UNIT 10 : PUBLIC UNDERSTANDING OF SCIENCE

UNIT STRUCTURE

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10.1 LEARNING OBJECTIVES

After going through this unit, you will be able to –

- learn about public understanding of science
- understand the concept of public
- explore the need for public understanding of science and technology
- emphasize the role of communication

10.2 INTRODUCTION

Public Understanding of Science (PUS) is an evolving discourse. From the knowledge of 'science' (thereby scientific literacy) to public engagement (PUS) – this discourse has now moved to 'science in and of society', thus, attributing the change of 'attitude' of the public towards science and technology. In the past, information regarding scientific advancement was disseminated to the public as a part of public lectures, discussions and demonstrations by scientists, nature observers and professionals. After the nineteenth century, the specialisation and professionalization of different branches of science have led to the widening gap between the public and practitioners of science. New ideas and findings were published mostly in academic journals written technically and reviewed by experts. As a result, a sharp distinction between science and society became visible.

From the twentieth century, scientific bodies revisited the issue and science popularisation and movements were initiated by scientists in various countries. After World War II, 'science literacy' and 'science communication' gradually became a part of the government policies in many countries. Today, public communication of science as a part of the policy, education and scientific discussion have become routine. It is now an object of research across the globe to reduce the gap between experts and the general public and to inspire public engagement in the field of science and technology.

The expression, public understanding of science has two-fold meanings: (a) public attitudes and behaviour and (b) understanding of science. Though public communication of science was steadily growing, it emerged as a new area of interest after the widely acclaimed report of the Royal Society of London in 1985 under the chairmanship of Dr. W. F. Bodmer. In the report, study areas such as mathematics, technology, engineering and medicine, systematic investigation of the natural world and the practical application of knowledge derived from such investigation was included as a part of 'science'. 'Understanding' refers to comprehension of the nature of scientific activity and enquiry, and not just knowledge of some of the facts and 'public' meant non-scientific public.

Martin Bauer in his article *The Evolution of the Public Understanding of Science - Discourse and Comparative Evidence* stated that PUS had a *rationalist* and a *realist* agenda. For the *rationalist*, attitudes arise from information processing with a rational core. It is assumed that if people had all the information, and were able to understand probabilities, they would be more supportive of science. It is a battle of minds of the public with more information and the correct statistical reasoning (i.e., risk perception).

For the *realist*, 'attitudes' are emotional relations with the world. Realists understand emotions with the logic of advertising. Thus, the battle for the public mind becomes a battle for hearts. Based on survey evidence, Bauer shows that the public understanding of science might be significantly different in an industrial-developing context and a knowledge-intensive developed context.

In India, the dissemination of scientific ideas was initiated in the ninetieth century, when several science books were translated from English to regional languages. Newspapers [like *Arunudoi* (1846) in Assam] introduced dedicated pages for providing news and information on issues related to science. After independence, the Government of India initiated concepts like scientific temperament, broad scientific outlook, scientific belief system etc. to facilitate public understanding of science. Efforts of Kerala Sastra Sahitya Parishad (1962), Assam Science Society (1953) and other organisations in different parts of the country like in West Bengal,

Maharashtra, Karnataka, Tamil Nadu led to people's movement for communicating science in India. Gauhar Raza and Surjit Singh in their article *25 Years of Public Understanding of Science in India: Analysis Based on Cultural Distance* elaborately describes the genesis of public understanding of science in India. The investigations into people's understanding of science in the country have been pioneered by researchers working at the Council of Scientific and Industrial Research (CSIR), Science Academies, National Council of Science & Technology Communication (NCSTC), Department of Science and Technology (DST), New Delhi etc.

10.3 CONCEPT OF PUBLIC

The public is an indispensable part of the communication process. They are the 'receiver' or 'decoder' in media studies, for whom messages are transmitted through a channel or medium. The public in science communication is heterogeneous and is geographically dispersed. Understanding of public is significant as contents are specifically designed according to the need of the specific public (generally referred to as the primary target audience). Today, action research has turned into a major branch of science communication research for effective, public-oriented content generation and media influence.

The public in science communication is diverse, differentiated, and plural, hence the use of 'the public' is often in practice. For a long time, the public remained as a broad spectrum of non-scientists in scientific communication. While some define public in science as non-expert or layman (patients and their families, community groups, citizens), or citizen, the American Association for Advancement of the Science (AAAS) considers public as members of the society who already understand basic scientific facts and concepts, yet they may disagree or uncomfortable with the presumed implications. The public consists of people who participate in opinion sharing and hence the public engagement has become a significant part of the public understanding of science movement since the 1980s. There are many ways of classifying the public.

(a) **Demographics and Psychometrics**

The public can be categorized according to their demographic profiles. The demographic profile defines groups based on characteristics like:

(i) Age: Children, young, adults and old

(ii) Gender: Male, female and others

(iii) Education: from illiteracy to the higher level of degree obtained

(iv) Income level: Below poverty line, lower middle class, middle class etc. and

(v) Occupation: Categorization as per occupation. It includes the unemployed category as well.

(b) **Type of Media Consumed**

(i) Reader: When the audience read a newspaper or written communication

(ii) Listener: People listening to audio (example: radio listener)

(iii) Viewer/ spectator: Public for visual presentation

(iv) Netizen: This is a new form of individuals or groups who are confined to digital world.

(c) **Geographical Location**

(i) International: When the target audience is dispersed without geographical boundaries

(ii) National: When the message is limited to the citizen of a nation

(iii) Regional: When information is confined to a region

(iv) Local: When approaches are targeted for a locality.

(d) **Public as a Societal Group**

(i) Individual (Information targeted to influence at the *individual* level)

(ii) Community (Information targeted to influence at communication level)

(iii) Organization (Information prepared for groups like academic institutions, research organizations or special focus groups)

(iv) Policymakers (They sit at the top of the hierarchy in a society bound by law. Message should be strategically designed to influence policymakers.)

(e) **Public as Defined by the Report of the Royal Society of London**

Royal Society of London's report on Public Understanding of Science in 1985 classified 'public' into five overlapping categories. These are:

(i) private individuals for their satisfaction and wellbeing

(ii) individual citizens for participation in civic responsibilities as members of a democratic society

(iii) people employed in skilled and semiskilled occupations, the large majority of which now have some scientific content

(iv) people employed in the middle ranks of management and in professional and trades union associations; and

(v) people responsible for major decision-making in our society, particularly those in industry and government.

(f) **Public as 'Overlapping Groups'**

According to Bruce Lewenstein (1998), 'audience are overlapping group of people in the society with their own 'need, interest, attitudes and levels of knowledge'. According to Burns et al (2003), the public in science communication may involve- science practitioners, mediators, and other members of the general public, either peer-to-peer or between groups. Lewenstein classified 'audience' into the following categories:

(i) Scientists: in industry, the academic community and government.

(ii) Mediators: communicators (including science communicators, journalists and other members of the media), educators, and opinion-makers.

(iii) Decision-makers: policymakers in government, and scientific and learned institutions.

(iv) General public: the above three groups above, plus other sectors and interest groups. For example, school children and charity workers.

(v) Attentive public: the part of the general community already interested in (and reasonably well-informed about) science and scientific activities

(vi) Interested public: is composed of people who are interested in but not necessarily well informed about science and technology.

(g) **Public as per Engagement**

Traditionally, the public tends to remain passive in the adoption of innovative ideas due to a sense of uncertainty, risk, distrust and a usual fear for science. This *ivory tower syndrome* place audience as a *passive audience.* The model which deals with the understanding of such a non-interactive, passive audience and the gap between the knowledge of science and the public is called the *deficit model* of science communication. With more interactions from the scientific communities, organisations and government, today, public participation has been increased for contemporary scientific development. Such enthusiastic public who are open to scientific engagements is referred to as an *active audience*. Audiences who take a critical stand for scientific development are considered critical audiences. From passive to being critical and active, the public has a significant role in the advancement of society and contribute to establishing a knowledge-based scientifically literate audience.

(h) **Public as 'Market'**

With the growth of science and technology, a market has evolved (for example: in the field related to health, technology, aeronautical, space, gadget etc.) and the term 'consumer' is preferred rather than public in recent years. Consumer profile, service, product, consumer interest are other common terminologies associated with this growing market for science and technology. From the 1950s onward, funding research on what impacts or influence public perception have received greater attention. Apart from these, Social and behaviour change is exponentially growing as a topic of research.

CHECK YOUR PROGRESS
Q. 1: What is meant by two-fold meaning of 'public understanding of science'
Q. 2: What is Bodmer report?
Q. 3: Why deficit model of public understanding is significant?

10.4 NECESSITY OF PUBLIC UNDERSTANDING OF SCIENCE AND TECHNOLOGY

The necessity of public understanding of science has been well argued by the report of the Royal Society of London. Some of the significant points of the report are:

(i) Better public understanding of science can be a major element in promoting national prosperity, in raising the quality of public and private decision-making and in enriching the lives of the individual.

(ii) There would be a considerable competitive advantage if those who hold positions of responsibility had at least some understanding of what science and technology can

and cannot achieve, and were better able to call for and evaluate advice on scientific and technological issues.

(iii) A better understanding of science by the government and the higher levels of the Civil Service should also lead to better policies for science. The government needs to appreciate, for example, the interconnections between basic, strategic and applied research, the relative timescales and uncertainties of these three phases, special factors such as increasing instrumental sophistication that affect the cost of research, and the dynamics of the system for financing research in the higher education sector.

(iv) In a democracy, public opinion is a major influence in the decision-making process. It is therefore important that individual citizens, as well as the decision-makers, recognize and understand the scientific aspects of public issues

(v) An understanding of science is also important for the individual in his or her private life. Personal decisions, for example about diet, smoking, vaccination, screening programmes or safety in the home and at work, should all be helped by some understanding of the underlying science.

(vi) Greater familiarity with nature and the findings of science will also help the individual to resist pseudo-scientific information. An uninformed public is very vulnerable to misleading ideas.

(vii) Science and technology influence the individual's daily life in an enormous variety of ways in our gadget-filled, technology-based society. Ignorance of elementary science cuts off the individual from understanding many of the tools and services used every day.

(viii) Understanding the nature of risks and uncertainty is an important part of the scientific understanding needed both for many public policy issues and for everyday decisions in our personal lives. Decisions on nuclear power stations or medical screening programmes or seat belts or motorway speed limits all involve a balancing of risks, taking into account a variety of social, political, economic and scientific factors.

(ix) Without some understanding of science, an individual is cut off from much of the richness of contemporary human thought. Indeed, whatever the benefits of public understanding of science may be, the intrinsic contribution of science to our culture argues that imparting such understanding is a duty the scientist owes to the public.

According to AAAS, public engagement with science describes intentional, meaningful interactions that provide opportunities for mutual learning between scientists and members of the public. Mutual learning refers not just to the acquisition of knowledge, but also increased familiarity with a breadth of perspectives, frames, and worldviews. The webpage of the Society declares that goals for public engagement with science in addition to mutual learning include civic engagement skills and empowerment, increased awareness of the cultural relevance of science, and recognition of the importance of multiple perspectives and domains of knowledge to scientific endeavours. The complex relationship that exists between science and society can be constructive, tension-filled, or everything in between. Public engagement can provide a constructive platform for public views to be combined with scientific expertise in decision-making contexts.

10.5 SCIENCE AND CULTURE

Scepticisms about scientific developments and acceptance of the same are associated with the cultural origin of the public. It is a fact that culture shapes attitude and public behaviour. Cultivation of scientific temperament, therefore, demands higher levels of literacy, correct information and constant public engagement at the grassroots level. In a pluralistic society like India, culture is a prime factor that determines the acceptance of innovative scientific ideas. In developing countries, it is pertinent to understand how society talks about science. It is hard to avoid traditional beliefs (which may be irrational and unscientific sometimes) that are entwined with the culture for centuries. For example, eclipse (solar or lunar) is associated with many unscientific traditional beliefs. Common people in Assam used to throw overnight cooked food, considering it to have ill effects on the body. People avoid travelling and taking food during the hours of eclipses. Constant efforts from various scientific organisations such as academic, Government and Non-Governmental organisations have been able to encourage young children to consider such events as mere celestial happening; yet, a considerable number of the public still have reservations to accept this scientific fact. Likewise, believing miracles, astrology and other non-scientific issues minimise the degree of public engagement.

Scientific culture is a distinct and coherent object that can be infused into the general culture and in the mind of the public through extensive communication. It is interesting to note that scientific culture or culture of science is used to refer to science in the general culture of a country. British scientist C. P. Snow, in his influential book *The Two Cultures* (1959) argues that great cultural divide which separates two intellectual groups ‘science’ and ‘the arts’ into two opposite poles leads to two cultures in a society. Snow suggested that practitioners from

the areas should work coherently to build a bridge for the benefit of public understanding of science.

CHECK YOUR PROGRESS
Q. 4: What do you mean by ‘mutual learning’ in public understanding of science’?
Q. 5: Define ‘two cultures’. Who coined it?

10.6 ROLE OF COMMUNICATION

Communication has a significant role in the public understanding of science. The aim of communication, therefore, is to bridge the gap and to act as a facilitator among different stakeholders of the society including policymakers, scientists and ‘the public’. Various models exist to describe the role of communication in the popularisation of science. Three models are discussed below to understand the pivotal role of communication in public understanding of science.

(a) **The Steller Model**

Proposed by Michel Claessens, this model explains how scientists depend on journalists to simplify complex ideas so that the public understands science. Scientists are often busy with their research and findings. The process of scientific research is a complex one. The public does not need to know all the complex steps and information of scientific research. Communication makes these ideas simple and palatable for the audience. The association of the story of an apple falling on the great scientist Newton while sitting legibly in a park and thereby the discovery of the theory of Gravitation is such a charming example of how communication plays a significant role in simplifying complex theories for public understanding.

(b) **Contextual Model of Science Communication**

It is well known fact that the audience perceives information depending on various contexts like -psychological, geographical, economical, social, political etc. Contextual model establishes the fact that communication in science is essential to disseminate

information in accordance to the contexts of subject and audience. For example, in health care systems, the relationship between practitioners, policymakers and the public depends on the context of the individual or public at the mass level. Here, we may refer to the phase II Lockdown process in India as an example. The government of India abstained from a nationwide lockdown during the second wave of the Covid-19 pandemic and allowed state governments to decide whether they will impose lockdown or not depending on the context of the cases reported. Likewise, in the case of individual health issues, the views of practitioners, caretakers and the public are always taken care of. This model also clarifies how communication in public understanding is essential in risk perception and risk communication (e.g., risk associated with nuclear research, chemical explosion, environmental issues etc.)

(c) **Public Participation Model**

Efforts of communication in public understanding of science are to encourage interaction and more engagement among the public in scientific issues. The public engagement approach promotes interactive opportunities for dialogue and exchange. Through engagement, the public participates in discussions. Apart from this, various outreach programmes, science fairs and festivals, public policy activities, museum projects, science communication ventures – such as radio, TV, books, film, social media etc. can enhance public participation. This participation, according to Edna F. Einsiedel, can happen according to three purposes: for policymaking, for public dialogue (an inclusive category that incorporates education, entertainment, persuasion in various dialogic forms) and for knowledge production. The public participation model demonstrates the democratic power that communication can offer to the public in the understanding of science, valuing nation-building and upholding decisions at individual or wider social level. This model also manifests the commitment policymakers need to have, the obligation of scientific communities towards public engagement as well as the responsibility of the public towards science.

CHECK YOUR PROGRESS
Q. 6: What is the role of communication in public understanding of science?
Q.7: What are the three steps of public participation in science according to Edna F. Einsiedel?

10.7 LET US SUM UP

- Public Understanding of Science (PUS) is an evolving discourse. From the knowledge of science (thereby scientific literacy) to public engagement (PUS) - this discourse has now moved to science-in and of society, thus, attributing the change of attitude of the public towards science and technology.
- After World War II, science literacy and science communication gradually became a part of the government policies in many countries.
- The expression, 'public understanding of science' has two-fold meanings (a) public attitudes and behaviour and (b) understanding of science.
- Public communication of science has emerged as a new area of concern after the widely acclaimed report of the Royal Society of London in 1985 under the chairmanship of Dr. W.F. Bodmer.
- In India, the dissemination of scientific ideas was generated discretely from the ninetieth century, when several science books were translated from English to regional languages.
- 'Public' in science communication is diverse, differentiated, and plural, hence the use of 'the public' is often in practice.
- There are many ways of classifying the public (e.g., depending on demographics and psychometrics, type of media consumed, geographical location etc.)
- Better public understanding of science is required in promoting national prosperity, raising the quality of public and private decision-making and enriching the lives of the individual
- Scepticisms for acceptance of scientific developments are associated with the cultural origin of the public.
- Communication has a significant role in the public understanding of science. There exists a gap between science and the public. The aim of communication, therefore, is to bridge the gap and to act as a facilitator among different stakeholders of the society including policymakers, scientists and 'the public'.

10.8 FURTHER READING

1. Bucchi, M. & Trench, B. (2008). *Routledge Handbook of Public Communication of Science and Technology*. Ed. Routledge.

2. Brossard, Dominique, & Lewenstein, Bruce V. (2010). A Critical Appraisal of Models of Public Understanding of Science: Using Practice to Inform Theory. In LeeAnn Kahlor & Patricia Stout (Eds.), *Communicating Science: New Agendas in Communication*, Routledge, 11-39.

3. Baron, N (2010). *Escape from the Ivory Tower: A Guide to Making Your Science Matter,* Island Press

4. Bauer, Martin W. (2009). The evolution of the public understanding of science - discourse and comparative evidence. *Science, technology and society*, 14 (2). pp. 221-240. DOI: 10.1177/097172180901400202

5. Simis, M. J. *et. al*. (2016). The lure of rationality: Why does the deficit model persist in science communication? *Public Understanding of Science*, Vol. 25(4), 400– 414. DOI: 10.1177/0963662516629749

6. Lewenstein, B.V. (1992). The Meaning of 'Public Understanding of Science' in the United States After World War II. *Public Understanding of Scie*nce, Vol. 1(1), 45-68.

7. Royal Society of London. (1985) *The Public Understanding of Science,* Royal Society of London, https://royalsociety.org/topics-policy/publications/1985/public-understanding-science/

8. Raza, G & Singh, S. (2016). 25 Years of Public Understanding of Science in India: Analysis based on cultural distance, *Journal of Scientific Temper*, Vol 4(3&4), July-Sep & Oct-Dec, pp. 81-101

10.9 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q No 1: The two folded meanings of 'public understanding of science' are: (a) public attitudes and behaviour and (b) understanding of science.

Ans to Q No 2: Royal Society of London published a report on Public Understanding of Science in of Though public communication of science was growing, 1985 under the chairmanship of Dr. W. F. Bodmer. This report which established new concern for the discourse is called the Bodmer report.

Ans to Q No 3: *The deficit model* is significant because deals with the understanding of non-interactive, passive audience, and the gap between the knowledge of science and public in science communication.

Ans to Q No 4: Although the traditional meaning of mutual learning refers to the acquisition of knowledge (between scientists and the public), it goes beyond in public understanding of science which aims to increase familiarity with a breadth of perspectives, frames, and worldviews.

Ans to Q No 5: A great cultural divide exists in society which separates intellectual groups into two opposite poles called 'science' and 'the arts'. This is referred to as the 'two cultures. It was coined by British scientist C. P. Snow in his influential book *The Two Cultures* (1959).

Ans to Q No 6: Communication has a significant role in public understanding of science. As we know there exists a gap between science and the public. The aim of communication, therefore, is to bridge the gap and to act as a facilitator among different stakeholders of the society including policymakers, scientists and 'the public'. At large, communication can offer to the public -understanding of science, valuing nation-building and upholding decisions at individual or wider social level.

Ans to Q No 7: The three steps of public participation in science according to Edna F. Einsiedel are: *policymaking*, *public dialogue* (an inclusive category that incorporates education, entertainment, persuasion in various dialogic forms) and *knowledge production.*

10.10 POSSIBLE QUESTIONS

A. Short Questions (Answer each question in about 150 words)

Q.1: What is the *rationalist* and *realist agenda* in public understanding of science?

Q. 2: Write a note on (a) 'public as market' or (b) 'public as engagement'

Q. 3: Discuss the need for a *Public Participation model* in public understanding of science

Q.4 : What is the significance of the contextual model in public understanding of science?

B. Long Questions (Answer each question in about 300-500 words)

Q. 1: Briefly mention the necessity of public understanding of science.

Q. 2: What are the various categories of 'public' in public understanding of science? Classify the public as suggested by Bruce Lewenstein or Royal Society of London.

Q. 3: Define 'public'. Do you think that culture has a role in the public understanding of science? Discuss with suitable examples.

Q. 4: What do you mean by 'public engagement'? Mention some steps to enhance public engagements.