

# Indian Journal of Science Communication

*Communicating Science of Science Communication*

**Newspaper framing of Kudankulam Nuclear Plant in  
Tamil Nadu**

**Science reporting in Hindi newspapers: Studying the  
usage of English terms**

**Hands-on science: Developing science concepts using  
waste materials**



**Popularizing Yoga: Towards a new world order**

# Indian Journal of Science Communication

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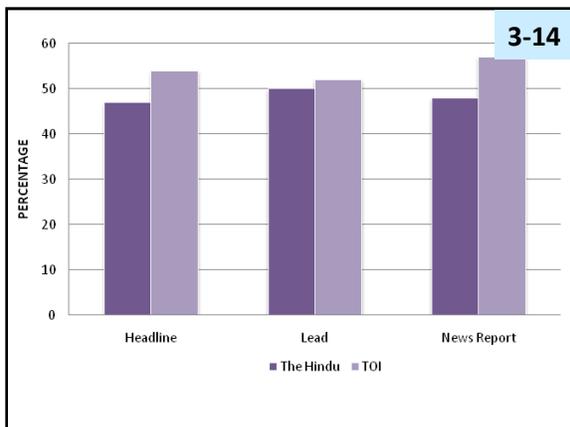
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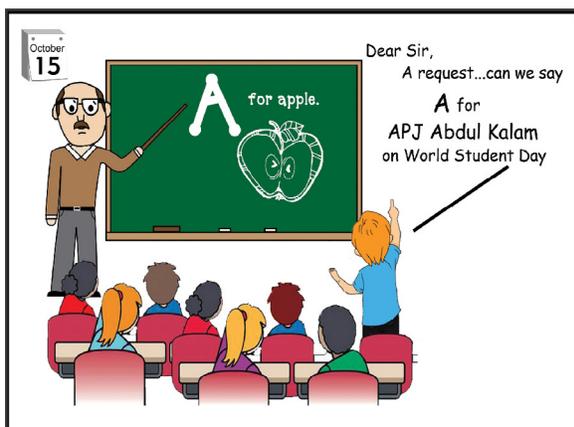
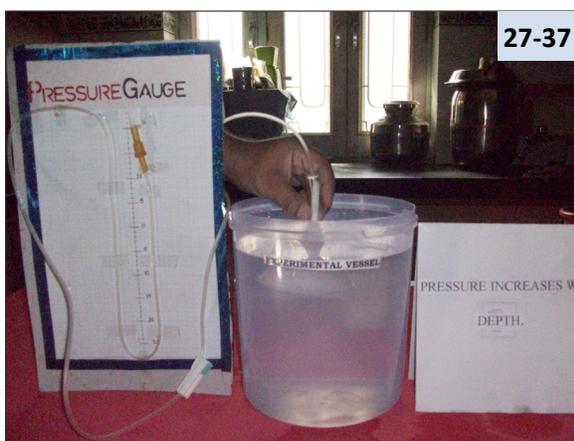
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# India's Scientific Wisdom: The Emerging Worldview



*India is known for her early scientific wisdom and a treasure of scientific heritage. Several sages and scholars had been working on medicinal, mathematical, astronomical, agricultural, physiological, physical and chemical sciences in Indian subcontinent. They had composed books or volumes in their respective fields based on their own self-earned experiments. They have used various means of communication, like oral communication, Guru-Shishya-Parampara (Teacher-Pupil Tradition) of learning and dissemination of knowledge by interacting people. Thus, for a long time, the tradition of oral communication continued, in addition to scientific books written by such knowledge creators.*

*Toynbee (1976) has written: "The scriptures of Hinduism cannot be dated. They were composed and transmitted orally for an unascertainable length of time before they were committed to writing, but the oral transmission of them is likely to have been accurate, since the efficacy of a liturgy was believed to depend on its words being recited correctly."*

*The then Indian intellectuals transmitted the knowledge through oral communication and unique compositions, for generations after generations. However, much later, they had written down such information on different surfaces, rocks, like palm leaf, bark of various trees, copper and bronze plates, and eventually on paper. These communication materials have now become the potential sources of the information on early science and technology in India.*

*Dr. Murli Manohar Joshi, a noted physicist, Hon'ble Member of Parliament (Lok Sabha), and Former Union Minister of Science & Technology has recently opined that "debate about Indian contribution to science must not be seen as jingoism and we must talk about what India has given to the world as well to have a balanced worldview over India's scientific wisdom." Dr. Joshi said in a conversation with The Sunday Observer on January 17, 2015, that all talks of ancient Indian science branded as jingoism by a section of the "intellectuals." He said that undoubtedly, India has learnt many things from the West, but he wonders why there is apathy about what India has given to others! He feels the need for an "evidence based reappraisal" of India's early contribution to science.*

*While delivering Dr. Rajendra Prasad Memorial Lecture on 'Science and Culture' organized by the All India Radio, Dr. Joshi mentioned a German physicist Werner Heisenberg's principle of uncertainty and its origin in Indian philosophy to invoke country's rich scientific glory. He quoted Heisenberg having said that "the modern world is a ship with all material abundance mired in consumerism that does not know which direction to go, India is a compass that will guide this ship as where to go!" In his famous uncertainty principle, Werner Heisenberg had said that there is a fundamental limit to our understanding of the behaviour of quantum particles adding that at most we can calculate probabilities for where things are and how they will behave.*

*A series of evidence based debates involving scholars, scientists, philosophers, historians, academicians from India and abroad would pave the way for a scientific discourse and concretize the base for a clear worldview on a treasure of India's scientific wisdom. A well-researched periodical and regular exchange of contents, views and ideas would lead to arrive at a consensus understanding amongst scholars in India and abroad especially on India's contribution and impact on foundations of modern science. The proceedings and reports of such academic elaborations may lead to further in-depth studies under an existing or new organizational form and would eventually help restore India's glory of scientific excellence.*

*India has a tradition of acquiring knowledge, discovering the secrets of the nature; by examining and thorough observations and by applying certain procedure; what we call today, the method of science. A pragmatic, balanced and realistic worldview over the issue would help India move forward with a fine blend of our "ancient scientific wisdom" and "modern scientific excellence", as we should not afford to "reject" anything in the name of "old" or "accept" anything in the name of "modern" unless there is a scientific evidence - and this is the "spirit of science", as well as the spirit of the "Indian logic", and "theory of cause and effect" that have been prevalent in India even centuries before the advent of the Ionian concept of "science" itself!*

**Dr. Manoj Kumar Patairiya**

# Newspaper framing of Kudankulam Nuclear Plant in Tamil Nadu

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*Clean energy is the word that substantially denotes a safe and reliable resource for the future needs of the people. Nuclear energy was promoted as a clean energy in the end of the last decade when climate change came into dominant discourse. So much that in the UN Copenhagen Climate Conference, 2010, nuclear energy was eulogized as green energy and as one of the best alternatives to fossil fuels. Nevertheless, the nuclear disaster in Fukushima in Japan, following a disastrous Tsunami of March 11, 2011 rekindled the debate on nuclear energy. Almost at the same time, the Kudankulam nuclear power project issue was also warming up in India. Since the media has a major role in disseminating information on science and influencing public perceptions, the study analyzes the framing of the Kudankulam nuclear power project issue in two major newspapers – The Hindu and The Times of India. The research found that episodic framing was used more in The Times of India than The Hindu. The Hindu than The Times of India mostly adapted thematic frame. The policy oriented solutions stressed by the editorials were mainly about Indian nuclear projects, nuclear deal and demand for energy.*

**Keywords:** Kudankulam nuclear power project, media framing, protest, nuclear energy, nuclear safety.

In spite of assurances from the government and experts, that nuclear energy is safe, there is a lack of acceptance amongst people. The decline in acceptance might be due to the notions of the public defining risk in a broader way than technical experts

and officials tend to emphasize different dimensions (Office of Technology Assessment, 1984; Pligt, 1985). Whereas industry and government officials are unlikely to give emphasis on the probability that an accident will occur. The public appears to

be more concerned about the potential seriousness of an accident, if it happens, and the consequences thereof.

The construction of the discourse on any issue in the media has a potential influence on different audiences. The media plays a significant role in constructing the meaning on nuclear energy issues and it is the main source of information and opinions for millions of readers, listeners and viewers. The selection and representations of nuclear issues in newspapers play a major role in political decision.

The study analyses the newspaper coverage on the nuclear power project in Kudankulam, in Tirunelveli district of Tamil Nadu, which is about 20 km away from Kanyakumari, the southernmost tip of the mainland of Indian peninsula.

### **Overview of the Kudankulam nuclear power project**

Kudankulam is a big village with a population of 11,029 with 2,386 households – the main occupation of the people is fishing on shores and the deep sea. The women in Kudankulam make a living by rolling beedi, a local form of tobacco-stick.

In 1988, India and the undivided Soviet Union had entered into a memorandum of understanding to establish a nuclear power plant in Kudankulam with two units of 1,000 megawatt. Later, the Soviet Union split and Russia was rolled out. In 2001, the Nuclear Power Corporation of India launched work and when it was near completion, the local population began their agitation in September out of fear over the safety arrangements of the plant. The People's Movement Against Nuclear Energy (PMANE) was formed and agitated under the leadership of peace activist S.P. Udayakumar against the commissioning of the nuclear plant. The PMANE argued that the region is rich in thorium and monazite due to which there is natural radiation that is 40 times higher than the normal.

Farmers, anglers, intellectuals, and activists opposed the setting up of the nuclear power project. Farmers joined the anti-nuclear movement because the nuclear project is likely to get its water from the nearby Pechiparai reservoir. It means irrigation water would be diverted to the Plant, which would eventually lead to drop in agricultural yield. Later, desalination plants were set up to overcome the problem. Fish is also suspected to be affected by radiation. Then, according to them, both agri-

culture and fisheries, the mainstay of the people, might suffer! The air was thick with rumours that radiation will affect basic commodities such as milk and water too, besides causing cancer, thyroid and anemia. Around 40,000 people, including those of Kudankulam, are living close to the nuclear project site. Idinthakarai is another village located close to the nuclear plant. Similarly, in villages like Uvari and Kooththankuzhi, the residents were actively involved in the movement. There were also priests from Tuticorin and Kottar who were involved in the movement against the nuclear plant. People from three districts – Tirunelveli, Kanyakumari and Tuticorin – organised a massive rally at Tirunelveli. When it was decided in 2011 to install four more reactors in the same nuclear project site besides the initial two of 1,000 MW each, certain amount of displacement was required. This made the people of Kudankulam exacerbate the movement.

### **Study background**

Anti-nuclear movements all over the world have pursued different strategies with different levels of impact on energy policies (Kitschelt 1986). In the West, anti-nuclear movements branched out of environmental movements in the second half of the 1970s. The Three Mile Island nuclear accident in 1979 had triggered several protests in the US and elsewhere. These movements in the West were characterised as 'new social movements'. They were different from the classical working class movements. The Chernobyl accident in the then USSR gave rise to many anti-nuclear protests, particularly in Western Europe. Moreover, the anti-nuclear movement in the West emerged after a certain process of industrialisation. At the same time, many countries had stopped constructing new plants, which resulted in anti-nuclear movements concentrating more on nuclear waste rather than nuclear reactors.

The anti-nuclear movement in India mainly centres on livelihood and displacement. Safety became a new concern after Fukushima 2011. The paradigm of nuclear energy being the major alternative to meet the energy requirements is being questioned.

The debate of alternative sources of energy to combat global nuclear policies is rooted within the current development model. However, the answer lies in locating a safe alternative development model, rather than trying to shift from one source (fossil) to another (nuclear). It is in the above context

that the Kudankulam anti-nuclear movement is discussed. There are two streams of anti-nuclear movements in India. The first, an urban-based movement, largely represented by the mainstream media just as in the West. It aimed at addressing the issue of the nuclear bomb rather than the fallout of nuclear energy. The movement as such is not against nuclear energy. The second views the links among development, security, the state and nuclear scientists. This version of the movement is rooted in the livelihood of the people. Development encourages increased consumption; the rising consumption levels are eventually creating the problems of climate change and dwindling resources for which nuclear energy is pursued as the alternative, they argue. The scientific consensus on the nuclear issue was questioned by civil society activism, however, the reports suggest that the movement has outside support!

Anti-nuclear movements all over the world have pursued different strategies with different levels of impact on energy policies (Kitschelt 1986). In the West, anti-nuclear movements branched out of environmental movements in the second half of the 1970s. The Three Mile Island nuclear accident in 1979 had triggered several protests in the U.S. and elsewhere. These movements in the West were characterised as 'new social movements'. They were different from the classical working class movements. The Chernobyl accident in the then USSR gave rise to many anti-nuclear protests, particularly in Western Europe. Moreover, the anti-nuclear movement in the West emerged after a certain process of industrialisation. At the same time, many countries had stopped constructing new plants, which resulted in anti-nuclear movements concentrating more on nuclear waste rather than nuclear reactors. Even following Fukushima incidence, Japan revealed that some 80% respondents do not favour nuclear plants.

Benjamin K. Sovacool (2011) reported that worldwide there have been 99 accidents at nuclear power plants. 57 accidents have occurred since the Chernobyl disaster, and 57% (56 out of 99) of all nuclear related accidents have occurred in the USA. Serious nuclear power plant accidents include the Fukushima Daiichi disaster (2011), the Chernobyl disaster (1986), the Three Mile Island accident (1979), and the SL-1 accident (1961).

The Fukushima disaster in Japan has brought to the fore the dangers of nuclear radiation. There is a need not only to have greater safety measures in nuclear plants but also to allay the fears in the minds

of the people if we go in for nuclear plants.

## Objectives

The objectives of this research are to study the framing of Kudankulam nuclear power project issue in two prominent English newspapers in India, *The Hindu* and *The Times of India*, from February 1, 2011 to January 31, 2012, with a view:

- To identify the frames adopted by the two newspapers *The Hindu* and *The Times of India* on the Kudankulam nuclear power project coverage; and
- To interpret the motives behind the nuclear framing in both the newspapers.

## Profile of newspapers

The study selected the Chennai editions of two English national dailies: *The Hindu* and *The Times of India*. The news reports and editorials published in these dailies during the period from 1 February 2011 to 31 January 2012 were taken as samples. The selection of two newspapers in the region was based on the fact that they had adequate level of coverage of the issue. According to the Indian Readership Survey (2012), *The Hindu* is the third most widely read English newspaper in India (after *The Times of India* and *Hindustan Times*) with a readership of 2.2 million people. *The Hindu* has its largest base of circulation and widely read in Tamil Nadu. According to the Audit Bureau of Circulation (ABC), it has a circulation of 1.46 million copies as on December 2009. *The Times of India* too is an Indian English language daily newspaper. According to ABC, it has the largest circulation among all English language newspapers in the world, across all formats (broadsheet, tabloid, compact, Berliner and online). In 2008, the newspaper reported that (with a circulation of over 3.14 million) it was certified by ABC (India) as the world's largest selling English language daily, ranking it as the 8th largest selling newspaper in any language in the world. According to the Indian Readership Survey (IRS) 2012, *The Times of India* is the most widely read English newspaper in India with a readership of 76.43 lakhs (7.643 million). This ranks *The Times of India* as the top English daily in India by readership.

## Methodology

The framing research is derived from the study of Goffman (1974) wherein he examined how individuals understand their environment and interpersonal interactions. He described frames as “schemata of interpretation” that allow individuals to locate, perceive, identify and label issues, events and topics. In addition, he states that words are triggers that help people negotiate meaning through the lens of existing cultural belief and worldviews. Reese (2001) defines frames as “organizing principles that are socially shared and persistent over time, that work symbolically to meaningfully structure the social world.” Whereas Entman (1993) writes, “To frame is to select certain aspects of a perceived reality and make them more salient in a communicating text, in such a way so as to promote a particular problem definition, causal interpretation, moral evaluation, and/ or treatment recommendation.” Gamson and Modigliani (1989) define a frame as “a central organizing idea or storyline that provides meaning to an unfolding strip of events, weaving a connection among them. The frame suggests what the controversy is about, the essence of the issue.”

Framing is the process by which a communication source, such as a news organization, defines and constructs a political issue or public controversy (Nelson, Clawson and Oxley 1997). After the exposure to the framed message, audience accept or are at least aware of the issue (Scheufele and Tewksbury 2007). Gamson (1992) has promoted a “constructionist” approach in news framing. His research reveals that people make sense of political issues by using the frames available in media coverage, and by incorporating these packages with the frames forged by way of personal experience or conversations with others. Media frames might help set the terms of the debate among citizens, but rarely, if ever, do they exclusively determine the public opinion. Instead, as a part of “frame contest” one interpretative package might gain influence because it resonates with the popular culture or a series of events, fits with media routines or practices, or is heavily sponsored by the elites (Price, Nir and Capella, 2005). Kinder and Sanders (1996) state that the frames for a given policy controversy exist within the public discourse surrounding that controversy – a discourse that is typically communicated to ordinary citizens through the mass media. How an issue characterized in news reports can have an influence on how it is understood by audiences (Scheufele and Tewksbury 2007)!

Framing is one such tool, which determines

the characterization and presentation, and can be used to study the content of the media. Scheufele (1999) dealt at length on how framing can be used to broaden our understanding of media effects. Vreese (2005) defines framing as an emphasis the salience of different aspects of a topic. While agenda-setting theory deals with the salience of issues, framing is concerned with the presentation of issues. He explains that one influential way that the media may shape public opinion is by framing events and issues in particular ways. The process of framing has also been proved to have a significant impact on public as well as policy level decision-making. This had been studied by Vreese (2005) who points out, “an individual level consequence may be altered attitudes about an issue based on exposure to certain frames. On the societal level, frames may contribute to shaping social level process such as political socialization, decision-making and collective actions.

Gamson and Modigliani (1989) in their study discuss about the people understandings of the concepts of nuclear power is mainly by the framing devices employed by the media and also state that the media framed nuclear energy in terms of benefits resulting from technological advancement. Singer and Endreny (1993) found that the media did not account the long-term hazards of nuclear energy.

The study looked for the words ‘Kudankulam’, ‘anti-nuclear protest’, ‘alternative energy’, ‘Fukushima’ and their equivalents to select the journalistic pieces. The content of 324 journalistic pieces along with editorials was analyzed quantitatively and qualitatively.

Framing analysis has been widely used research method to study newspaper content. In this study, the content of the samples was analyzed based only on framing based parameters. The news reports and editorials were analyzed quantitatively and qualitatively, with the lead (first paragraph of a news item) and the headline as units of analysis.

The two types of frames used are thematic and episodic. ‘Thematic framing’ is a more general representation supported by statistics, historical trends and collective outcomes. ‘Episodic frame’ is a concrete instance or events that involve individuals located at specific places at specific times. In episodic framing, the coverage focuses on a single event or instance and does not provide much background information on the subject. This leads the receiver of the frame to assume that the individual is responsible. In thematic framing, the coverage puts the is-

sue in a general or abstract context while providing a lot of background information. This leads to the frame receivers assuming society is at fault for all problems. Episodic framing limits social issues to individual events while schematic framing places them in a broader interpretation or context. Usage of episodic frames attributes the responsibility of solving the issue to individual, thus failing to address the need for collective actions, which could be emphasized if thematic frame is used.

**Framing task:** The three types of framing tasks diagnostic, prognostic and motivational are used as sub-parameters. Diagnostic task captures arguments, conflicts and blame-games between the supporters and opponents of the nuclear plants, and problems that might arise due to the nuclear power phenomenon. Prognostic task presents solutions, strategies and suggestions to resolve the conflicts.

**Framing diversity:** This parameter aims at studying the frequency in which different news frames are used during coverage of nuclear issues. This study used a framework analysis established by Nielsen and Kjærgaard (2011).

- **Policymaking:** This frame captures the policy issues involved in the Kudankulam nuclear power project.
- **Public understanding:** News involving people from Tamil Nadu responsible actions taken/ to be taken by the government, individual level actions.
- **Scientific research:** Theories and concepts specific to nuclear plant.
- **Technology:** Text here represents the technological information involved in the operation of the nuclear project.
- **Economics:** The text here represents the expected economic benefits in the host community where the power project is going to be commissioned (e.g. jobs, increased tax base, and development).
- **Ethics:** Text here identifies the safety and reliability aspects of the nuclear power project addressed by the scientist and other important stakeholders.

This research has also used in-depth interviews to explore possible reasons for the trends identified in the analysis of the content of news reports. Differ-

ent guideline questions were framed for different interviewees, depending on their background and the reason for interviewing them. The interviews mainly served as a backgrounder for framing analysis in the nuclear issue, which is complex in nature.

## Analysis and interpretation

The content of 324 news reports and editorials were analyzed to find the number of occurrences of various parameters. The significant trends observed from analysis are presented. During the analysis of the sample units based on framing parameters, the study observed a number of trends either from headline, lead, and news reports separately or together. It was observed that headlines and leads adopted a generalized structure whereas news reports focused mainly on the issue.

As shown in Figure 1, analysis of the ‘type of framing’ used in news reports showed that episodic framing had a rise of 68% in *The Times of India* than *The Hindu* 54%. Thematic representation was 32% in *The Times of India* and 46% in *The Hindu*. The analysis of ‘framing tasks’ represented in headline, lead and news reports showed that the diagnostic task highlights the problems or places the blame on one of the parties involved, has been more prevalent in the news reports and the lead. This means, *The Hindu* is more prone to select and analyze the issue in context than focusing on individual events, as compared to *The Times of India*. See below *The Hindu* report, which originated from Kochi but carried in the Chennai edition:

### Kudankulam project safe: Scientist

*Kollam, December 20, 2011*

*R. Chidambaram, Principal Scientific Adviser to the Union Government, has said that all concerns pertaining to the Kudankulam nuclear project have been addressed. At a press conference at Amritapuri, near here, on Monday, Dr. Chidambaram said people should understand how safe the reactor was.*

*He said the safety system that had been built into the Kudankulam reactor was very advanced. There were 16 such reactors in operation in Russia and nine in operation outside Russia, he said. “There is a kind of reactor that has very advanced security features,” he said.*

*Dr. Chidambaram said the human development*

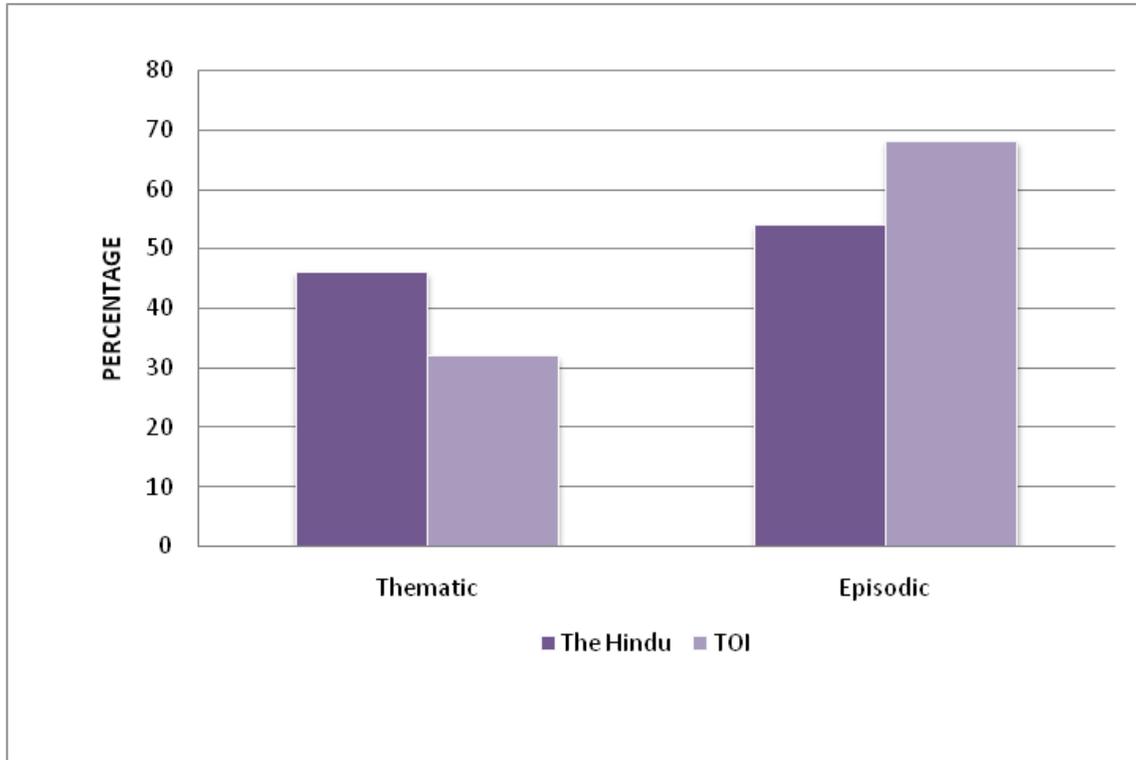


Figure 1: Type of framing in news reports

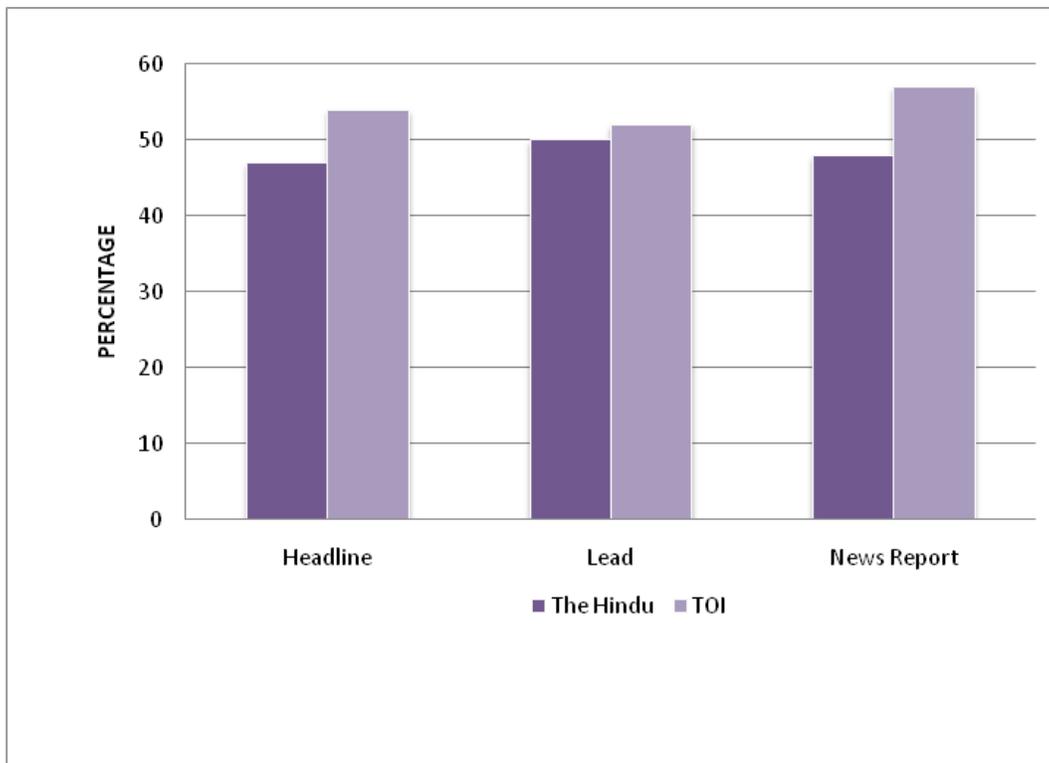


Figure 2: Diagnostic framing task in headline, lead and news report

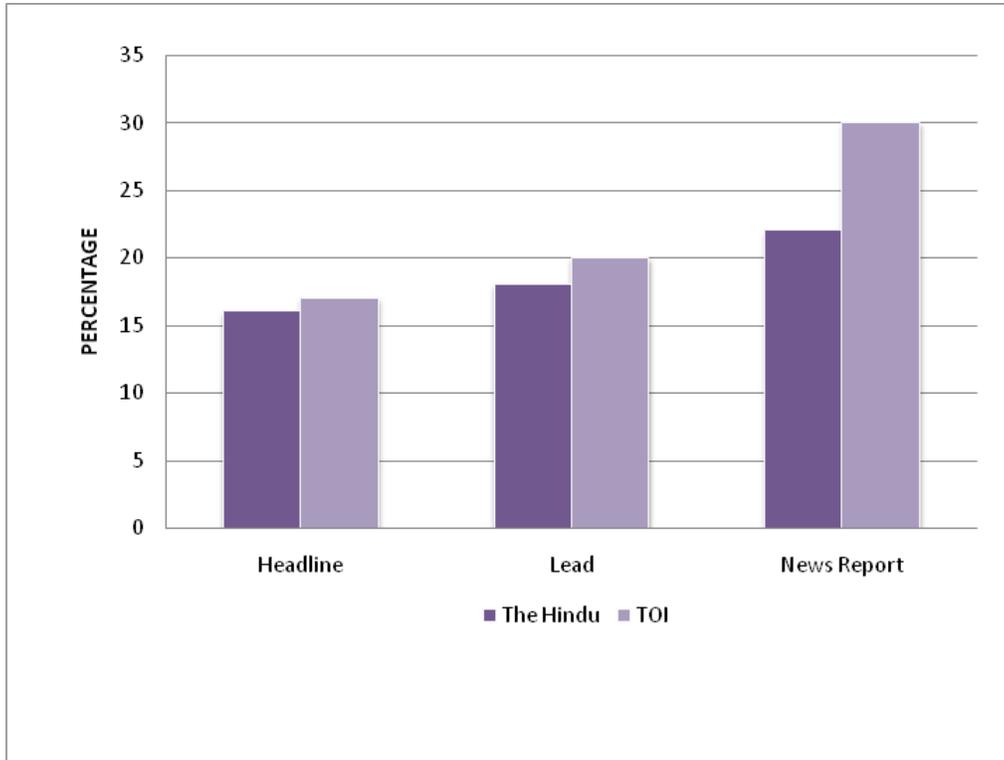


Figure 3: Prognostic framing task in headline, lead and news report

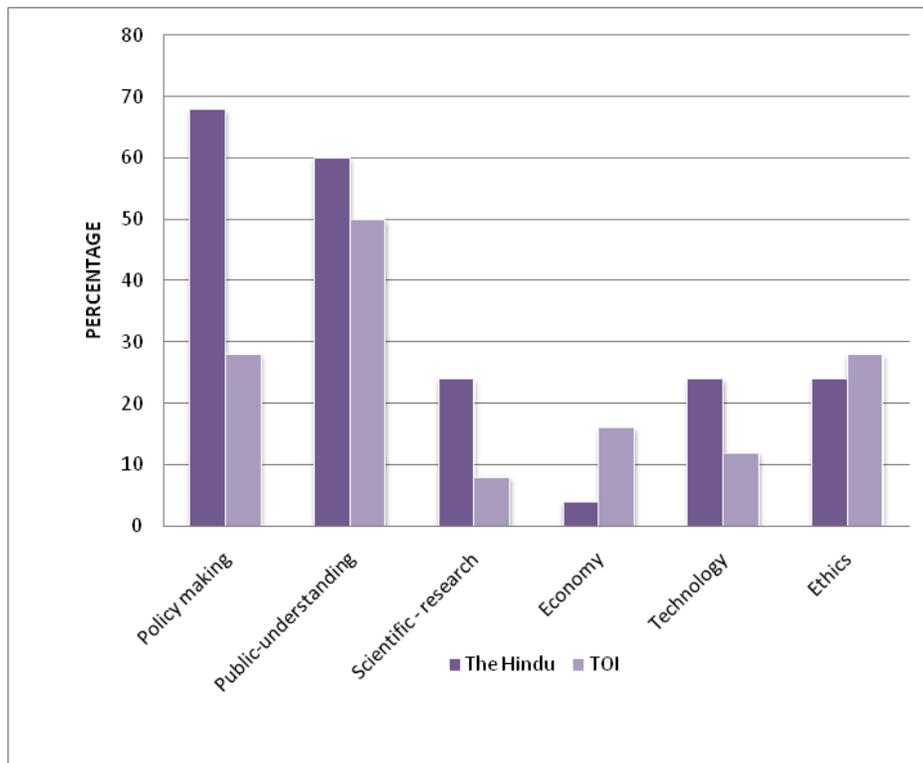


Figure 4 : Frame Diversity - Six major frames used

*index depended very strongly on per capita electricity consumption. If India had to become a developed country, two things needed to be done. One was to become nearly 100% literate without gender discrimination, and the other was that the per capita electricity consumption should go up six to eight times. . . .*

Diagnosing a problem is a little more with *The Times of India* than with *The Hindu*. The conflict mainly happens between the government and PMANE activists. The activists were blaming the government that it does not care for the people as the plant does not meet the required safety, whereas the government blames the PMANE activist group that there is a Western support for the anti-nuclear agitation, particularly suspecting money flow to non-governmental organizations leading the agitation.

Figure 3 illustrates how the prognostic framing task was found to have had increased presence within a news report rather than headline or lead. *The Times of India* had the highest 30% prognostic framing. Prognostic frame gives solutions to problems.

While studying the ‘frame diversity’ of the units of analysis in the 324 news reports, it was observed that ‘Policymaking’ frame was used the most and ‘Economy’ frame was used least in *The Hindu*. The second popular frame that appeared in *The Hindu* on an average was ‘Public understanding’. Contrarily, ‘Public understanding’ frame was used the most and ‘Scientific research’ and ‘Technology’ frames were used least in *The Times of India*. The second popular frame that appeared in *The Times of India* on an average was ‘Policy making’. *The Hindu* has used ‘Policymaking’ frame more because it is a paper read widely by bureaucrats and conservative elite public and as the saying goes the paper serves as a government gazette to some extent (Despite the newspaper publicizing commissioning of the first reactor in Kudankulam as early as March 2011, the reactor was not commissioned till the end of 2012 at least; and, the nuclear project got embroiled in a court case in the intervening period).

### **Kudankulam reactor commissioning in April**

*Chennai, March 7, 2011 (The Hindu)*

*“Everything is on course,” for the enriched uranium fuel bundles to be loaded into the first reactor of the Kudankulam Nuclear Power Project (KKNPP),*

*Tamil Nadu, by the end of March and the reactor will be started up in April. “This is the target today,” said S.K. Jain, Chairman and Managing Director, Nuclear Power Corporation of India Limited (NPCIL). “The hot run of the reactor will start in a few days. All the systems have already been individually commissioned. Some of the systems were commissioned in an integrated fashion when the cold run was done. Although this VVER-1000 reactor from Russia is the first-of-its-kind to be built in India, we have not come across any problem in the individual commissioning of the systems,” said Mr. Jain. . . .*

*The Hindu* is extremely low on economy frame compared to *The Times of India* because the latter has a strong financial sister publication *Economic Times* too, and a good number of business people read *The Times of India*.

An increased focus on the protests rumours and the functioning of the nuclear plant was observed on the media’s agenda. The study observed that there was no balanced representation of issues by *The Hindu* and *The Times of India*. *The Hindu* highlighted the ‘difference of opinions’ among the central and state governments in the headlines and the news reports. For example, in one news report, the State Government was opposing the plant and the Central Government wanted to open the plant as soon as possible.

Prominence of diagnostic framing task could be attributed to increased framing diversity of ‘Policymaking’ and ‘Public understanding’ as news reports were critical about the agreements and accidents. Diagnostic framing task in headline and lead gives a negative picture of nuclear deal negotiations as most readers skim through only these two areas. Prognostic framing task occurred only within news reports, which implies that readers will perceive a positive picture only if the news reports, were read fully. Nuclear plants and the nuclear deals are complex to interpret as they involve the interests of many countries. Hence, providing prognostic solutions have to be supported with inputs from field experts and it requires good rapport among them as well as the journalists.

In *The Hindu* and *The Times of India*, there were significant trends such as more balanced representation of ethical frame, increase in episodic frame which adds value to human interest reports. This could be due to the fact that it was fully journalist-reported. Scientific research was reported least in *The Times of India* since it demands basic

knowledge about the nuclear science among journalists as well as readers. Further observations reveal that two or more frames were used together in some news reports of *The Times of India* like safety and policy. The number of editorials in *The Times of India* was more than those of *The Hindu*. The editorials dealt with more specific and important issues that may not find a place among news reports, like adaptation, renewable energy, individual responsibility, other nuclear plants, nuclear disasters, etc. They presented a mixed type of framing, by being broadly episodic and introducing thematic incidents in between to support their suggestions. In a single editorial, a diagnostic task was introduced followed by presentation of prognostic tasks. But the allocation of intensities to these tasks differed. Editorials analyzed policy changes announced by the Government on the sidelines of the nuclear plants and presented positive and negative implications that could have on the nation's development like how the plant will help reduce deficit of power in the country. They displayed more of a policy-oriented discussion than environment-based or science-based. Editorials also made suggestions on the kinds of measures the Government should take to fulfill its mitigation responsibilities as a fast growing economy, by avoiding some destructive development path followed by developed countries. *The Times of India* concentrated more on public understanding of the issue and the safety measures, giving suggestions and discussions relevant to local audience than at policy levels.

The Missile Man and Former President of India, A.P.J. Abdul Kalam went to the agitating spot as a mediator. Besides assuring safety of the reactors as a scientist, his 10-point action plan, suggesting development of the surrounding villages on a priority basis and creating 10,000 jobs has struck a chord with a section of people. This was one reason of the agitating people mellowing down. Both the newspapers covered his visit.

### Manufacturing consent

Both the elite newspapers were vehement in "manufacturing consent" (Herman and Chomsky 1988) towards nuclear energy. First, they vehemently propagated the safety issue regarding the Kudankulam plant soon after the Fukushima disaster and then they came down heavily on the anti-nuclear activists. Here are a few quotes:

An article in *The Hindu* by P. Sudhakar titled

"Koodankulam reactor quite safe" a couple of days after Fukushima disaster dated March 15, 2011, argues three points: a) The designers have considered the ground elevation of all the buildings to be starting from 7.50 meter (25 feet) above the Mean Sea Level (MSL) to preclude flooding due to any reason whatsoever, including tsunami; b) Koodankulam comes in a Very Low Seismic Category Zone 2 as per the seismic classification; and c) the reactors have the third generation safety design features, in terms of various passive safety features backing up the active safety system. To convert any hydrogen formed in the unlikely event, passive hydrogen re-combiners are provided in the containment to recombine the hydrogen back to water. This precludes the possibility of accumulation of explosive quantity of hydrogen in the containment. Thus, the events that had taken place in Japan would not happen in the Koodankulam reactors.

*The Times of India* article titled "N-review focuses on Japan lessons" says, "If all these measures fail and the core starts melting, considering the worst scenario of nuclear accident – then a solid metallic piece with a ceramic coating will hold the melting core and prevent it from leaving the structure.

In a *The Hindu* editorial titled "A necessary pause at Kudankulam" concludes with the words, "Kudankulam offers India a new opportunity to meet the challenge of achieving the highest safety standards in the nuclear power sector – under the watch of a truly independent authority." This means in spite of a sober headline, the editorial is strongly arguing for the Kudankulam nuclear project (*The Hindu* editorial, September 22, 2011).

Another editorial of *The Hindu* dated October 13, 2011, argues: "Here a clear distinction needs to be made between the 'fundamentalists' who are philosophically and absolutely opposed to nuclear power and those who have real and legitimate fears about nuclear safety. Nothing the government or, for that matter, anyone can do is likely to persuade the former group but plenty can be done to engage democratically and transparently with the latter." The use of word 'fundamentalist' is too strong for *The Hindu*, which normally even refrains from calling militants taking to violence as 'terrorists.'

Initially, the state government was tactically supporting the agitators saying that the Centre has to convince the people of safety measures. However, after the Prime Minister had a meeting with Chief Minister on December 27, 2011, she made an about

turn. The Chief Minister was particular about the Centre's intervention about the Mullaperiyar dam issue with the neighbouring state of Kerala. Nevertheless, this was overtly stated only in *The Times of India*, unlike *The Hindu*, which refrains from definite events.

*The Times of India* editorial dated September 22, 2011, titled "Misguided activism", concludes: "The aim, ultimately, is to have our nuclear power programme take off. Fast developing India cannot rest content with Luddite responses to technology, as frequently manifested in misguided activism be it against transgenic crops or nuclear energy. Our power consumption is set to increase rapidly. Government-friendly energy use being critical to our high growth path, we require alternatives to polluting fossil fuels. Renewables – coming with their own set of headaches concerning use of land and other resources – cannot do the trick alone. We need a diversified energy basket, which includes an emissions free source like nuclear power generated to benefit people on a mass scale."

## Findings

Edward S. Herman and Noam Chomsky (1988) argue that the large bureaucracies of the powerful states subsidize the mass media, and gain special access to the news, by their contribution to reducing the media's costs of acquiring and producing news. The large entities that provide this subsidy become 'routine' news sources and have privileged access to the gates. Non-routine sources must struggle for access, and may be ignored by the arbitrary decision of the gatekeepers. This is one of the reasons that major newspapers with readers concentrated in the cities go for bureaucratic sources at the expense of grassroots ones.

Editorials in *The Hindu* and *The Times of India* had a holistic coverage of issues that did not appear in news report. The editorials took up issues such as adaptation, renewable energy, individual responsibility, nuclear disaster and displacements, unlike news reports, which did not like multiple issues.

The policy-oriented solutions stressed by the editorials were mainly about Indian nuclear plant, nuclear deal and power sufficient country. Both nuclear disasters as well as issue-based coverage demand a good knowledge on the issue by journalists and hence, training is needed. A major difficulty faced by journalists is the lack of sound understand-

ing of science, policy, economic and ethics of the nuclear plants. Nuclear issues are under-reported in developing countries for this very reason though they are the ones who will be worst hit by the impacts.

'Scientific research' and 'Technology frames' were reported least in *The Times of India* since it demands basic knowledge about the nuclear science among journalists as well as readers.

'Economic frame' was least reported in *The Hindu*. *The Times of India* covered more of economics because its constituency is more of business class and it has a dominant sister publication in *Economic Times*.

Nuclear news is much beyond just environment and science. It offers scope for journalists to write change-making stories. They must pitch to editors, stories that are about people, politics, health, economy etc. However, journalists also need to know how science and scientists work.

Editorials analysed policy changes announced by the government on the sidelines of the nuclear plants and presented positive and negative implications that could have on the nation's development. They displayed more of a policy-oriented discussion than environment-based or science-based.

*The Times of India* carried more number of editorials compared to *The Hindu*. *The Times of India* concentrated more on public understanding of the issue and the safety measures, giving suggestions and discussions relevant to local audience than at policy levels.

In *The Hindu* and *The Times of India*, there were significant trends such as more balanced representation of ethical frame, increase in episodic frame, which adds value to human-interest reports. This could be because they were fully journalist-reported.

Policymaking was found dominant in *The Hindu*. *The Hindu* is traditionally read more by technocrats and bureaucrats, and it often toes the line of the government.

Public understanding was found dominant in *The Times of India*, more of peoples safety, health issues, impacts of other nuclear plants were mentioned. Some instances where the Jaitapur nuclear plant was compared to the Kudankulam plant.

There was a significant trend of policy-oriented stories in *The Hindu* after November 2011 as stories relating to other frames were entirely stopped. For example, stories like the Russian policymakers and

our own ministers announcing about the starting of third and fourth units of the plant, were mostly carried rather than other economic, or ethical frames. This may be due to the policymakers' announcement of operating the plant, etc.

Nuclear energy as a source of clean energy and alternative energy to meet the energy needs is projected well by the two English newspapers both in their editorials and news reports. Out of the 2000 MW produced in the first two plants of Kudankulam, Tamil Nadu is likely to get 950 MW, and when four more plants are commissioned with a capacity of 4000 MW, Tamil Nadu will get 1600 MW more power. This means six hours of power cut a day in most places in Tamil Nadu will be reduced drastically.

### Recommendations

Based on these findings, the study concludes the following recommendations:

- Newspapers should highlight both nuclear issues and local aspects of nuclear plants because the former will have an influence on how India is going to battle nuclear resource as a country and the latter will determine how local communities are going to mitigate or adapt to the consequences of nuclear issues within their region.
- Focusing on people-centred news reports based on local impacts, consequences and actions could lead to better collective action.
- Nuclear energy is a global issue with local consequences. Therefore, it is necessary to interact with global experts. Journalists can join online forums to be informed about the ongoing debates and advancements.
- More development is needed in the locality with all basic needs fulfilled. Thus, the government could build confidence in people's minds that would make them recognize that the nuclear plant will contribute to their development.
- People panic every time when there is a noise from nuclear power plants' direction. Officials are trying to allay the fears using technical presentations but what needed is the use of public relations professionals to communicate to the lay people besides frequent safety drills for people on the steps to be taken in the unlikely event of a nuclear disaster.

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# Science reporting in Hindi newspapers: Studying the usage of English terms

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*The role of mass media in dissemination of scientific information is continuously on increase. The efforts are being made steadily by different government and non-government organizations and individuals to spread scientific knowledge using mass communication as a tool. The present communication reports a study on the coverage of science news in leading Hindi newspapers and assesses the present scenario of science reporting in Hindi newspapers. The study focuses on the current trends in science news reporting and usage of English terms in Hindi newspapers while covering science issues. It mainly includes important subjects that carry more or less English terms, kinds of words or phrases used for science coverage, and essentiality of usage of English scientific terms in Hindi science reporting.*

**Keywords:** Science news, science reporting, terminology, news language.

Science literacy is necessary for each of us as the literacy is. The mass media has its stake towards developing a scientific temperament in the society. Science reporting could be a means for promoting science literacy. Science news should be simple, direct and related with daily lives of common people. The selection of words should also be done carefully. The use of English words in Hindi newspapers is considered an undesirable habit, though some newspapers promote it for popularity of the newspaper and increase of circulation. The study also seeks to understand how the use of language of science reporting is changing vis-a-vis social changes taking place nowadays. The trend in coverage and use of English words in science news was also assessed as part of the study.

Only a few studies are available on the topics closer to science news reporting in India. Manoj Patariy in 'Science Journalism in India' says that the coverage of science news is not satisfactory, as large-

ly it remains miniscule to the tune of 3-4% against the expected 10% (1990). Similarly, Narottam Shahu in 'Science reporting in regional languages' also expresses similar views on the coverage of science news (2003), besides a study carried out by P. M. Narayanan that throws light on the coverage of science news (2002).

Such studies are also reported from other countries as well. M.G. Pellechia in 'Trends in science coverage: a content analysis of three US newspapers' found a changing trend (1997). It has revealed, "Although science articles represent only a small fraction of the total articles printed, this percentage has steadily increased at any given time period. The study shows that science coverage does not deviate substantially in terms of the topics covered except a few exceptions. However, the articles frequently lack methodological and contextual information and do not present an exhaustive account of a particular subject dealt in such coverage."

A comparative analysis of the coverage of science news in Cape Town newspapers by Turner, Gillian Kim includes three daily newspapers (*Cape Argus, Cape Times and Die Burger*) and three weekend newspapers (*Saturday Argus, Sunday Argus* and Saturday edition of *Die Burger*) in Cape Town. The quantitative research method of content analysis was employed in order to provide statistical evidence for the study’s problem statement, namely that science news be covered very differently in these six newspapers. This exploratory comparative analysis formed the core of the research. The qualitative research methods of surveys and in-depth interviews with the newspapers specialists and science writers were used for the study, where science writers are considered as “gatekeepers” (as per the theoretical model of gate keeping). Their education, knowledge, interests, beliefs about science, attitudes towards their reporting, and interactions with editors within the newspaper structures were taken into consideration while determining science coverage in these newspapers.

The content analysis of the newspapers has been done for the study. The usage of English words in science reporting in Hindi was mainly observed for the purpose of study with a qualitative approach. Hindi newspapers *Hindustan, Amar Ujala and Dainik Jagran* have been analyzed for the months of May and June 2011. The data collected from the random samples indicated the trend of coverage of science news and use of English words therein.

Science coverage is common but not consistent in majority of the newspapers. The frequency of coverage of science news in comparison to the news like crime, accident, politics, education and glamour, etc., is very low. Event based science news are normally missing as science events are not considered newsworthy amongst media buffs. However, as a matter of fact, a number of science seminars, workshops, and conferences, etc., are constantly organized and are available for reporting besides the findings of research as well.

**Observations**

The *Hindustan* gives science news on its last page based on research findings related to health, agriculture, environment or any other aspect of science. Nevertheless, the number and space of such stories is very small. The number of such news items is generally two or occasionally more than two. *Dain-*

*ik Jagran* and *Amar Ujala* do not have such regular pages. Although, they publish some since news on different occasions, there are instances when the newspapers were published without any science news. Pure science subject based news is less in comparison to the news that is having some applied science content. Many science stories have more than half of their contents related to some other subjects possibly to avoid monotony. The coverage of science news is also given on some specific day associated with science. For example, *Hindustan*, 17 May 2011 gave information about blood pressure as the day is designated as the World Blood Pressure Day. Similarly, science news is published on the World Hepatitis Day on 19 May 2011. This pattern was followed even on some other occasions also. Various specific observations are summarized here. Table 1 carries data on science news.

**Table 1: The coverage of science news**

Newspaper	Without science news	With one science news	With more science news
<i>Dainik Jagran</i> (24)	May: 5, 9, 12, 13, 16, 19, 20, 27, 30, 31 June: None	May: 25, 26, 27 June: 1, 6, 16, 22, 26, 30	May: None June: 5, 14
<i>Amar Ujala</i> (24)	May: 8, 10, 16, 18, 19, 20, 25, 26, 27, 28, 29 June: 3, 4, 6, 29	May: 7, 15, 17, 22, 30 June: 5, 7	May: 11 June: None
<i>Hidustan</i> (24)	May: 10 June: 13	May: 6, 8 June: None	May: 5(3), 9(6), 12(5), 23, 24 June: 9(4), 11(3), 15, 16(7), 22, 27(7), 29(3), 30

**Occasion for science news:** Most of the science stories are published when any specific days are celebrated related to science. Science seminar, workshop and conference are other occasions for giving science news.

**Useful information in science news:** Any kind of useful research information related to common person could find space as science news. Maximum numbers of such news are directly related to daily lives of common people. Such news are given in view of the utility of necessary information. For example, the news about cause and prevention of diarrhea was given in *Dainik Jagran* on page 18, June 30, 2011 issue.

**Special page on science including articles and features:** All three newspapers have more or less tendency of giving specific page covering science articles and features once in a week. *Dainik Jagran* publishes a weekly page “Sapt Rang” wherein it gives information mainly related to different issues of health including causes and cure of diseases. The page is useful and popular amongst readers. Though, it does not include science news in each issue. *Amar Ujala* gives a page “Dunia 360” that contains science news, feature and articles, but it is also not regular. Mainly the articles are written in the form of a science fiction. *Hindustan* gives a regular page on health on Wednesday. It covers variety of information on health. More than a half page covers such articles and features. It also gives a weekly page on science and technology, including various aspects of information science and technology. There is no avoidance of science articles on editorial page, but their appearance in this page is rare. The contributions are normally by the specialists of concerned fields. The language of these articles is simple and can be easily understood by common person.

**Percentage of science news:** The percentage of science news is complex in nature depending on the presentation. Some attempts have been made to give an idea about the quantity of science news. The percentage of science news can be found in two ways, i.e. space wise or number wise. The coverage of science news in these three newspapers is still very low and ranges from zero to 0.15 percent of the total space given to various items, with little fluctuation from time to time. If we count the percentages of number of science news items out of the total number of the news items published in the newspaper, the result will be different. The number of science news varies between 0, 1, 2, or 3 in a single issue of a newspaper. The number of pages of newspapers also varies from 16 to 24 pages. However, the variation in the number of page doses not affect the total

number of science news significantly. With increasing number of pages, advertisement also increases. The number of total news items in *Dainik Jagran* varies from 150 to 180 and therefore, the science news would a little above to 0.5 percent. The percentage of science news seems increasing when we calculate it according to number. However, normally the space given to science news is very small. Therefore, the percentage drawn according to space gives more accurate picture about the coverage of science news.

**Reporters for science news:** Newspapers generally do not have any special science correspondents for coverage of science news. None of these newspapers has a system for appointing science reporter. Normally, the person deputed for education reporting takes care of science also. Surprisingly, many a times the correspondents without a science background are also asked to cover science who are unlikely to do justice with the subject. Hence, the state of complacency continues with very little or no science news.

**Contents and quantity of scientific information:** Some stories also carry science information but given under some other subjects from education, economics, disaster, or political, economics. The news (*Amar Ujala* May 16, page 13) on supporting “Sunder Lal Bahuguna’s campaign on environment being political agenda” by Union Minister of State for Environment and Forests, is basically a political news, but it has partial contents of the environment news. Similarly, the content of science in the article (published in *Amar Ujala* on May 31, page 8), “The impact of global warming on agriculture” is a subject of economics, but it also has potential science content. An editorial in the newspaper on a subject on economics also contains important science element. The court news related to a political leader also sometime has scientific content pertaining to DNA test. There are several news stories that require a scientific approach to explain its complexity. The scientific way of record keeping as given in *Hindustan* (June 9, 2011, Page 2) qualifies to be a science story. It gives detail news about well-managed computerized system to keep land records. In fact, various news stories have a trigger towards scientific information that can be further developed into science stories by a vigilant science reporter. When the content of scientific information is more, the chances of

usage of English words are also more. For example, the article published in *Dainik Jagran* on the occasion of 'No Tobacco day' on May 31 contains 10% English words, whereas another article on waist-ache contains less than 1% English words.

**Science news on front page:** No tendency of giving science news on front page was observed, but it does not mean that science news never gets place on front page. Normally, science news are given in the innermost pages of a newspaper. Even news of Nobel Prizes many a times do not find place on front page, only news on breakthroughs, disasters, or important space explorations, etc, become the front-page affair, irrespective of those which may be very important for the daily lives of common person. The successful launch of satellite from India also got place on front page in all leading newspapers. Rarely they attract the attention of editors, such as, news on harmful effects of electronic equipments was given on front page of *Hindustan*, June 2, 2011, and news on new seeds of blackberry on June 22, 2011. The farming of flowers by farmers in rural areas of Lucknow also has a good coverage on the front page (*Hindustan* May 9, page 1). The news of lunar eclipse is given on front page in *Hindustan* on June 15. Groundwater conservation became a big headline of *Hindustan* on May 8, 2011. However, other newspapers have comparatively less number of science news on front page unless they are controversial in nature.

**Letters to the editor on science topics:** The readers of a newspaper normally give their opinion on current issues related to any social subject. The content analysis of letter column reveals that current important science issues also attract the attention of readers. The letter column does have contents on science subjects. The main content may be different but they have scientific approach. The readers have expressed their views on blood donation, against tobacco consumption, environment protection, and alike (*Dainik Jagran*, May 14, page 10; June 16, page 10, and June 5, page 10). *Hindustan* (May 5, 2011, page 12) has published 4 letters of which 3 belong to environment. *Amar Ujala* gives only two letters and has published letters on weather (May 30, and June 6, 2011). It can be inferred that the readers also have interest in science as expressed by them in the form of letters to the editor column.

**One-way channel of science news:** Even today, the science news contains opinions of elite class like doctors, scientists, academics, and policymakers. Sometime, it looks strange when some bureaucrats in the name of "official authority" try to explain a scientific subject rather than a "domain authority". The opinion of common people of our country still could not directly become the part of scientific activities. There is no direct involvement of common people. This trend shows that there is hardly any common person to be included in science news. There is almost total absence of opinion of common people in respect of science news.

**Headlines of science news:** Normally, the headlines of science news is very attractive, full of curiosity and sometimes even misleading and confusing. Science news headlines are given associating them with daily lives of common people. Reporters try to make news-interesting. But there are several stories whose headlines are very straight and simple.

**Photos and graphics:** Nowadays, photos and graphics have become an important part of science news. Maximum number of science news carries photographs and graphics to make it more effective, meaningful and interesting. Many a times, graphics become main source of information. However, lack of suitably trained science photographer and science reporter becomes obvious in newspapers.

**Usage of English terms in science news in Hindi:** Scientific information did not carry any scientific term in English (*Hindustan*, May 29, page 7). Actually, the scientific facts can be presented in Hindi as well. Many science stories can easily be given using simple Hindi terms. However, it has been observed that instead of using Hindi terms, the newspapers tend to use English terms when it comes to explaining a scientific subject, as if use of English terms is a kind of compulsion for such subjects. Some of the English terms used in science news in Hindi in these 3 newspapers were the common English names of:

- Scientific instruments/ equipments
- Various diseases
- Vitamins
- Body parts/ organs
- Various treatment technologies - Chemotherapy, Radiotherapy
- Scientific name of various living/ non living

- things
- Space science related terms
- Scientific bodies
- Information technology related terms.

#### **Percentage of English terms in science news:**

There is no set pattern of English words in different science news. A varied range of percentage of English words has been seen in science news reporting in Hindi newspapers. It depends mainly on the nature of science content and the nature of presentation. The study records that there is not any uniformity as far as number of English words is concerned and it varies from 1% to 10% of the total words used for science news. However, the articles written on science subjects have some 9% English terms. The news given by *Amar Ujala* on May 25, 2011 on the World Thyroid Awareness Day on page 6 also contains around 10% English words. Similarly, the news given on World Blood Pressure Day in *Hindustan* (May 17, 2011) also contains around 10% English words. Many a times, some English words are merely repetition. Therefore, the exact number and percentage of English words may be little less. For example, the term blood pressure has occurred 12 times in a science news. Similarly, the news given in *Amar Ujala* on May 19, page 5 on World Hepatitis Day contains term hepatitis almost half of the total number of English terms used in the news. The number of words depends mainly on the approach of science news. Science news on feticide also presented a statistical data on the sex ratio in country where the orientation may be towards a social issue rather a scientific one! Therefore, the orientation and approach of the treatment of a piece change the usage and complexion of the technical terms.

#### **Complexion of scientific terms in science news:**

There are two types of English terms used in science news reporting in various newspapers - common and complex. Common science words include those English words, which are used in our day-to-day lives in conversation about any subject. They are other than science words but they are used in the science news. Most of these words have alternatives in Hindi. Such words are easily avoided as compared to those of English words, which do not have appropriate Hindi alternatives. Complex science words include names of various diseases, vitamins, elements, drugs, equipments, etc. They are core words of science subjects and are frequently used according to

the contents and topics. The use of English words in scientific news under the present study may further broadly be described into four categories:

- i) There are large numbers of words, which do not have their Hindi alternatives so far. These English words have become well familiar despite their complex names but due to the reason of unavailability of their exact Hindi alternatives. Most of the scientific terminologies originate in English. The names of various elements are mostly in English. There are no commonly acceptable alternatives available for these words, i.e. DNA test, dieting, plasma, code, phone, i-phone, cellular, chickenpox, recovery position, corps, spooning, nicotine, cholesterol, including a long list of various chemical compounds.
- ii) There are several words, which have Hindi alternatives, but now preference is given to English words for their popularity. For example – therapy, body, scrubbing, clinic, acidity, Gastec, thyroid, injection, globe, design, missile, system, etc. These words were earlier not very familiar among common people, but the repeated use has given them more publicity and they became popular over the period.
- iii) There are also certain terms, which are used sometime in Hindi or English both. These words are in transitional phase. After sometime, the English terms are given more preference and finally they make their permanent place in Hindi language. For examples - arthritis, blood circulation, blood pressure, gastroenterology, urologist, heart, diabetes, hypertension, check, space, oil therapy, treatment, immunologist, headache, infection, pesticides, etc.
- iv) There are also some words, which are written in Hindi and English simultaneously. In this category, the words are very difficult and if written without Hindi equivalent, they may not convey the true meaning. Such English words may be so complex that it becomes necessary to explain them repeatedly. Some words written in English may have Hindi alternatives but they are even more uncommon to the people, i.e. Esophagus, Detoxification, Leukemia, Knee-replacement, or Ornithology, etc.

#### **Findings and conclusions**

- a) The coverage of science news is abysmally low

in Hindi newspapers; *Hindustan* gives more science news as compared to other Hindi newspapers.

- b) Almost no trend is observed in appointing science reporter in Hindi newspapers.
- c) The study establishes that the use of English terms in science news is very common despite the fact that Hindi equivalents are available.
- d) Almost no exclusive science page was seen, as there were many on the subjects like sports, business and films, etc.
- e) Full-length science articles, editorials, interviews and reports have been vanished and only tits-bits appear here and there in a newspaper in the name of science.
- f) People generally when meet first tend to talk about weather, politics, glamour and so on, but unfortunately, science conversation has yet to find place during people's informal discussions unless there is a breakthrough or disaster! Science news could be a trigger for igniting such public conversation leading to informal science communication!
- g) Daily life issues, crime and accident, etc., dominate the news reports.
- h) The study mainly covers the contents and scientific terms for analysis that appeared in Hindi newspapers.
- i) Science news were observed based on headlines given for the news.
- j) The magazine supplements were excluded in the study.
- k) Consistency or uniformity in coverage of science news was almost missing; similarly, the space devoted to science news also varies from one issue to the other.

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# Popularizing Yoga: Towards a new world order

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For India, the International Yoga Day was an occasion to celebrate the recognition of Yoga by the globalised world as India's finest gift to humanity. Yoga is neither a matter of faith nor of superstition; it is in fact, a subject with well-defined philosophy, grammar and goal based on 'holism'. It best epitomises India's world-view and seeks to integrate personality at all levels of existence. It is a method of finding things out for himself rather than a preconceived metaphysical theory of reality or universe. The recent opening of a Yoga centre in Turkmenistan by the Indian Prime Minister Narendra Modi is yet another event pointing towards increasing acceptability of Yoga. Globalisation, broadly characterised by the removal of barriers to free trade and free flow of capital, goods and services, seeks a closer integration of national economies and has a philosophy, institutions and goal rooted in 'reductionism' or 'scientific rationalism'. This coming together of two completely divergent worldviews is a very significant event. The possible consequences of this engagement need to be understood carefully. For this, one has to examine the fundamentals of both these worldviews.

The works of Galileo Galilee, Francis Bacon, Rene Descartes and Issac Newton laid the foundations of the scientific rationalism dominating the western mind for the past three centuries. Descartes statement 'Cogito ergo Sum' (I exist because I think) resulted in a fragmented human personality with 'mind' separated from the 'body' and functioning as a controlling authority of the body. Descartes extending the mechanical view of matter to living

organisms also said, "I consider human body as a machine". Cartesian method consisted of breaking up thoughts and problems into fragments and then arranging them in their logical sequence. It also implied that with persistent refinement of the experimental techniques and mathematical methods the scientist would one day become master of nature with full liberty to exploit it. Scientific rationalism or reductionism thus provides a philosophical justification for an exploitative system. It has also created a permanent conflict between humankind and nature.

The reductionist approach had a profound effect on the western mind and John Locke drawing parallels with Cartesian approach developed an atomistic view of the society by reducing the patterns of social behaviour to individual behaviour. This approach provided a new value system and resulted in the development of a socio-economic paradigm characterized by individualism, democracy, property rights, free market economy and reduced role of state. As a result, a techno-economic system and industrial society emerged on the western horizon. Significantly enough, these very ideas continue to be the tenets of the political and economic thought of the globalised world.

The advancements in science and technology based on the reductionist worldview have played a very critical role in transforming the human society and producing overwhelming affluence and staggering levels of consumption. Alongside one also finds a rapid depletion of non-renewable natural resources, serious environmental degradation, climate change and widening economic disparities resulting

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in serious global imbalance and turmoil offering a grave threat to world peace.

Serious concerns regarding the growing disparity among and within the nations were voiced by Joseph Stieglitz in his seminal work 'Globalisation and its Discontents' in 2001. He had argued that, 'the globalization today was not working. It was not working for many of the poor. It was not working for the environment. It was not working for the stability of the global economy'. Obviously, this raises a question mark on the fundamentals of 'globalisation'.

Raising similar concerns James D. Wolfensohn, the then President of World Bank Group in a speech delivered in 2003, said, "We must address the fundamental forces shaping our world. In many respects, they are forces that have caused imbalance." He continued, "Our planet is not balanced. Too few control too much, and too many have too little to hope for - too much turmoil, too many wars, too much suffering." Further, "Let us move forward to fight poverty, to establish equity and to assure peace for the next generation".

No perceptible forward movement for restoring the balance or establishing equity and creating a peaceful world is visible anywhere during the last decade. In fact, as the recent happenings in different parts of the globe show, the world today is more violent, more unequal, more turbulent, more disintegrated and more unstable. Can Yoga make some positive contribution to bring back the balance and reduce the turmoil and the sufferings?

The development of the biomedical model that considered the human body as a machine that could be comprehended in terms of its parts is also the result of reductionism. Nevertheless, reduction of life to molecular phenomena does not help understand either life or total health. Nor does it explain the origin of mental and psychological disorders. On the other hand the definition of health, given by WHO that 'Health is a state of complete physical, mental and social well-being and not merely the absence of

disease or infirmity', is quite contrary to the reductionist approach, rather it emphasizes the 'holistic' nature of health.

Again, a very different situation arose when attempts were made to understand 'life' based on molecular biology. The leading molecular biologist and Nobel Laureate Francis Crick had wondered that even after six decades or more, we do not understand "how does a wounded organism regenerate to exactly the same structure it had before?" This dilemma arises because generally, the molecular biologists believe that whole of life and mind can ultimately be understood based on the structure and function of DNA molecules. Can holism help resolve this dilemma?

Since the very dawn of human civilization, the Indian mind had reflected on the nature of the Universe and every constituent of the physical world

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around their interrelationship and us. These thinkers had discovered the fundamental unity of entire cosmic phenomenon. They had realized that behind this changing physical world there is an undying, unchanging reality termed as "Cosmic Consciousness" or "Cosmic Spirit" which pervades entire universe and every entity of the physical world is the manifestation of this Cosmic Conscious-

ness. This was perhaps the first enunciation of the holistic nature of Universe.

The Universe according to this view is a hologram in which each part contains the whole. In this holistic view, consciousness is the essential aspect of the Universe. The physical world is so structured that whole is enfolded in each of its parts, which in some sense contain the 'whole'. In other words, what is in the macrocosm is also in the microcosm. An important consequence of holism is that 'whole' is primary and the properties of the 'parts' can only be derived in terms of the dynamics of the whole. All objects and events in the physical world are interdependent and inseparable "parts" of the "Cosmic whole" as a result the 'whole' and its 'parts' are in perpetual and mutual interaction. In this approach

the human persona is a continuum of perpetually and mutually interacting body, intellect, mind and spirit, - none superior to the other. The mind-matter dualism vanishes and so does the domination or exploitation of 'nature'. Holistic view, therefore, demands that humankind must learn to live in peace and harmony with the environment. Thus, life and its problems can only be understood in totality but not by dividing them in parts. Maintaining the harmony with nature is Yoga!

The term Yoga appeared for the first time in the *Rig-Veda*, but as a 'spiritual discipline' the term Yoga appeared much later. Patanjali defined Yoga as "restraining the mind stuff from taking various forms". Over the course of time, Yoga travelled to different parts of the world. In the West, Yoga started gaining popularity in

the 19<sup>th</sup> century mostly as a health regime for physical fitness, and relaxation through the yogic exercises. Various experiences of the yogic *sadhakas* were initially categorised by several western authors as a mystic phenomenon. But during the last decade or so, much literature has come out

about the changed Western approach about Yoga as reflected in the writings of scholars like Evelyn Underhill, who says, "Mysticism, in its pure form, is the science of ultimate, the science of union with the Absolute and nothing else."

Two eminent neurologists - Andrew Newberg and Eugene D'Acuily, have answered the question why does consciousness inevitably involve us in a spiritual quest and their answer is simple and scientifically precise, 'the religious impulse is rooted in the biology of the brain.' They conclude their findings by observing, "the neurobiological roots of spiritual transcendence show that Absolute Unitary Being is a plausible, even probable possibility and that all religions are branches of the same spiritual tree - the fact that this ultimate unitary state can be rationally supported intrigues us the most. Our minds are drawn by the intuition of this deeper reality, this utter sense of oneness". This utter sense of oneness, this integration of personality at all levels of existence - is the crux of yogic experiences. The scientific rationalist will argue that this is a different

level of reality. How can this utter sense of oneness be given a scientific language. However, physicist's own way of investigation showed the path.

Just as the biologists faced difficulties in explaining life and health based on Cartesian dualism, so did the physicists. When they tried to understand the sub-atomic world, serious problems confronted them. Classical mechanics failed to explain the motion of sub-atomic particles and experiments in the domain of the particles resulted in Heisenberg's Uncertainty Principle according to which 'efforts to discover ultimate reality through experiments were meaningless, and also that the common division of the world in to subject and object, inner world and outer world, body and soul was no longer adequate.' Consequently, in sub-atomic world, the observer

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becomes a 'participator'. This leads to the notion of a participatory universe quite different from the mechanistic worldview.

Perhaps the most revolutionary development of the twentieth century was quantum theory, which is at the basis of our understanding of the behaviour of sub-atomic particles. Er-

win Schrödinger one of the two founders of quantum theory wrote before this revolutionary theory was completed in 1925, 'This life of yours which you are living is not merely a piece of this entire existence, but in a certain sense the whole; only this whole is not so constituted that it can be surveyed in one single glance. This, as we know, is . . . again expressed in such words as I am in the east and the west. I am above and below, I am this entire world.' He also says 'this is you (tat twam asi)'. Schrödinger considered the idea of pluralisation of consciousness and the notion of plurality to be a result of deception (*maya*). In the later half of the twentieth century, J.S. Bell a leading physicist at the European Organisation for Nuclear Research while explaining the paradoxical results of a famous thought experiment, had proposed what is known as Bell's theorem that 'at a deep and fundamental level the separate parts of the Universe are connected in an intimate and immediate way.' Thus reiterating the concept of a holistic Universe.

Towards the middle of the twentieth centu-

ry several scientists including David Bohme, had questioned about Cartesian philosophy. According to Bohme, 'all of reality is enfolded in each of its parts' and cautioning about the deleterious effects of reductionist approach he says, 'However, men who are guided by a fragmentary self-worldview cannot, in the long run, do other than to try in their actions to break themselves and the world in to pieces, corresponding to their general mode of thinking' . . . 'Then society is . . . broken up into separate nations and different religious, political, economic and social groups, etc., and the natural environment that is also seen as an aggregate of separately existent parts, will be exploited by different groups of people' and continuing further he says, 'The unity in the individual and between man and nature as well as between man and man, can rise only in a form of action that does not attempt to fragment the whole of reality.' Thus, one can see that the serious environmental degradation, worldwide political and economic disorder and emerging fault lines, which have produced a civilisational crisis, are the result of the fragmentary worldview. Consequently, a proper worldview becomes the central factor for maintaining harmony in the individual and the society as a whole.

The holistic or integral worldview, as we have seen, offers a new approach to look at 'nature'. It recognizes as unbroken relationship between humankind and the ecosystem. The relationship is organic and symbiotic; injury to one is injury to the other. In consequence, the holistic paradigm completely prohibits the exploitation of nature or for that matter of any part by the other. Exploitation of any part in ultimate analysis is the exploitation of the whole. It also establishes a dynamic balance between humankind and ecosystem, which should not be disturbed beyond repair. It is easy to recognize that the three tenets of the holistic view are: a) 'Truth or Reality is one but wise men describe it in different ways', b) 'World is a Family', and c) 'Unity in Diversity'. Any socio-economic system built on these concepts is inherently value based, non-violent, democratic, inclusive, secular, and egalitarian. Any human activity not based on value system will ultimately pro-

duce unbearable stress leading to a violent collapse of the system.

What are then the possible consequences of a close engagement of these two systems based on fundamentally divergent worldviews? Consider the case when the Yoga comes under the sway of the market forces. In the international community, Yoga has been accepted primarily due to its cost-effective health potential. In the west, the benefits of Yoga are largely confined at the body plain and it does not reach the stage where mind, intelligence and spirit are all in harmony. In consequence, globalised world will fail to realize its full potential for providing total health and well-being. On the other hand, it will be used merely as an ordinary regimen for physical fitness and will soon be relegated as health merchandise; it will be one of the medical products with high business promise. Even at present, Yoga business worth US \$ 30 billion or more is thriving in USA. If Yoga or its integral worldview remains confined to body plain alone and becomes a tradable commodity, it loses its philosophical and spiritual dimensions entirely, hence the holistic approach!

We may recall that the WHO has warned that depression will become the biggest killer by 2030. Even today, a sum of US \$ 150 bn. is spent on mental illness and depression alone. As Shri Shri Ravi Shankar has pointed that while the remission rate through medical treatment is about 14%, a study has shown that the same would be 64% by practicing Yoga. Several studies have established a direct relationship between meditation and crime rate change. In a paper published in 1987 in the *Journal of Mind and Behaviour*, the authors have reported about transcendental meditation and changes in social indicators. Thus, the integral worldview can lead towards total health and solutions to psychological disorders as well. Yoga recognizes whatever is in microcosm is also in macrocosm, thus the wounded cell contains the entire structure and can regenerate to its original structure. The work of J.C. Bose towards the end of the nineteenth century had shown that the autographic records of the stress and strains and responses to the effects of poisonous drugs in

*'The unity in the individual and between man and nature as well as between man and man, can rise only in a form of action that does not attempt to fragment the whole of reality.'*

the living and the non-living were so similar that we cannot draw a line of demarcation and say, “here the physical ends and there the physiological begins.” Life and consciousness can only be understood with an integral approach and not through the fragmentary one. Consequently, the proponents of the prevailing health-science and health care regime will be required to take a fresh view on the current medical practices and a new approach towards total health and healing may come out of this engagement of the two systems.

Yoga is also defined as ‘Karmasu Kaushalam’ that is attaining maximum level of proficiency in all our actions. As mentioned earlier Yoga restrains the flickering of mind stuff. Obviously people with an integral approach having a disciplined body, focused mind and sharp intellect all in harmony would be highly creative, innovative, psychologically balanced, eco-friendly and ethical in their socio-economic conduct. Such a high quality human persona, imbued with ethical and moral values, would be a powerful driving force for both spiritual and material development of a society rooted firmly in the concept ‘World as a Family’.

Such a society would be inherently secular, democratic, inclusive, harmonious, non-violent, value based and egalitarian. For it, diversity is not a matter of merely tolerance or acceptance, but of respect and celebration as the very life of nature. Any socio-political institution and techno-economic system based on these fundamentals would not allow unsustainable consumption of natural resources (renewable or nonrenewable) and irreparable degradation of environment. A holistic society, therefore, demands a new world-order quite different from the one practiced by the globalised world.

Globalisation based on the fragmentary world-view also attempts to integrate societies through the concept of ‘World as one Market’. In the process of economic integration, the communities generally tend to maintain their separate identities. The recent experience regarding the widespread global, economic and cultural turbulence amply testifies

that the sense of one-ness has not yet taken any deep roots. This sense of fragmentation results in a conflict between economic integration and existing political and cultural diversity. In the present world scenario, the concept of ‘world as one market’ has turned out to be divisive, exclusivist, fragmentary and has not helped in resolving any of the conflicts. There is no manifestation of a global consciousness, which makes one to experience oneness and unity. On the other hand, the widespread terrorism and religious fundamentalism are posing serious challenges to the very existence of cultural diversities. The market forces instead of harmonizing, have further deepened the fault lines. The cult of violence

is spreading fast which is opposed to the very concept of oneness. All this has created a world totally out of balance. Restoration of the balance in this planet is a big challenge, which has to be addressed urgently.

The statement of the UN Secretary General Ban Ki-Moon on the International Yoga Day that ‘we should do

this (Yoga) before every negotiation so that we can work with a calm mind’, indicates that a dialogue has already set in. It can be argued that if the international negotiations could be held based on the holistic tenets viz. ‘World is a Family’ and ‘Unity in Diversity’ alongwith a calm mind, perhaps UN would be able to use its time for good purpose. If such and other practices of holistic behaviour are pursued, possibly a new culture of conducting world affairs might evolve in future. There is increasing awareness that the present imbalance is the outcome of the inability of the existing socio-economic institutions and the political structures to deal with the current impasse. According to Fritjof Capra, this inability is derived from the inadequacy of the concepts and values of an outdated model of universe and the belief that unlimited growth is possible through technology. Capra argues that, ‘during recent decades all of these assumptions have been found severely limited and in need of radical revision.’ He further elaborates, ‘And at the same time, researches at the leading edge of science, various social movements,

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and numerous alternative networks are developing a new vision of reality that will form the basis of our future technologies, economic systems and social institutions.' The need for a new paradigm is quite evident.

India now has an opportunity to emphasize the parallelism between the holistic vision of Yoga and the thinking of the modern physicist in their description of the phenomenon. Once these similarities are recognized, it will be easy to discuss the implications of their engagement. Two important questions naturally arise - one, should scientists give up all their efforts and the technological advancements and start practicing Yoga, or should the followers of Yoga abandon their holism and two, can there be a mutual understanding between the two leading to a synthesis? The answer to the first question is - that Yoga does not need science and technology the way these are being pursued today and the scientist does not need the methods and practices of Yoga and for the second - humankind needs both. In this backdrop, India should have invited the enlightened public opinion to debate as to how a harmonious and dynamic interplay between the two will influence the existing socio-economic and techno-political structures. Instead, the debate veered round the narrow lanes of political and communal rhetoric, which

unfortunately does not reflect the sense of unity and oneness of a yogic mind.

Such a transformation can only take place through a cultural revolution in the real sense, which may give a new direction to the march of civilisation provided we are ready to get out of the centuries old, outdated reductionist worldview of reality. Such a revolution means joining of science and spirituality Atom and Ahimsa in a creative synthesis whereby humankind will attain a new level of purposefulness, prosperity, peace and harmony. Possibly this integration might lead towards the restoration of balance in a totally out of balance planet. May be as a result, the present 'ego - centric' world order is transformed into an 'eco - centric', egalitarian, non-violent and inclusive paradigm.

India now has an excellent opportunity to initiate a meaningful discourse as to how such a 'Creative Synthesis' can be achieved. How the new paradigm can create an experience of unity and oneness. It is India's burden to play a central role in creating a materially happy and spiritually evolved balanced planet living in peace and harmony, where Yoga becomes an important means to achieving a new world order!



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## Hands-on science: Developing science concepts using waste materials

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Indian education has been suffering from a tremendous lack of experiment culture, but not lack of experimental facilities, for a long time. We had great theoreticians in the past, and we also have them in the present scenario of international competition. However, we had very few physicists who excelled in experimental physics.

In the majority of the schools including government schools, there are no laboratory facilities at middle school level. Only theoretical teaching of physics cannot inculcate the qualities needed for one to learn scientific methods and attitudes. The situation is even worse in the schools situated in rural areas and low-fee schools. To give children a real essence of science demonstration method cannot be replaced by words.

It is possible to create fresh, simple innovative, concept-centered experiments and quick effective demonstrations at a fairly modest cost or using waste materials. This paper is intended to provide an

analytical view of my last six years experience with the children's of rural areas of Rajasthan. Following concepts has been successfully developed to the target group of class 7<sup>th</sup> to 11<sup>th</sup>.

To find out the density of given liquid, transmission of liquid pressure, existence of upward thrust, pressure increases with depth, concept of buoyant force by measuring it, Archimedes's principle, concept of flotation, compressed air, relation between ml and cm<sup>3</sup>, inflating a balloon in normal air pressure, static electricity, air pressure. The teacher should not wait for the government aid to make teaching-learning material, but he or she can easily manage to use home waste materials to introduce and demonstrate the concepts of physics. Some simple experiments are given here, which are successfully conducted by the author, and the readers may like to use them for their science popularization and activities.

- Name of the Project** : **Developing scientific concept of hydraulics using waste materials**
- Objectives** :  
 i. To develop effective methodology for learning by doing.  
 ii. Compare merits and demerits of the proposed technique.  
 iii. To boost up the interest and enthusiasm of students.
- Methodology** :  
 i. The teacher has developed the origami and handicraft toys with the help of the group selected for experimentation.  
 ii. After implementation, comparison was made between the selected group and other group.  
 iii. Evaluated utility and effectiveness of technique.
- Concept Introduced** :  
 i. To find the density of given liquid.  
 ii. Transmission of liquid pressure (Pascal's Law).  
 iii. Existence of upward thrust.  
 iv. Pressure increases with depth.  
 v. Concept of buoyant force by measuring it.  
 vi. Archimedes's Principle.  
 vii. Concept of flotation.  
 viii. Compressed Air.  
 ix. Relation between ml & cm<sup>3</sup>.  
 x. To determine relative density of a solid substance by using Archimedes's Principle.  
 xi. Two bodies of different weight but equal volume experiences equal buoyant force.  
 xii. What will be the buoyant force experienced by a body when dipped in different liquids.
- Conclusion** :  
 i. Students appreciated and welcome the new method, as they understood the concepts.  
 ii. Origami toys are least costly. So the students were found very relaxed in handling them confidently.  
 iii. This experimental method increased the student's involvement in the process of learning.  
 iv. The limitations of usual experiments given in the text book are overcome by the new technique.
- Concept 1** : **To find out density of a given liquid**
- Apparatus** : Spring balance, measuring cylinder, different liquids
- Teachers Instruction** :  
 : Add some amount of different liquid in a measuring cylinder.  
 : Find its mass with the help of spring balance.  
 : Find the ratio of mass and volume of different liquids.
- Observation** :

No.	Name of Liquid	Mass of the Liquid	Volume of the Liquid	Density = Mass / Volume
1.	Water			
2.	Glycerin			
3.	Oil			

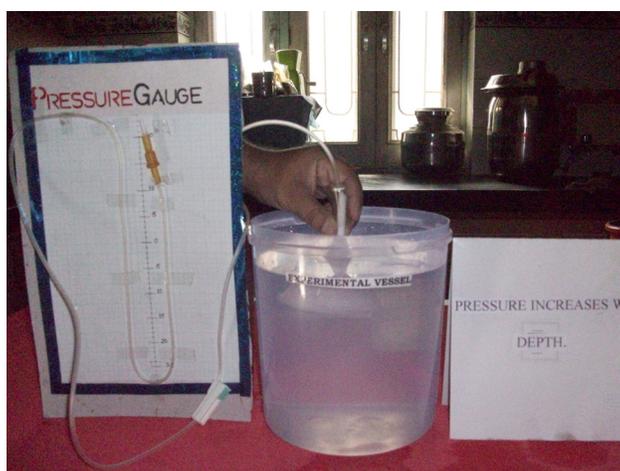
<b>Conclusion</b>	:	Density of the following liquids are _____ Kg/m <sup>3</sup> density of Water
	:	Density of the following liquids are _____ Kg/m <sup>3</sup> density of Glycerin
	:	Density of the following liquids are _____ Kg/m <sup>3</sup> density of Oil
<b>Concept 2</b>	:	<b>Pascal's law of transmission of liquid pressure</b>
<b>Apparatus</b>	:	One plastic water bottle, 4 syringe, water.
<b>Teachers Instruction</b>	:	Fill the bottle with water. Press one syringe inside Notice what happened.
<b>Observation</b>	:	When one of the syringes is pressed the other syringe moves outward/ inward.
<b>Conclusion</b>	:	Whenever a pressure is exerted anywhere in a mass of a confined liquid, it is transmitted undiminished in all directions throughout the mass and also acts normally to the surface of vessel in contact with the liquid
<b>Concept 3</b>	:	<b>Existence of upward thrust</b>
<b>Apparatus</b>	:	Small plastic bucket, hollow glass, cylindrical pipe open at both ends, a disc made of tin, thread, etc.
<b>Teachers Instruction</b>	:	Take a plastic bucket of medium size. Fill it with 3/4 of water. Dip a wooden piece inside water and release it. See what happened? (rises up)
	:	<b>Think why it rises upward?</b> Again take a hollow glass cylinder open at both ends. Hold tightly a light metal disc at the lower end by a string. Lower the whole system into the water. Observe what happens when the string is released? (disc does not fall)
	:	<b>Why the disc does not fall?</b> Carefully pour water into the cylinder and observe what happens (disc falls down).
	:	<b>When does it happen?</b> (when water level inside becomes equal to that on the outside).
<b>Conclusion</b>	:	The upward thrust at any depth is equal to downward pressure there. This upward thrust is called up thrust or buoyancy.



- Concept 4** : **Pressure increases with depth**
- Apparatus** : Thistle funnel, rubber sheet, U tube pressure gauge.
- Teachers Instruction** : Dip the thistle funnel into the bucket full of water.  
: Notice the change in U tube pressure gauge.
- Observation** :

No.	Thistle funnel placed at different positions on plastic scale	Difference in water levels in the arms of the pressure gauge
1.	10 cm	
2.	20 cm	
3.	30 cm	
4.	40 cm	

- Conclusion** : Pressure is exerted by the water on a body submerged in it.  
: Pressure goes on increasing with the depth.



- Concept 5** : **Understanding buoyant force by measuring it**
- Apparatus** : Spring balance, overflow can, bodies of three different weights.
- Teachers Instruction** : Check the zero of the spring balance.  
: Weigh body A, and C in air.  
: Simultaneously dip turn by turn all the three bodies.  
: Measure the difference between two readings.  
: Confirm the volume of displaced water by pouring them into three vessels.
- Observation** :

No.	Weight of three different volume of vessels in air	Weight of vessels in water	Difference of weight diminished in water	Weight of the displaced water
1.	45 gm wt.	5 gm wt.	40 gm wt.	40 gm wt.
2.	95 gm wt.	20 gm wt.	70 gm wt.	70 gm wt.
3.	275 gm wt.	70 gm wt.	205 gm wt.	205 gm wt.

- Conclusion** :
- Since difference in weight diminished in water = wt. of water displaced by the body
- : This is the buoyant force exerted by water when body is completely immersed in it.
- : Volume of water displaced = water completely filled in that vessel.

***Hence, when a body is immersed in water, it displaces equal volume of water.***



Hands-on science: Developing science concepts using waste materials

- Concept 6** : **Archimedes's principle**
- Apparatus** : Spring balance, over flow cans, small plastic hollow cylinder.
- Teachers Instruction** :
- : Take a body of weight 410 gm.
  - : Suspend it with a spring balance and weight it.
  - : Dip it in 4 different portions.
  - : Collect the displaced water in another plastic bag.
  - : Note the differences between the readings of a body weight- ing in air and in water.
  - : Compare this reading with the weight of water displaced.
- Observation** :

Position of Body	Weight of Body in air (gm. wt.)	Reading of Spring balance when dipped in water	Buoyant force	Wt. of water displaced in gm. wt.
1/4 dipped	410 gm. wt.	370 gm. wt.	40 gm. wt.	40 gm. wt.
1/2 dipped	410 gm. wt.	330 gm. wt.	80 gm. wt.	80 gm. wt.
3/4 dipped	410 gm. wt.	250 gm. wt.	160 gm. wt.	160 gm. wt.
Completely dipped	410 gm. wt.	90 gm. wt.	320 gm. wt.	320 gm. wt.

- Conclusion** :
- : A body dipped partly on completely in a liquid is bouyed up- wards.
  - : Buoyant force experienced by the body is always equal to the weight of the water displaced.



<b>Concept 7</b>	:	<b>Flotation</b>
<b>Apparatus</b>	:	Spring balance, bucket 3/4th full of water, three balloons filled with 200 ml of salt water, 200 ml of oil, 200 ml of water, overflow can.
<b>Teachers Instruction</b>	:	Take a rubber balloon and fill it with 200 ml of water.
	:	Suspend it with a spring balance
	:	Find its weight in air.
	:	Dip it in water and observe reading in the balance.
	:	Repeat the above steps by using 200 ml of salt solution and oil.
<b>Observation</b>	:	

No.	Wt. of balloon filled with 200 ml liquid in air	Wt. of liquid balloon in water	Buoyant force	What happens?
1.	Water			Floats in the middle
2.	Salt Solution			It sinks
3.	Oil (160 gm. wt.)			It floats

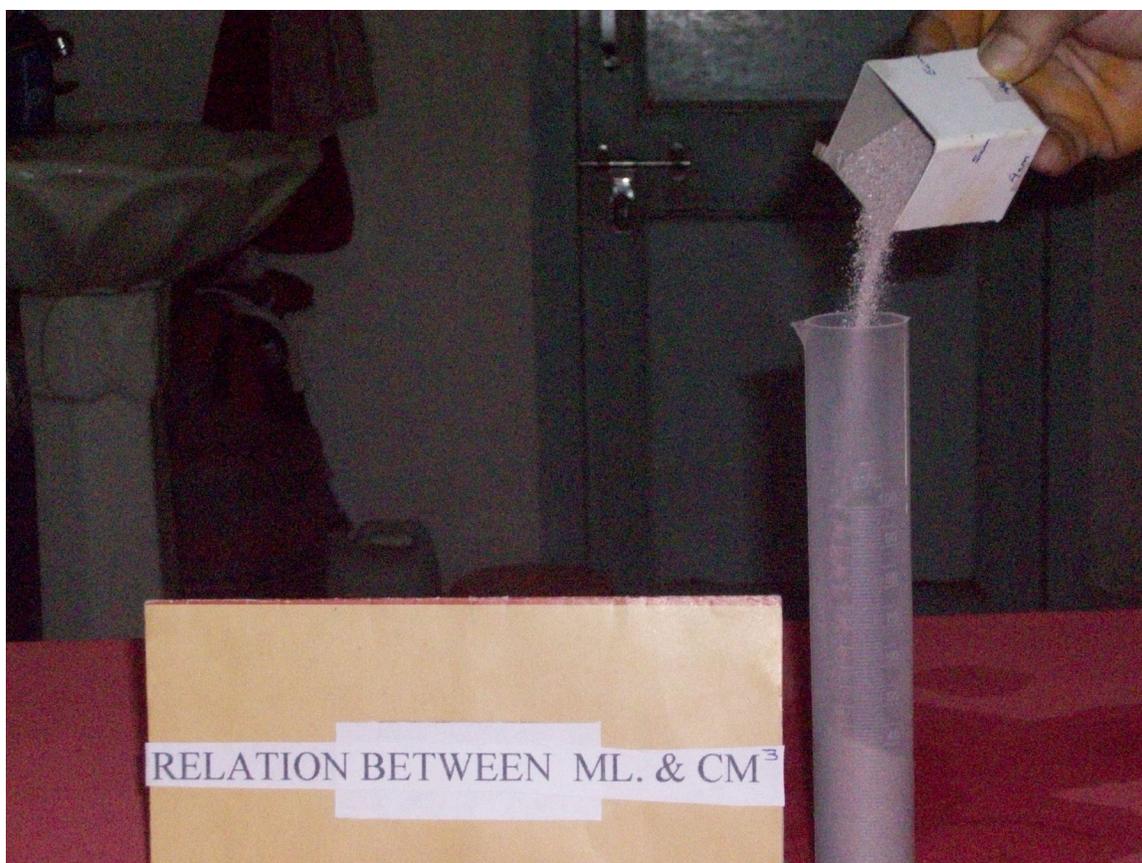
<b>Conclusion</b>	:	It floats, neither sinks nor rises Gravitational force acting downward on balloon = Upward buoyant force.
	:	It sinks wt of 200 ml of water > wt. of 200 ml of water in air. Gravitational force acting downward on balloon > Upward buoyant force.
	:	It floats on water surface. Gravitational force acting downward on balloon < Upward buoyant force.



- Concept 8** : **Water attains equal levels**
- Apparatus** : Any two transparent containers (PET bottles of different shapes/sizes), polythene pipes of different diameters, sealing material, scale, notebook, graph paper, pen/ pencil, water, stop watch..
- Teachers Instruction** :
- : Make a hole of small diameter in the lower side of each of the containers and connect them up with the polythene pipe, and to make the joints leak-proof with sealing material.
  - : Pour water into one of the containers and watch the water levels in the two containers rise.
  - : Repeat after connecting the two containers with polythene pipe of a different diameter.
- Observations** :
- : Record with the stop watch the time required for the level of water in the two containers to attain equal heights (keeping the rate of filling of water constant).
  - : Plot height-vs-time on the graph paper
- Conclusion** : Water level in two connected containers always remains same.



- Concept 9** : **Relation between ML EXCM<sup>3</sup>)**
- Apparatus** : Card sheet, sand, measuring cylinder.
- Teachers Instruction** :
- : To prepare a cuboids of 80cm<sup>3</sup> factories 4 x 4 x 5.
  - : Make a cuboids of length 4cm, width 4cm and height 5cm.
  - : Pour sand in it and fill it up to its brink.
  - : Now take volume graduated cylinder and pour the sand in it.
- Observation** : 80cm<sup>3</sup> of sand = .....ml
- Conclusion** : 1cm<sup>3</sup> = 1ml



<b>Concept 10</b>	:	<b>Equal distribution of applied pressure in a liquid</b>
<b>Apparatus</b>	:	A plastic soft drink bottle (capacity 500ml), pin, water, bucket.
<b>Teachers Instruction</b>	:	The teacher to ask the children to do the experiment repeatedly and then take them for a discussion.
	:	Make a number of punctures on different sides of the bottle surface at the same level with pin pricks.
	:	Fill up the bottle with water.
	:	Apply air pressure at the open end of the bottle by blowing into it.
<b>Observation</b>	:	Observe how the water spurts out from the full bottle
	:	Did the water flow change when air pressure was applied
	:	How did the water flow change when air pressure was applied?
	:	How far did the water flow before and after applying air pressure?
<b>Conclusion</b>	:	Pressure applied on a liquid is exerted equally on all sides.



**Concept 11** : **Two bodies of different weight but equal volume experience equal buoyant force**

**Apparatus** : Two vessels of same volume but of different weigh, spring balance, over flow can.

**Teachers Instruction** :  
 : Weight both the cylinder material in air and note down.  
 : Weight both the cylinder material in water and note down.  
 : Subtract both the readings and observe the buoyant force.

**Observation** : 80cm<sup>3</sup> of sand = .....ml

Cylinder's material, and volume in Cu cm	Weight in air	Reading of spring balance supporting the cylinder under water	Buoyant force
Iron 50 cu cm	400 g wt	350 g wt	50 g wt
Aluminum 50 cu cm	135 g wt	85 g wt	50 g wt

**Conclusion** : Buoyant force experienced by cylinders of different weights but of equal volume in equal, because they displace water of equal weight.

- Concept 12** : **What will be the buoyant force experienced by a body when dipped in different liquids**
- Apparatus** : One plastic box.  
: Over flow can, filled by water and oil turn by turn  
: Spring balance, etc.
- Teachers Instruction** : Weight the plastic box with the help of spring balance filled with sand in air.  
: Note down the reading first when dipped in water and then in oil.  
: Calculate the difference in the reading and experience the buoyant force.
- Observation** :

Liquid	Weight of cylinder	Reading of spring balance while cylinder under liquid	Buoyant force
Water	400 g wt	350 g wt	50 g wt
Oil	400 g wt	360 g wt	40 g wt

- Conclusion** : The difference in the buoyant force is because the weight of oil displaced by the body is less than the weight of an equal volume of water, the volume of water and of oil displaced is equal. Hence, buoyant force on the cylinder dipped in oil is less than that when dipped in water.

- Concept 13** : **Static electricity**
- Apparatus** : Plastic water bottle, water, a balloon, nails.
- Teachers Instruction** : The teacher to guide the children in conducting the experiment  
: Puncture a small hole at the lower end of the bottle.  
: Fill up the bottle with water. A water jet spurts out of the hole  
: Inflate the balloon and hold it near the water jet  
: Rub the inflated balloon a few times on your garment and hold it near the water jet.
- Observation** : How does the water jet behave in (c)?  
: What happens in (d)?
- Conclusion** : This experiment demonstrates properties of static electricity.

■

# India International Science Festival 2015

**Organised by:**  
**Vigyan Bharati**  
**TIFAC**  
**Ministry of Science & Technology**  
**Govt. of India**

**Venue: IIT, Delhi**  
**December 04-08, 2015**

Ministry of Science & Technology and Earth Sciences, Government of India and Vijnana Bharati, are organizing 'India International Science Festival (IISF)' from 4th to 8th December 2015 with the following objectives:

- Exposing the fruits of Science & Technology to the masses
- Building strategy to instil scientific temper among the masses
- Showcasing Indian contributions in the field of S&T over the years
- Providing platform to young scientists from SAARC and neighbouring countries for exchange of knowledge & ideas
- Supporting flagship programs like Make in India, Digital India, Start-ups, Smart Villages, Smart Cities, etc. initiated by the Hon'ble Prime Minister

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Abstracts must reach latest by October 15, 2015. Acceptance shall be communicated by October 30, 2015. Please send the abstract(s) online only.

## Themes

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- Indigenous Knowledge
- Innovative Agricultural Practices & Livestock Management
- Integrated Healthcare including Innovative Diagnostic Aids
- Vector Control & Mitigation
- Remote Sensing Applications
- Smart Design & Advanced Manufacturing Technologies in line with 'Make In India'
- Green Energy
- Waste to Wealth Technologies, Water & Ocean Resources, Environmental Management and Climate Change

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# International Conference “India’s Scientific Wisdom: Emerging Worldview” (ICISW-2016)

## Organised by:

**Indian Science Writers’ Association (ISWA)  
International Centre for Science Communica-  
tion (ICSC)  
Indian Science Communication Society (ISCOS)**

**Venue: Haryana Bhawan, New Delhi  
February 27-28, 2016**

India is known for her early scientific wisdom and a treasure of scientific heritage. Several sages and scholars had been working on medicinal, mathematical, astronomical, agricultural, physiological, physical, chemical, metallurgical and architectural sciences in Indian subcontinent for the time immemorial. They had composed volumes in their respective fields based on their experiences and experiments. They have used various means of communication, like oral communication, Guru-Shishya-Parampara (teacher-pupil tradition of teaching and learning), and dissemination of information by interacting people. Thus, for a long time, the tradition of oral communication continued, in addition to scientific texts written by such knowledge creators. According to Sappier: “Every cultural pattern and every single act of social behaviors involve communication, in either an explicit or implicit sense”.

India has a tradition of acquiring knowledge, discovering the secrets of the nature; by examining and thorough observations and by applying certain procedure; what we call today, the method of science. The then Indian intellectuals transmitted the knowledge through oral communication and unique compositions, for generations after generations. However, much later, they had written down such information on different surfaces, like rocks, palm leaf, Bhojpatra, bark of various trees, copper and bronze plates, and eventually on paper. These communication materials have now become the poten-

tial sources of the information on early science and technology that has made tremendous impact on the emergence of modern science and technology.

## Main Theme:

India’s Scientific Wisdom: Emerging Worldview

## Sub Themes:

- Scientific Wisdom: The Genesis
- Scientific Wisdom: Evidence Based Reappraisal
- Scientific Wisdom: Connecting links from where we left
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## Important Dates:

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## Contact:

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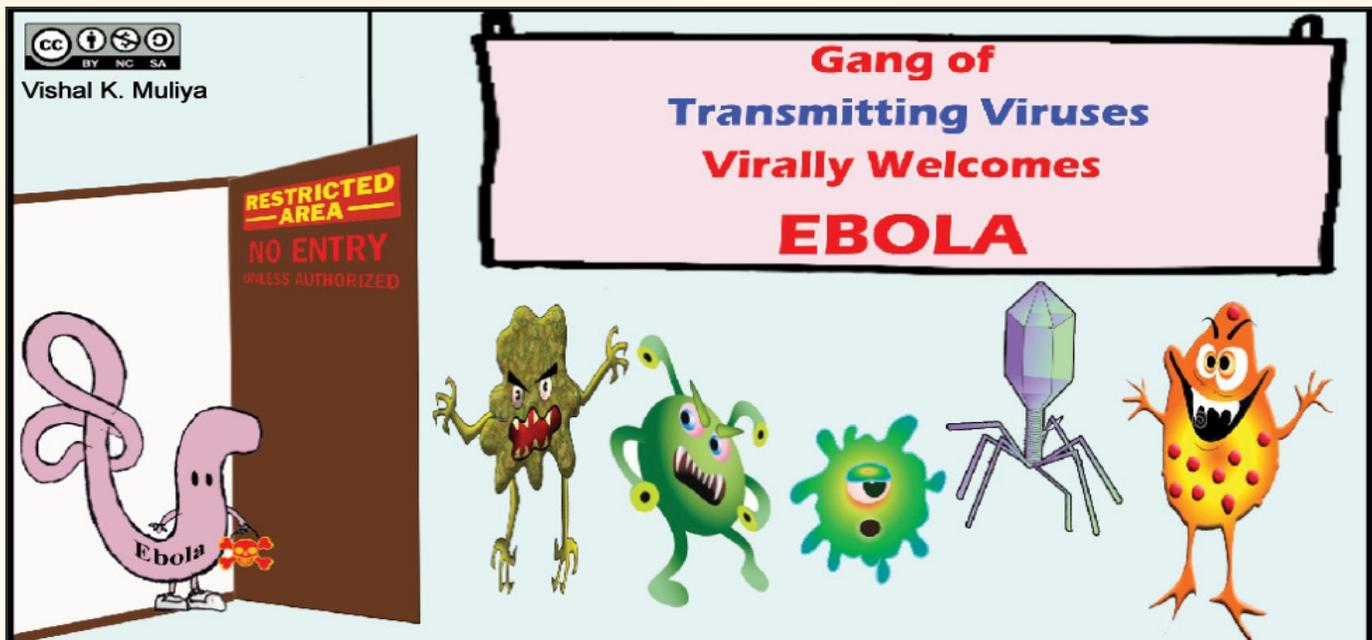
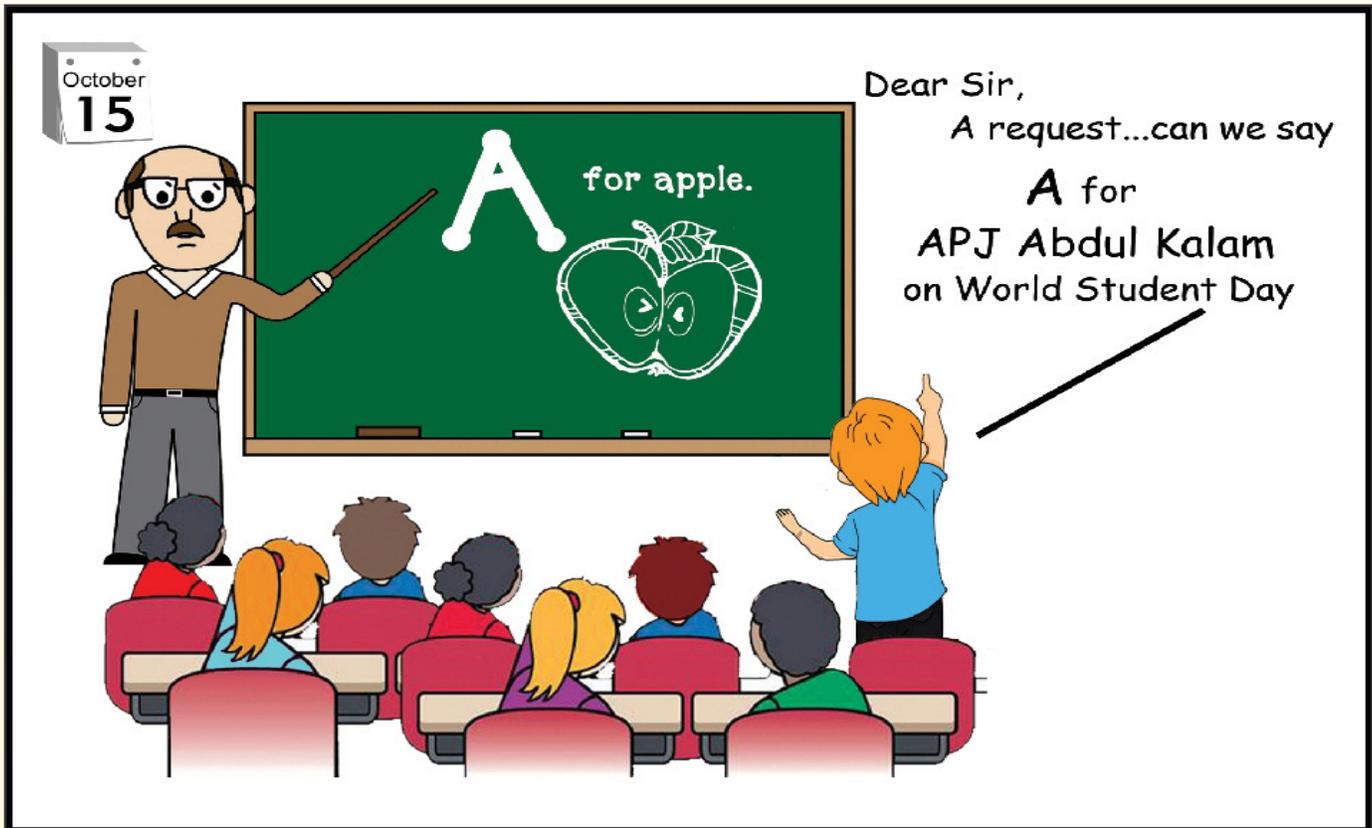
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