Knowledge and Knowledge Systems

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1 Education and Educatedness

Education is the process of helping learners become educated. Educatedness is not a matter of receiving certificates and degrees. It is a quality of mind. A person who never obtained a Bachelor's degree can still be a highly educated individual, and one who has a Doctorate be considered a poorly educated one.

Given this viewpoint of educatedness, Institutionalised Higher Education's primary function should be to help learners develop those qualities of mind that we expect from highly educated individuals, and not just that of providing credentials.

Among the qualities of mind that we expect of individuals who have had the opportunity for higher education are a set of capacities that are associated with the knowledge they acquire. When designing curricula in a Higher Educational environment, it is imperative that the designers have a deep understanding of the nature of Academic knowledge, and the nature of the Knowledge Systems that shape the construction and critical evaluation of knowledge.

It is equally important that students being educated in institutions of Higher Education obtain a rudimentary understanding of the nature of knowledge and systems of knowledge, and develop the capacity of Higher Order Cognition as stated by NEP 2020 This calls for the students to develop the ability to think like academics — like mathematicians, scientists, philosophers, historians, literary critics, as well as engineers, doctors, lawyers, and so on.

Bearing in mind the goal of education suggested above, this article is a preliminary attempt to share with the stakeholders of higher education our answers to two questions:

- What is knowledge?
- What is a knowledge system?

2 What is Knowledge?

Imagine that you are walking along a path in a forest. You experience a particular fragrance. If you have lived in a village in India, chances are that you would be able to identify that fragrance as coming from a particular category of flowers, say, the flowers of a jasmine plant. A few meters further, you get a whiff of another fragrance, perhaps coming from the flowers of a champaka plant (*Magnolia Champaca*). Someone who has never had the prior *experience* of the fragrance of jasmine flowers and champaka flowers would not be able to do what you did. That person does not have the *knowledge* of the flower fragrances that you have.

Given this, it would be reasonable for you to say, "I know what jasmine and champaka flowers smell like."

Now consider the following dialogue:

Zeno: Which of these propositions is true?
Proposition 1: The Earth revolves around the Sun.
Proposition 2: The Sun revolves around the Earth.

Plato: The first one.

Zeno: So it would be reasonable to say that you *know* that the earth revolves around the Sun?

Plato: Definitely.

Knowing that the Earth revolves around the Sun is an example of textbook knowledge that communicates the findings of academics. We may use the term ACADEMIC Knowledge to denote this kind of Knowledge. EXPERIENTIAL Knowledge, on the other hand, is the kind of knowledge you have about the fragrance of jasmine and champaka, and is not the same as ACADEMIC knowledge.

However, they are both valid forms of knowledge and share the same framework:

X knows that Y

where X is the individual human knower, and Y is a statement that the knower knows.

There is another dimension to knowledge that we may call "know how-to" knowledge, as distinct from the "know that" knowledge. For instance, knowing *how to ride* a bicycle is not the same as *knowing that* bicycles have two wheels. In this article, our primary attention would be on the *know-that* form of knowledge.

3 Types of Knowledge

One way of classifying or categorising knowledge is in terms of its subject matter. Disciplines such as astronomy, physics, materials science, chemistry, biology, anatomy, physiology, psychology, sociology, economics, and history are examples of the subject matter of knowledge.

Another way of classifying knowledge is in terms of what it is based on or where it is derived from. In the previous section, we suggested that we can say that X knows that Y only if X believes Y to be true. With this in mind how do we determine something to be true?

Consider the following examples:

~ Knowledge based on the testimony of an authority

Zeno: Do you believe that the Earth revolves around the Sun?

Plato: Yes, indeed.

Zeno: Why do you believe that?

Plato: Huh? Because it's true.

Zeno: I'm asking you why you think it is true. Why do you think that the statement that the Sun revolves around the Earth is false?

Plato: Well, that is what the textbooks say.

Now compare that with the following ones:

~ *Knowledge Based on Experience*

Zeno: Do you believe that a stubbed toe is more painful than a pin prick?

Plato: Yes, indeed.

Zeno: Why do you believe that?

Plato: Because that has been my experience.

~ *Knowledge based on Observation and Reasoning*

Zeno: Do you believe that Socrates is taller than Aristotle?

Plato: Yes.

Zeno: Have you seen them standing side by side or measured their heights?

Plato: No. I haven't. But I have seen Socrates standing next to Dogenes. Socrates is taller than Diogenes. And I have seen Diogenes standing next to Aristotle. Diognes is taller than Aristotle. So it is legitimate to conclude that Socrates is taller than Aristotle.

~ *Knowledge based on Prior Knowledge and Reasoning*

Zeno: Do you believe that all ants have compound eyes?

Plato: Yes.

Zeno: Have you looked at every ant to check if it has compound eyes?

Plato: No, I haven't.

Zeno: Why then do you believe that that statement is true?

Plato: Well, I know that all insects have compound eyes. I also believe that ants are insects. It follows therefore that all ants have compound eyes. If the first two statements are true, then the third statement must be true.

~ *Knowledge based on Feeling*

Zeno: Do you believe that Athena loves you?

Plato: Yes, indeed.

Zeno: Why do you believe it is true?

Plato: I have a strong feeling that is it true. There is no other reason.

Closely related to the concept of Knowledge based on Feeling are the concepts of Experiential Knowledge and Personal Knowledge. Suppose someone called Mino says:

"On 21st December 2024, I dreamt that I was an insect."

Mino's statement is part of his PERSONAL Knowledge, not Academic Knowledge; it is what an individual believes to be true, and is knowledge that only that person has access to, such as dreams. This is not only an

example of PERSONAL but EXPERIENTIAL knowledge as well, showing how many of the categories intersect or overlap.

Our intention is not to defend the postulation of any of these categories, but to give the readers a sense of the variety of categories based on different reasons for believing that something is true.

4. Knowledge, Knowing, Cognition, and Cogniser

The term *cognition* comes from the proto-IndoEuropean root *gno-* from which the English words *cognise* and *know* are derived (see https://www.etymonline.com/word/cognition). The Sanskrit word *jnana* 'knowledge' is also derived from the same root (see https://en.wikipedia.org/wiki/jnana).

Cognising is knowing, and hence we may use the term *cogniser* to mean 'knower', which in our terminology, includes not only individual human beings who know something, but also communities of knowers who share a certain knowledge. In this sense, we can say that those who have a university degree know that the Earth revolves around the Sun, ancient knowledge seekers knew that the Sun revolves around the Earth, and physicists know that electrons are negatively charged.

What does it mean to say that a cogniser X knows that Y? We propose the following answer:

> For us to say that
> X knows that Y,
> the minimal condition is that X believes Y to be true.

Earlier, we made a distinction between *know-that* knowledge and *know-how-to* knowledge. The issue of truth does not apply to *know-how-to* knowledge.

5 What is Academic Knowledge?

In the previous sections, we took it for granted that the category of knowledge that Higher Education is concerned with is that of Academic Knowledge. We also discussed examples that implied a distinction between Academic Knowledge and other types of knowledge such as EXPERIENTIAL KNOWLEDGE and PERSONAL KNOWLEDGE. But we did not answer the question: What do we mean by the term 'Academic Knowledge?'

We might begin by saying that Academic Knowledge is *a body of statements that are accepted as true by the community of academics*. And we define academics as *those who are professionally committed to the pursuit of truth.*

Another way of characterising the concept of Academic Knowledge is to consider it as the sum total of knowledge in all of the disciplines in the structure of a University: mathematics, astronomy, physics, biology, sociology, history, philosophy, and so on.

Yet another way of defining Academic Knowledge is as the knowledge transmitted through institutions of Higher Education. Knowledge of theory construction in Mathematics, the physical-biological-human sciences, and the humanities, such as art history, are examples of academic knowledge. A course in anthropology that explores courting patterns in different cultures might find a place in a university, while a course that provides training in the the art and craft of flirting, or in how to engage in effective gossip, has no place in a university.

6 Characteristics of Academic Knowledge

Academic knowledge is one of the bodies of ***RATIONAL*** knowledge. What do we mean by that? As a starting point, we may say that being rational requires adherence to two guiding principles of rationality:

Accepting Logical Consequences

If we accept a set of premises, we must also accept the conclusions that logically follow from them.

If we accept the statements that all humans are primates, all primates are mammals, all mammals are vertebrates, and all vertebrates are animals, then we must also accept the conclusion that all humans are animals.

Rejecting of Logical Contradictions

Combinations of propositions that are logically contradictory must be rejected as false.

The compound proposition that the earth is flat and the earth is not flat constitutes a logical contradiction. Hence we must not accept it as part of our knowledge.

Logical consistency is the absence of logical contradictions, hence we may alternatively formulate this principle as: “A body of knowledge must be logically consistent.”

We are by no means suggesting that Academic Knowledge is superior to or more valuable than any of the other forms of knowledge. Nor are we saying that Academic Knowledge is the only form of rational knowledge.

Rational considerations are equally important for other forms of knowledge. For instance, fishermen use their geo-centric Ethnic knowledge of the sky and the stars, the seasons, and the ocean, to reason and decide when and where to fish. This decision is certainly based upon rational thinking. Similarly, for some forms of illnesses, homemade plant remedies based upon one’s ethnic knowledge may be more effective cures than pharmaceutical products offered by modern mainstream medicine, while for other illnesses, the medications of modern mainstream medicine may be more effective.

In the context of Higher Education, the term *ethnic knowledge* is often contrasted with *universal knowledge*, with the implication that academic knowledge is universal. Let us take a close look at this distinction.

What does the term *universal* mean in the claim that Academic Knowledge is universal? Suppose we say that what it takes as true applies to the whole universe, and is not restricted to a specific part of the universe such as a specific individual community, a region on the earth, or even the earth itself. How tenable is this distinction?

The so-called universal law of gravitation that says that every material body in the universe attracts every other material body is indeed universal. However, the statement creates a problem for Galileo's law of falling bodies. If we drop a stone from a height, its downward acceleration is 32 feet per second. This is not universal because while it may be true for the earth, it is not true for some other planet or for any of the moons. If we take Galileo's law as universal, then we must reject our definition of universality. Even the statement that the Earth revolves around the Sun may be problematic, as the words Earth and Sun are restricted to the Solar system.

To solve this problem of terminology, can we say that Academic Knowledge is universal in the sense that it holds true on all of the earth? In this sense, Galileo's law of falling bodies might appear to be universal at the first blush, but on closer examination, difficulties arise. If we drop a rock from a height of, say, a kilometre above the earth, it would obey law of 32 feet per second acceleration. But what if it is from a height of a little more than half the distance between the earth and the moon? Would it still obey that law?

Suppose we were able to build a tube, say,with a radius of 5 meters from one side of the earth through the molten metal at the center to the other side, would the acceleration be the same at the center? If not, does Galileo's law apply to all regions of the earth? Is it a universal law?

Even if we manage to solve that problem, we still have problems, for instance, with the status of the statement that water boils at 100^0 C. It is true on the earth at sea level, but not true at higher altitudes on the earth.

The knowledge of the effectiveness of the glutathione molecule ($C_{10}H_{17}N_3O_6S$) in healing cellular dysfunctions is part of our academic knowledge, not ethnic knowledge, because it has no geo-cultural restrictions. Glutathione is a constituent molecule of the *tulsi* plant (*Ocimum tenuiflorum*) which is found in Asia, Australia, and the Western Pacific. There is a belief that tea made from the combination of fresh tulsi leaves and ginger root can cure a common cold. Is this belief part of Academic Knowledge or Ethnic Knowledge? We leave the question open for you to gnaw on.

However, bear in mind that there are different varieties of what we call tulsi and ginger and within these varieties the properties may vary depending on the environment such as the soil or the climate. And in addition, the processes of making the tea can vary depending on many factors as well.

What we have done in this section is to outline some of the characteristics of Academic Knowledge which it may or may not share with other forms of knowledge. We have also raised questions about some of its alleged characteristics.

7 What is a Knowledge System?

Having provided a number of examples of different types of knowledge, we are now ready to answer the question, "What is a knowledge system?" As the first step, we begin with the question, "What is a system?"

A SYSTEM is *a set of interrelated components that perform a given function or a set of functions.* In this sense, the respiratory system, the circulatory system, the neural system, the digestive system, and other systems in a human body are prototypical examples of systems. So are economic systems, legal systems, and systems of medical practice in human society.

Given this concept of system, we may define the concept of 'knowledge system' as follows:

> A KNOWLEDGE SYSTEM is a set of interrelated components that together have the function of constructing knowledge and evaluating knowledge claims.

The components of knowledge systems include:

- the norms for establishing knowledge claims as true or false (ways of justifying or refuting the claims);
- ways of looking for answers to questions that need investigating (methodology); and
- modes of arriving at conclusions from premises (reasoning).

Readers who are familiar with the history and philosophy of science would immediately see that the concept of knowledge system is a generalisation of the concept of paradigm in Thomas Kuhn's 1962 book, *The Structure of Scientific Revolutions.* In our judgment, the best definition of the concept of paradigm appears in S Dasgupta's 1992 article, "Understanding design: Artificial intellligence as an explanatory paradigm":

> "In essence, a Kuhnian Paradigm is a network of generalised theories, metaphysical assumptions, metaphorical and heuristic models, methodological commitments, values and exemplars that are shared by, or are common to, a given scientific community. A paradigm provides the framework within which members of that community recognise and solve problems."

If we replace 'scientific communities' with 'academic communities' in this quote, then Dasgupta's definition of paradigms is the same as the Systems of Academic Knowledge. And if we generalise further by deleting the specification 'academic', then it means the same as what we mean by 'Knowledge Systems'.

As far as Academic Knowledge is concerned, a central component of the knowledge system is ***reasoning***, the study of which is ***logic***. To illustrate,

let us look at the differences between proofs in mathematics and experimental proofs in science.

Mathematical proofs are arguments in support of knowledge claims called CONJECTURES. The premise propositions for mathematical arguments are the ***axioms and definitions of a theory***, which we will call ***postulates***. Once a conjecture has been proved to establish it as a theorem, then that theorem can in turn be used as a premise. The form of reasoning used in mathematical proofs is that of ***classical deductive reasoning,*** found in most standard textbooks on logic.

In experimental proofs, the premises are the outcomes of the experiment, a sample of ***data points***. In this domain, the counterpart of a conjecture is called a ***hypothesis***. Once established as true, hypotheses become ***observational generalisations*** on a population. The mode of reasoning from data points to observational generalisations is that of ***inductive reasoning.***

We urge the readers to reflect on how legal proofs in the criminal court are different from both mathematical proofs and experimental proofs.

Central to the differences between knowledge systems is the concept denoted by the English word, ***argument***. We use the term as synonymous with ***proof*** and ***rational justification***. But the reader must be warned that not everyone uses that word with the same meaning. Examples of different meanings include sentences like: "Don't you dare argue with me;" or "The couple were arguing throughout the night;" where it refers to disagreeing (with each other). In "I argue that AI is a wonderful gift to mankind," it probably refers to providing an extended exposition of an assertion, not providing reasons for the assertion.

The English words *know* and *knowledge* are also multiply ambiguous. Clarity in the understanding of the concepts denoted by these terms is central to the study of knowledge and knowledge systems.

Given our limited space, we do not expect all readers to fully understand the concepts we have given in bold italics. All that we have tried to do in this article is to outline the bare skeleton of the concepts of knowledge and knowledge systems, all of which need to be fleshed out.

Seeing the skeleton of an animal is hardly sufficient for anyone to understand its anatomy and physiology, let alone behaviour. What we have in this article is such a skeleton, as a starting point for further exploration. In subsequent articles, we will explore each of the sub-concepts of knowledge and knowledge systems, and show how an understanding of different systems of academic knowledge is essential for all stakeholders of Higher Education anywhere in the world if they wish to acquire academic knowledge in a meaningful way.

8 Evoluion of Knowledge and Knowledge Systems

Whether the cognizer is an individual, a community, or the human species, knowledge keeps evolving. So do knowledge systems.

Suppose we assume that t*he rational knowledge created and transmitted in a University is Academic Knowledge.* Suppose we also define a University as *a place where novice learners and experienced learners are engaged in the pursuit of knowledge*. If so, we may say that the earliest Universities in the recorded human history were those of Takshashila, also known of Taxila, established around 1000 BCE. (https://en.wikipedia.org/wiki/Taxila) Scholars like Paanini and Caraka were products of Takshashila, and Paanini's Ashtaadhyaayi and Charaka's Charakasamhita were examples of the academic knowledge of the Ancient times. Plato's Academy, established around 400 BCE came next. Next came the ancient University of Nalanda, established around 400 CE. (https://en.wikipedia.org/wiki/Nalanda_mahavihara)

The evolution of Academic Knowledge and of the Systems of Academic Knowledge is for the historians to investigate, but we will point to a few evolutionary changes without the time line.

Many propositions believed to be true two thousand years ago are now considered to be false, and vice versa. Examples are not hard to find in mathematics (e.g., axioms being self-evident), astronomy (e.g., geocentric and heliocentric theories), physics (theories of motion and gravity), chemistry (e.g., matter being infinitely divisible vs. indivisibility of atomic units of matter, water and air being elements), biology (e.g. evolution from unicellular ancestors), and psychology (e.g., mind being an emergent property of the body).

What is less well known, perhaps, is that knowledge systems also keep evolving. This includes our preconceptions of the nature of reality (called ontology), and the ways of establishing a proposition as true (called epistemology, logic being one its components.)

An important matter of debate in Ancient Knowledge Systems centered around the nature of ultimate Reality. The philosophical school called Sankhya, for instance, subscribed to dualism (*dvaita*), holding that the diversity of phenomenal reality is the result of the interaction between *Purusha* and *Prakriti*. The philosophical school called *advaita* subscribed to monism, holding that the diversity of phenomenal reality is a manifestation of a single ultimate reality called Brahman. In the West, the concept of the world being created by a Deity subscribes to dualism, while modern Cosmology lends itself to monism.

The very concept of rationality has been evolving. The logic of the ancient and medieval Western World was two-valued: every proposition was taken to be either true or false. In medieval Buddhist logic, logicians like Nagarjuna propounded a four-valued logic called *catushkoti* (tetralemma). Three-valued logic and multi-valued logics entered the western world in

the early twentieth century. And four-valued logics emerged with quantum theory (quantum logic).

Is it rational to believe that a given proposition is neither true nor false? The Aristotelean system of two-valued logic tells us that it is not. It also tells us that it is not rational to believe that a given proposition is both true and false.

The four-valued system of quantum logic tells us that it is irrational to believe that a given proposition is both true and not true. But it allows the possibility of a proposition being neither true nor false, as well as being both true and false. (For a discussion of this issue, watch the youtube video "Wittgenstein's Games by A. C. Grayling" at https://www.youtube.com/watch?v=PmckTveYNI8)

In forthcoming articles, we will explore in depth each of the concepts discussed in this article. We will also show how an understanding of different systems of academic knowledge is essential for all stakeholders of Higher Education, whether to acquire or to transmit academic knowledge in a meaningful way.

Astute readers must have realised by now that an important factor that distinguishes one knowledge system from another is the set of ways of knowing that they adopt, and the criteria they use to judge the reliability of knowledge. Another factor leading to their diversity is the historical circumstances in which they evolved.

9 The Series

In forthcoming articles in this series, we will explore in depth each of the concepts discussed in this one. At the heart of these concepts are the following characteristics exemplified in the best of academic knowledge and inquiry, though not by every academic or every 'discipline'.

A) Doubting and questioning what one already believes to be true. (For a brief glimpse of this, watch what Hepatia, the heroine of the movie, says in the three minute YouTube clip: "Question your beliefs – Agora." (https://www.youtube.com/watch?v=4N8EFH-qYJ4))

B) Doubting and questioning candidates for belief. (Such candidates may come from others, or from one's own introspection.)

C) Taking steps to minimise the doubts in (A) and (B), while avoiding complete certainty of belief.

Central to (C) is:

(D) Rreasoning.

We will show how an understanding of different systems of academic knowledge in terms of (A)-(D) is essential for all stakeholders of Higher Education, whether to acquire or to transmit academic knowledge in a meaningful way.

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