented in different subjects and disciplines. Understanding at the deepest level is the result of a process of critical thinking, inquiry, and integration.

We have outlined above the key elements of our approach to the intellectual dimension of education. We will explore these more fully during the course. We are sure that you would enjoy the course, and, armed with the newly acquired tools of rational thinking and reasoning, become a high caliber inquirer capable of working towards your own well being and contributing to the well being of Planet Earth in your unique way.