The Dynamics of Knowledge and Knowledge Representation in Education

Technological Advances and Knowledge Transfer in a Global Context

By

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Abstract

Knowledge is defined as, “Information that Men and Machines can think about.” Such definition suggests that knowledge is fluid and part of the modern computer revolution. Knowledge is created through human interaction using natural and man-made tools of knowledge transfer.

Knowledge is not static; it is dynamic in the sense that it can be modified and/or expanded depending on new experiences and scientific results.

Education is essentially the transfer of knowledge through the teaching-learning process, through experience, through interaction with the environment, through communication using spoken and written language, and the modern tools of electronic interaction.

In this lecture we will attempt to investigate how technology has influenced our educational process for better or for worse.

Belief, Hypothesis, Theory, Fact, Data, Information, Knowledge, Know-How, Wisdom

Before knowledge there was belief. Belief in the irrational where explanations of natural phenomena were borne out of our fantasies. There were the gods, there was God: Thor, Donar, Wotan, Zeus, the gods of thunder and lightning are still alive in our weekdays: Thurs(Thors)day, Donners(Donars)tag, Wednes(Wotans)day, Tues(Zeus)day. Friday is named after the fertility goddess, Frya. We have Moonday (Monday), Saturnday (Saturday), Sunday named after the gods behind the celestial bodies.

Hypothesis is the belief that something could be true, a proposition that may eventually lead to the “truth”. Hypothesis may eventually evolve into theory where mathematical reasoning is the basis for a logical understanding of initial propositions. Facts emerge when experiments verify the correctness of our theoretical assumptions.

There is fact and there is fiction. There are given facts and derived facts. Facts are observable, directly or indirectly. In contrast, fiction is just in our minds. Data is a collection of facts in alphanumerical and/or hieroglyphic or pictographic symbolism. Information is interpreted data. Knowledge is “information that men and machines can think about”. In contrast to a static database, knowledge should be dynamic. If out-dated, it is to be replaced by new knowledge. New knowledge is assimilated when it becomes understandable within the framework of our current perception of the world.
Know-how is the skill to use knowledge to solve practical problems. Experts know how to apply knowledge to problems of science, technology, and human interaction. Know-how has advanced humanity to technological heights never thought possible even 100 years ago. From the clubs and stone axes of the cave man we have progressed to interplanetary space flight, to long distance travel and global communication. But it has also delivered us to the dangers of weapons of mass destruction. Politicians know how to manipulate the ignorant populace to accept preemptive warfare in the name of “security” and even in the name of God.

It is, however, the wisdom of Einstein, Buddha, Zoroastra, Jesus, Kant, and Newton that provides us with profound insight into the mechanism of the universe, the external and the internal human universe.

Knowledge is dynamic. It depends often on prevailing beliefs and perspectives. Observation and experiment are frequently leading to wrong conclusions. When Galileo Galilei stated that the earth was circling the sun, he had to recant his position because the powers that were said that it was the other way around: Religious dogma prevailed over scientific wisdom. It is the religious fanaticism in all organized religions that often leads the world to the brink of total destruction. Hitler, Bin Laden, Hussein and the Iranian Mullahs are driven by power-hungry fanaticism that has murdered thousands and millions without humanitarian compassion.

Newton’s celestial mechanics was expanded by Einstein into the Theory of Relativity. Darwin’s Theory of Evolution is today recognized as the best explanation of diversity of living species on Earth. The Genome Project has come to the conclusion that men share the bulk of genes with all creatures alive. It is the religious fanatic again who tries to block research into engineering of disease-resistant plants and stem-cell science. “Born-again” presidents are on crusades against scientific progress “to preserve life”, yet they send citizen soldiers into high-tech wars and kill innocent people as “collateral damage”.

The Tools of Knowledge

Natural tools of knowledge are the processing centers in our brains and the physiology of our speech mechanisms. To be useful, knowledge needs to be stored in memory. Interaction with the environment through our senses is a necessary prerequisite to acquire knowledge. Natural languages are carriers of human knowledge; processing of natural language with machines is complex since there are multiple aspects to language. Every language has syntax and grammar as structure but it is semantics that counts. Semantics relates to meaning whereby context can change the meaning of words and sentences. Thus, processing of natural language by computers is a rather complex problem (Rudloff, W. et al.).

Memory is not only part of our brain; it resides in the genes, individual cells and/or cells in compound living structures. Memory is in our chromosomes, in our genes, in our environment. Historical memory is in the annual rings of the trees, the fossils of ancient flora and fauna. Memory rides on the electro-magnetic waves that, when deciphered, provide us with knowledge about the universe, the macro cosmos and the micro cosmos. It is the memory of the universe that tells us about galaxies, the stars with their planets, the black
holes, and is preserved over billions of light years in those signals. On the microscopic scale, electro-magnetic handwritings of the atoms, the electrons, the neutrons, neutrinos, the quarks tell us about their possible structure as matter, and their radiative behavior as energy, thus revealing their dualistic nature.

Human memory is made quasi permanent in writings on stone, on paper, and imprinted in the ferromagnetic materials of our computer disks and memory sticks of cameras. Memory is an essential part of knowledge. Although memory by its very nature is static as a storage devise, it becomes dynamic in that it changes its content in interaction with new knowledge. Large artificial memory of our computers in combination with compression technology has made it possible to store, recall, and transmit vast amounts of knowledge.

**Organization and Representation of Knowledge**

Knowledge is organized in domains, the domain of physics, of politics, of history, the domain of human behavior, etc. Each domain has developed its own specific language. There is the domain of primitive knowledge about everyday life; the knowledge of family, our social interaction, our working for a living. There is sophisticated knowledge of science and technology that can go beyond the directly observable. It is buried in mathematical equations which are interpreting the universe in its multi-dimensionality. Such equations make us understand the concepts of atoms, their nuclei and electrons. Complex experiments can indirectly “confirm” their existence without us ever seeing them with our naked eyes since our senses are very crude instruments of observation.

Knowledge is represented by language, the natural language and its alphabetic or pictographic symbolism as it is stored in books and/or audio and video tape. In computers, language is compressed in the electronic on/off switches represented by the binary code.

Our electronic gadgets allow us to organize knowledge in “virtual” folders, in scientific papers, in our books, in our lectures. It is stored on ferromagnetic and/or photoelectric devices. Short of an electro-magnetic catastrophe, knowledge can stay in computer memory forever. Our knowledge is manipulated by microprocessors and with nano technology, we can envision electronic machines with thousands, millions or even billions of processors on a chip that eventually may emulate our human brain.

**Global Distribution of Knowledge**

The Internet has contributed to extremely fast proliferation of knowledge. Essentially, the Internet has become a “universal” knowledge base (Rudloff et al.). It contains information in the domains of commerce, technology, science, politics, and everyday living. A very pertinent website in science that has been evolving over the past few years is **MERLOT**, the **Multimedia Educational Resource for Learning and Online Teaching**. It provides hyperlinks to an abundance of scientific websites that are peer-reviewed and are given ratings ([http://www.merlot.org](http://www.merlot.org)). Many of them are exciting demonstrations in multimedia as, for example, the marvelous animation of Einstein’s relativity of time by scientist at Caltech ([http://www.cco.caltech.edu/~phys1/java/phys1/Einstein/Einstein.html](http://www.cco.caltech.edu/~phys1/java/phys1/Einstein/Einstein.html)).
Knowledge bases on the Internet have the advantage that they are instantly available. They can be interactive like, for example, “wikipedia”. It is an open-content, multilingual encyclopedia that permits contributions by anyone who likes to share articles of particular interest. Such articles are hyper-linked to related and pertinent knowledge. For example, a recent article on Galileo Galilei shows cross-links to astronomy, Scientific Revolution, physics, the town of Pisa, where he was born, to Kepler and Aristotle, and, of course, to the Church Controversy. Besides English, there are articles in Polish, Danish, German, Chinese, and more. One finds even literature in Esperanto, the artificial language that is still around as a mix of many languages.

Global Education through Knowledge

There is certainly misinformation on the Internet that tries to indoctrinate innocent people for causes of murder and destruction. Osama Bin Laden whose evil philosophy has brought about murder and destruction, uses, how paradoxical, high tech to spread his crazy, medieval ideas, and the ignorant fall for them. It is here where fanatic beliefs are interfering with the knowledge and wisdom of modern science.

In order to counteract the murderous indoctrinations of the religious fanatics, we, as scientists, should promote our ideas over the global super highway, the Internet, with the goal to change society from a culture of war to a culture of peace.

We propose to utilize the evolving technology of Internet-Based Conferencing in Education via the virtual classroom as we discuss in our lecture on “Multimedia and the Internet”, for the promotion of our global Ph. D. Program where we match our international faculty with students from around the world. The suggestion is at hand to create a global database of scholars who are members of IIAS. The database would reflect their scholarly background and scientific interests that student from around the world would consult as potential Ph. D. candidates. We should develop a global curriculum based on these concepts.

Epilogue

In this paper, we have tried to elaborate on the nature of knowledge, its dynamics, and how it relates to its proliferation within the context of evolving new technologies that permit global education between an international faculty of IIAS and potential students from around the world. We believe that the time has come to promote our original idea of a Global Open University within the confines of the Institute. It would be appropriate to begin with brainstorming about its organization and a possible global curriculum that takes into account the specific character of IIAS.

Acknowledgement

We appreciate the generous travel grant of GSU’s Alumni Association and acknowledge the continuous support of our administration.