

Curriculum Framework for Higher Order Cognition

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This is a set of power point slides – along with my notes on the slides -- for the talk that I gave at the Vice Chancellor's Meeting organized by Association of Indian Universities (AIU), on 18th January 2023.

My talk is on a Curriculum Framework for Higher Order Cognition. To place this topic in perspective, I would like to share my dream of a university that pursues what my colleague and partner Tara Mohanan call ThinQ Education. This is a dream that extends to school education as well.

ThinQ Education takes the ultimate purpose of education as the same as what NEP 2020 and the NAAC white paper 2022 call well-being: the well-being of the individual, society, the human species, all the other species on the planet, and the planet itself. As Professor Bhushan said yesterday, to empower learners to pursue that goal, the essential underlying concept is that of educatedness.

That university we dream of is a Gurukula University, a modern version of Nalanda and Takshashila. The Gurukula will provide education without charging a fee. It will have no examinations, marks or grades, degrees or certificates, no compulsory attendance. A university where the pursuit of learning and of research don't involve money, but will be a community of learners and researcher-educators who have dedicated their lives to education and research with a vision of a better world beyond their time.

I am aware that the probability of this dream becoming an actuality in my lifetime is infinitesimally small, but it is not zero. Can at least parts of that dream be implemented in the universities in India, at least with partial success? I believe so.

One component of the curriculum that aims at educatedness is what NEP 2020 calls Higher Order Cognition. And one component of Higher-Order Cognition is the capacity to engage in research. I would like to invite you to go to the ThinQ website, click on Higher Order Cognition, click on courses, and take a look at our course *Introduction to Research* to get a sense of what Higher Order Cognition would look like in a course on research in a Gurukula University without fees and without degrees and certificates.

What I would like to share with you today is a general framework for curriculum design for Higher Order Cognition.

In ten minutes, all I can do is to take you through the first few slides of my presentation to persuade you to share the dream of a Gurukula University. But you have a hard copy of my presentation supplemented with notes on some of the slides, which you can read later. And please contact me at my email address if you have questions, comments, suggestions, or criticism.

CURRICULUM FRAMEWORK FOR HIGHER ORDER COGNITION

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[Text of the PowerPoint Presentation

Slides with accompanying notes]

<https://www.thinq.education/post/curriculum-framework-for-higher-order-cognition>

Slide 1: Title Slide

Slide 2: The Focus: Higher Order Cognition (HOC)

NEP (2020)

NAAC White Paper (2022) (Section 2.4 and Annexure 6)

“Re-imagining Assessment and Accreditation in India”

Notes

Introduction:

Both NEP 2020 and the NAAC White Paper 2022 “Reimagining Assessment and Accreditation in Higher Education in India” emphasise the need to incorporate Higher Order Cognitive Capacities (HOCC) as a core component of curricula for Higher Education in India. In this talk, I will be concerned with two questions on the implementation of this recommendation:

- A) **The Goals:** What are the learning outcomes that the design of a curriculum for Higher Order Cognition should aim at?
- B) **The Means:** What pedagogical strategies should a curriculum employ to achieve the learning outcomes it chooses to aim at?

The pedagogical strategies in (B) would include the strategies that classroom teachers employ in their classrooms, but would not be restricted to them. They would cover all the strategies that curriculum designers employ to bring about the desired learning outcomes. These would include the design of syllabi, the design of learning materials, the design of classroom activities, and the design of student assessment.

As clarified in the white paper, Higher Order Cognition is the same as the capacities needed for Academic Inquiry and Critical thinking: to think like a mathematician, think like a scientist, think like a philosopher, and so on. One way of structuring the diverse tools for is to define it as the capacity to construct and evaluate theories.

PART 1: A SAMPLE OF EXAM QUESTIONS

Slide 3:

Master’s in Mathematics:

A straight angle is 180 degrees.

On a straight line segment AB, with a point C between A and B, angle ABC is a straight angle.

A triangle is composed of three straight lines. There are infinitely many points in any straight line segment, so there are infinitely many straight angles in a triangle. If so:

The angle sum theorem says that the sum of angles in a triangle is 180 degrees.

Is the theorem wrong? Provide reasons in support of your answer.

Slide 4

Master’s in Physics:

Newton’s theory of gravity uses the concept of gravitational force.

Einstein’s theory of gravity uses the concept of gravitational field.

Does that mean that the concept of force is unnecessary in a theory of motion?

Provide reasons in support of your answer.

Slide 5

Master’s in Biology:

Sexual reproduction is found in both plants and animals.

Given Darwin’s theory of biological evolution that explains shared properties of two taxa in terms of common descent, this means that there is a sexually reproducing taxon from which both plants and animals descended.

This conclusion is inconsistent with textbook trees of life.

Should the textbook trees of life be revised? Provide reasons in support of your answer.

Slide 6

Master’s in Economics:

Noma, rated New York’s best restaurant, is closing, because given the (post)-covid environment, the “model is no longer sustainable.” And it is evolving into a food laboratory.

If we accept the definition of sustainability as the ability to maintain or support an entity or process over time, sustainability is the same as survivability, and is closely related to evolvability.

Construct a theory of sustainability and evolvability that applies to both economics and biology.

Slide 7

Master’s in History:

Textbooks treat the Egyptian civilization as a great civilisation, even though the empire depended on conquest and brutal treatment of slaves.

They also refer to the conqueror, Alexander, as *Alexander the Great*.

Should the epithet ‘great’ be applied to such instances in history textbooks?

Provide reasons in support of your answer.

Notes on Slides 3-7

The slides:

The purpose of slides 3-7 is to give the audience a feel for one of the central components of Higher Order Cognition (HOC), namely, the understanding of and the ability to provide Rational Justification for knowledge claims (statements that are claimed to be true). If we conduct the experiment of getting the graduates from the Master’s Programs in India to respond to these questions, we would find that almost all of them would flunk miserably, even graduates of the most prestigious programs.

The question that I would like to raise is:

What kind of curriculum in schools and in Bachelor’s programs would help our students engage successfully with such questions that probe into the Higher Order Cognitive Capacities of learners?

PART 2: THE CONCEPTS

Slide 8: The Structure of what follows

- ~ What is a Curriculum?
- ~ What is a Curriculum Framework?
- ~ What is Higher Order Cognition (HOC)?
- ~ Learning Outcomes of HOC
- ~ Reasoning
- ~ Theory

Slide 9: What is a Curriculum?

Curriculum: The **totality of interventions** designed to achieve the **learning outcomes** that an educational program **aims at**

Slide 10: *Components of a Curriculum*

Aims/Goals: the **learning outcomes** that a program aims at.
The information, understanding, skills, abilities, mindsets, predispositions, attitudes, as specified in the **syllabus** of the program.

Means: the pedagogical strategies (learning resources, learning tasks within and outside the classroom, ...)

Assessment Tasks

Administrative policies, infrastructure, ...

Slide 11: What is a Curriculum Framework?

Curriculum Framework: a framework of concepts, options, questions and ideas that help curriculum designers to design a curriculum, including:

- the answer to the question “What is a curriculum?”
- Inventories of educational philosophies, learning outcomes, pedagogical strategies, types of assessment tasks... to choose from

Slide 12: What is Higher Order Cognition (HOC)?

Cognition: ways of knowing, explored under cognitive science, and epistemology as the study of knowledge in philosophy.

(‘To cognise’ means ‘to know’.)

Human and non-human cognition

Academic and pre-academic cognition

Higher Order Cognition:

What distinguishes humans from other organisms:

thinking like an academic (mathematician, scientist, historian philosopher)

Academic Inquiry and Academic Critical Thinking

Slide 13: Learning Outcomes of HOC

Tools of Inquiry: reasoning, defining, categorizing, generalising, abstracting, integrating, justifying, critically evaluating, debating, ...

Modes of Inquiry: Mathematical, Scientific, Humanistic, Philosophical, Conceptual, Ethical...

(Not mutually exclusive)

Constructing and Evaluating Theories

Slide 14: Reasoning

Central Concepts: Logical consequence and logical contradiction

Types of Arguments:

Demonstration of:

Logical consequence (e.g., Straight-angled triangles)

Logical Contradiction

Refutation: e.g., Definition of Solid and Liquid

Proof: e.g., Concept of vertex

Occam’s razor: e.g., Humans as animals

Slide 15: Theory

Examples

A geocentric theory of the solar system

A theory of ethics

A theory of discrete geometry

Darwin’s theory of evolution

Notes on Slides 8-15

The slides:

Slides 9-12: What is a Curriculum, a Curriculum Framework, and Higher Order Cognition?

“To cognize means “to know”.

While Cognitive Science studies knowledge in terms of the scientific mode of inquiry, Epistemology studies knowledge in terms of the philosophical mode of inquiry.

While the capacity for cognition is found in all forms of life, from bacteria to humans, there are certain cognitive capacities that are unique to humans. These are the capacities of Higher Order Cognition.

Slide 13: Learning outcomes:

The learning outcomes that the strand of education for HOC ought to aim at:

Tools of Inquiry

Modes of Inquiry

Theories (Constructing and Evaluating them)

These ideas are discussed in detail in the NAAC White Paper 2022.

Slide 14: The central concepts involved in reasoning, and the main *Types of Arguments*. The examples given can be used even in the textbooks and class sessions of secondary school programs.

The example of humans as animals involves the use of Occam’s Razor in argumentation.

Slide 15: Examples for extended theoretical inquiry, again usable in secondary schools.