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A Peer Reviewed
Annual Interdisciplinary
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FOREWORD

I am pleased to learn that the 12th edition of the Teachers' Journal named "INSIGHT" is going to be published shortly. In this context, I do convey thanks to all the members of the Editorial Board for timely publication of this journal. At the same time, I would like to encourage the teachers who have not yet penned any article for publication in it, to try to enrich the journal by submitting the same in the years to come. It may be mentioned that this edition is being published on the very day of the opening of the Golden Jubilee year of the college.

Kalyan Kumar Mondal

Principal

FROM THE EDITORS DESK

*On the 50th anniversary of our esteemed institution, I present to you the 12th volume of **INSIGHT: SOVARANI MEMORIAL COLLEGE JOURNAL**. I would like to take this opportunity to extend my congratulations to the authors for their timely submission and gratitude to the editorial board for working tirelessly during these tough times.*

Subhajit Pandit
Chief Editor

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A view on psychological well-being of human health depending on Religion

Dr. Koyel Koley
Department of Philosophy

Abstract :

In this article I have focused on how the religious involvement are positively associated with the psychological well-being, which includes life satisfaction, happiness, positive affects, and higher moral, and excludes depression, suicidal thoughts and behavior, drug / alcohol use / abuse. Usually the positive impact of religious involvement on psychological health is more rapid among the people who are under stressful circumstances. Such as the person who are elderly, who are with disability and medical illness.

The article reviews the scientific evidence available for the relationship between religion and mental health. And thus concluded my paper reviewing that we need to meditate to improve our mental health. "Be religious to be peaceful."

Key Words : Disability, Meditation, Mental Health, Peaceful, Religious.

1. Introduction

Before discussing how religion is responsible for psychological well-being of human health, we must first introduce the concept of religion, we must first know what religion is. It is the belief in and worship of a superhuman controlling power, a particular system of faith and worship. There is no scholarly consensus over what precisely constitutes a religion. It may be defined as a cultural system of designated behaviors and practices, ethics, that claims to relate humanity to supernatural, transcendental, or spiritual elements. And thus the person with stronger religions faith have higher level of life-satisfaction, greater personal happiness and fewer negative psychological consequences of traumatic life events because religiosity is positively related to a number of measures of psychological well-being.

2. Materials and methods

This is a descriptive study. It is a cross-sectional community-based study. Some classical text has been followed to prepare this research paper.

3. Objectives

- To show how religion have negative effects on mental / psychological health.
- To show the positive effects of religion on mental health.

4. Result

In this article I tried to show that spirituality can play an important role in helping people maintain good mental health and live with or recover from mental health problems.

5. Discussion

5.1. Negative effects of religion on mental health.

Religion and spirituality unquestionably have a place in the treatment of many mental health patients. Various investigations have shown religious involvement to be positively correlated with well-being, happiness, life satisfaction, hope, optimism, purpose and meaning in life, higher self-esteem, greater social support and less loneliness, lower rates of suicide and fewer positive attitudes toward suicide, less anxiety, less psychosis and fewer psychotic tendencies, lower rates of alcohol and drug use/abuse, less delinquency and criminal activity, and greater marital stability and satisfaction.

But are there instances when religion can actually interfere with care or worsen patient outcomes? Any modality of medical or psychological treatment, no matter how beneficial, can have adverse effects, and this is true for religion as well. Although we believe that the occurrence of adverse effects of religion on mental health are infrequent relative to the much larger number of positive benefits, there are circumstances that demonstrate how religion may negatively affect the treatment course of some mental health patients.

Some patients may develop feelings of excessive guilt and condemnation because of religion (Koenig, 2007). Parts of many religious writings describe God's judgments for sin. Patients who focus on these writings may overlook the numerous scriptures that portray God's forgiveness. Patients who do not feel they meet God's standards may experience distress associated with striving to be virtuous (Exline, 2002).

Religion may cause or increase anxiety for certain individuals. For example, patients may worry about the welfare of family who do not share the same beliefs (Exline, 2002). Anxiety about judgment for sin, prophecies of future events, the rising of the Antichrist, and other issues may trouble some patients. Strong beliefs in the pervasiveness of sin have been positively linked with anxiety (Ellison, Burdette, & Hill, 2009).

Intense religious experience can lead to transient psychotic episodes. Psychotic breakdown linked to religious experience (sometimes referred to as the Jerusalem syndrome; Bar-El et al., 2000) or meditation (Kuijpers, van der Heijden, Tuinier, & Verhoeven, 2007) have been described. Fortunately, chronic mental illness usually does not result following these episodes (Linden, Harris, Whitaker & Healy, 2010).

Religion may cause problems with interpersonal relationships and diminish social support (Exline, 2002). Strain and even conflict may result from religious disagreements and from negative attitudes that may develop between the patient and others because of differing religious opinions. Decreased social support has a negative impact on mental health.

Sometimes patients may choose to rely solely on religion to address psychiatric issues, in essence substituting faith for treatment. In such cases, patients may demonstrate partial adherence, or treatment may be refused altogether. An example would be a patient with schizophrenia who abruptly stops taking antipsychotic medication because the patient believes he or she has been healed. Negative outcomes may result, particularly for those with serious psychiatric disorders. In some cases, patients may assume unrealistic expectations of their religion and adopt a sort of magical thinking that God will solve all their problems or even grant all their wishes (Koenig, 2007). Reality may be ignored, with patients making little attempt to use practical methods to address their psychological or social issues. In extreme cases, some individuals may unscrupulously use religion to manipulate and control certain psychologically vulnerable patients. The effect produced by this misuse of religion is not a part of medical treatment but occurs more often in the realm of cults.

Thus, religion may be seen to, at times, produce adverse effects in some mental health patients. Religion may be incorporated into mental health treatment in circumstances that are appropriate but should be avoided where it may worsen a patient's status (Koenig, 2007). Clinicians should not involve religion in treatment of patients who do not desire it (Sloan et al., 2000). Provider-patient differences in beliefs are an area of concern because such differences could potentially create strained relationships, transference issues, and even alienation of the patient. However, we emphasize that events such as those noted above represent a miniscule proportion compared with the numerous benefits of religion shown in hundreds of studies.

Although mental health practitioners recognize that religion sometimes causes negative emotions that may lead to increased patient distress, they generally have a positive attitude toward the influence of religion and spirituality on health. Most (93% of 1,144 physicians surveyed) say that it is usually or always appropriate to inquire about the topic (Curlin et al., 2007). For patients who desire it as part of their treatment, and with whom the clinician has compatible beliefs, religion can be an invaluable adjunct to psychiatric care. We are confident that future research will continue to demonstrate the value of religion and spirituality for the treatment of mental health patients.

5.2. Practice of religion and its effect on mental-health.

Psychologists have long been interested in studying the role of religious beliefs in psychological well-being. Within the psychology of health, the practice of religion has a significant effect on happiness and overall sense of personal well-being. The study shows that religious beliefs can shape a person's psychological perception of pain or disability as it creates a mindset that enables the person to relax and allows healing on its own. Those who attend religions services regularly, in their life happiness is greater and

psychological stress is lower. Because religions beliefs and practices contribute substantially to the formation of personal moral criteria and sound moral judgment. And the regular practice of religion encourages such beneficial effects on mental health, such as less depression, higher self-esteem and greater happiness. Religiosity provide hope in despair. The religious practices such as prayer, yoga and meditation have significant effect on psychological well-being and over all functioning of the body.

5.2.1. Protection of psychological well-being during stressful experience by religious belief.

Stress is a normal part of life that every person encounters, chronic stress is linked to both physical and mental problems if left untreated. Untreated chronic stress can result in serious health conditions such as anxiety, insomnia, muscle pain, high blood pressure and a weakened immune system. Stress can also contribute to the development of major illness, such as heart disease, depression and obesity. Depression and anxiety are not directly caused by stressors. The impact of stressors experienced is influenced by the individual's perception of their ability to cope with stressful situations and the strategies they use to address these stressors. When the stressor is viewed as harmful to personal well-being, the person is motivated to apply strategies that reduce the physical and mental impact of the stressor. The outcome of this process, and the health problems that may occur, is determined by the effectiveness of these coping strategies. One such coping mechanism is religion.

Religiousness encourages the development of positive emotions when faced with stressors, such as gratitude or forgiveness, while reducing worry. Again, religiousness may reduce the impact of stressors because of its association with a social support system, increased self-esteem, or a sense of mastery, and these suggest that religion can be used as a coping resource when faced with stressful events. Religiousness provides protection against stressors. Religiousness has been shown to be associated with lower levels of distress, depression, anxiety, helplessness, and perceived stress levels. Thus religion is an essential part of the liver of human being, because, nowadays, stress within an individual is very common which involves a complex interplay of nervous and hormonal reactions to internal and external stimuli. Stress can either be positive (eustress) or negative (distress). It is a natural process and human cannot function without it. Stress management helps people to develop the skills they need to cope or adapt to new situations throughout life. The consequences of chronic stress include increased mental health problems, negative impacts on physical health, and shortened morality. And all these negative sides of mental and physical health can be supersede by religious practices such as meditation. The practice of meditation have been shown to be modestly associated with lower levels of depression, anxiety and negative moods.

5.2.2. Protection of psychological well-being of elders involve in religions belief.

The study attempts to examine the status of psychological well-being of elders aged above sixty and below eighty nine year and the finding indicates that most elders had moderate and above moderate score on self-esteem and autonomy. Moreover, reasonable number of elders had moderate and high score on depression. But the significant difference between males and females in personal meaning in life, autonomy, self esteem and depression scores due to differences in educational level.

But the analysis has yielded that personal meaning in life, spirituality and religious involvement together contributed significantly to the variance in autonomy, self-esteem and depression of the elders. Concerning the positive influence of religion and spirituality, medical professionals and health care provides for the elderly should join hands with religious professionals in providing psychological resources and support for developing a 'Will to live' through personal meaning. Thus the influence of religion, spirituality and personal meaning have special implications for the elderly people.

Thus an understanding of the role of religion and spirituality in the psychological health of elderly people is needed to better treat and work with such populations so that they can prepare themselves long in advance to respond to the challenges of old age. Research shows that religious practices in therapy with clients, who profess such beliefs, can have a positive impact in the therapeutic encounter.

5.2.3. Protection of psychological well-being of disable person involve in religious belief.

'Belief' can be defined as the affirmation or acceptance of a fact, or an opinion accepted as real or true. That is, as 'the attitude we have, roughly, whenever we take something to be the case or regard it as true' (Schwitzgebel 2006)

Many people think that in religions, sickness and disability are seen as punishments for bad behaviour; but at least for the four big world religions, disability has a whole different role.

In Islamic, Christian, Jewish and Buddhist beliefs, disabled people play a very important role within the communities. Disability is not simply a punishment for mistakes but has the purpose to show others – healthier and wealthier people – respect, humility and charity.

From the beginning, Christianity tried to integrate disabled people into society as creatures of God. It is written in the gospels that Jesus used to live among blind, paralysed, and deaf people as well as among epileptics and mentally disabled people. To serve them, to be humble towards them made him greater in the eyes of God.

In Greco-Roman culture, disabled people were under the care of slaves. Christianity ended this; disabled people came in custody of the Christian communities, later in institutions founded by the church.

Orthodox churches display icons of saints. One of them shows the saint Christophorus with a dog's head which signifies a person with a severe birth defect. This icon is a symbol of the view that in a disabled person too lives God.

To help others is also entrenched in the Jewish culture. Jewish people are constrained to support weaker people and to accept them as fellow human beings. Moreover, one should help disabled people to become mostly independent.

In Buddhism, the concept of Karma explains a cause of disabilities. The disabled person receives the Karma of past life. Strictly seen, the disability is the result of committed mistakes in past life.

However, this is not all. Disability also includes the parents, the therapists and cares of the disabled person. For them and other people around the disabled person, the disability offers a chance to develop charity what results into a good karma for next life. The Dalai Lama, leader of the Tibetan Buddhism, sees a lot of potential in disabilities. They help us to lead an unselfish and graciously life.

In Islamic believe, weaker people have an extra position in the eyes of God. They have the right of great support. Allah does not love the proud, says the Koran.

This is equivalent to nobody should be vain to be in a better health or wealth. One should rather thankfully use his/her wealth to support those who have less. This leads to social balance that allows everybody the take part in social life.

5.2.4. Protection of the person suffering from medical illness involve in religious belief.

Most patients don't know the difference between religion and spirituality and tend to understand religion and spirituality as the same thing. There are also beliefs about spirits, spiritual beings or spiritual forces that can induce psychological or even physical harm to people (as in voodoo or witchcraft). Belief in demonic or evil spirits may lead to great distress in patients from spiritual traditions in which such forces are emphasized and where there is belief that people can become inhabited by such spirits. Spiritual practices such as transcendental meditation, mindfulness meditation, healing touch (involving "subtle energies"), acupuncture, may at times be offered to Christian patients as part of alternative or complementary medicine programs. Such

spiritual practices may be presented by practitioners with an almost evangelical zeal to patients who are desperate for help after allopathic medical treatments have failed. Patients from conservative Christian groups may know very little about such practices, which are rooted in Eastern or New Age religious traditions and may directly conflict with their Christian religious beliefs. Health Practitioners not knowledgeable about or insensitive to conservative Christian beliefs may impose these foreign spiritual practices on patients without fully explaining their origins and without providing traditional Christian alternatives more consistent with patients' beliefs (such as prayer, visit with a chaplain, access to religious services or religious literature like the Bible). Devout Muslim patients may likewise be offended when spiritual practices rooted in Eastern or New Age religious traditions are offered to them.

Spirituality or religion can be incorporated into health practice by engaging with and listening to patients (and their families). By acknowledging their beliefs and gaining an understanding of how they relate to their health. Being attentive to clues about spiritual/religious beliefs and practices is a useful starting point for health practitioners. Clues may be comments, actions, possessions or clothing with spiritual/religious significance. Health care staff can ask patients where they get their strength from; who or what supports them in life. These are non-intrusive 'open' questions. Patient's spiritual or religious needs should be documented and all health care team members should understand them. This will enable these needs to be integrated into treatment planning and care. This may include supporting rituals, customs and other valued practices, and/or working in partnership with pastoral care workers/ chaplains or representatives from a patient's religious community. Incorporating spirituality or religion into health care requires the same skills that competent practitioners already use in the delivery of person-centred care. These skills are underpinned by the principles of respect and collaboration. Besides the many positive effects that religion or spirituality may have on health, they can also have negative effects. Believers (and nonbelievers) may experience subtle psychological, social, and spiritual strains related to religious beliefs that distress them, their family, and their support network. Religious beliefs cause patients to forego needed medical care, refuse life-saving procedures, and stop necessary medication, choosing faith instead of medicine. Health Practitioners need to learn to respect the decisions that patients make based on their religious beliefs and not become offended or feel rejected. Instead, they should try to enter into a patient's religious worldview in order to better understand the logic of the decision. Only in this way can the door of communication be kept open between Health Practitioners and the religious patient. Health Practitioners should obtain training in understanding the religious or spiritual issues concerning patient's health in order to address such areas that may be of vital importance to many patients' psychological, social, and physical health.

Conclusion

People express their spirituality in many different ways. Spiritual beliefs can influence the decisions service users make about the treatment they receive or how they want to be supported. Taking the spiritual needs of service users into account can support their recovery and help them live with their mental health problems in the best way for them as individuals.

Encouraging service users to explore what is important to them spiritually can be a valuable self help strategy as people often want to talk about their spirituality.

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BIOLOGY OF THE LOCUST

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Locusts are large herbivorous insects (hexapoda) that can be serious pests of agriculture due to their ability to form dense and highly mobile swarms. They belong to the species of short - horned grasshoppers that periodically form large populations in dense migrating groups (gregarious), where individuals of this group differ in several characteristics from those living separately (solitary).

- **Scientific Classification :** Locusts belong to the order Orthoptera. True locusts belong to the family Acrididae. Grouse, or pygmy, locusts belong to the family Tetrigidae.
- **Only four species of locusts are found in India :** Desert locust (*Schistocerca gregaria*), Migratory locust (*Locusta migratoria*), Bombay locust (*Nomadacris succincta*), and Tree locust (*Anacridium* sp.). Among these, the desert locust is regarded as the most important in India as well as internationally, because of their nature and ability to make ill effect on the economy
- **Locusts are not Grasshoppers :** Locusts and grasshoppers are the same in appearance, but locusts can exist in two different behavioural states (solitary and gregarious), whereas most grasshoppers do not. When the population density is low, locusts behave as individuals, much like grasshoppers. However, when locust population density is high, individuals undergo physiological and behavioural changes, known as Polyphenism, and they form gregariously behaving bands of nymphs or swarms of adults.

Phase Polyphenism change may be accompanied by changes in body shape and colour, and in fertility, physiology and survival in addition to changes in behavior. These changes are so dramatic in some species that the swarming and non – swarming forms were once considered to be different species. The scale of population increase and migrations also distinguish those species known as locusts from grasshoppers.

The distinction between locusts and grasshoppers is often not clear- cut, as the extent to which different species exhibit gregarious phase characters is graded. The migratory locust has all of the features associated with phase change – differences in body shape and colour, fertility and gregarious behavior in both the nymph and adult life stages, forming dense bands and swarms. The plague locust also forms dense nymph bands and adult swarms, but does not exhibit changes in body colour. Spur – throated locust nymphs do not form bands and the adults do not lay eggs gregariously, but they do form dense swarms.

Identifying Male and Female Locusts :

Male – Tip of abdomen smooth and rounded.

Female – Tip of abdomen jagged.

The end of the abdomen of the male locust is rounded due to the sub – genital plate which conceals the reproductive organs.

The end of the abdomen of the female locust appears pointed due to the upper and lower jaws of the ovipositor.

On average, adult male locusts are smaller than adult females of the same species. However, size is not a reliable character to determine the sex of a locust as it varies according to the quality and abundance of food during the nymph stage.

Lifecycle of Desert Locust :

The Desert Locust is one of about twelve species of grasshopper which are able to change their habits and behaviour when their populations become large. When their numbers increase, they become gregarious and migrate in dense groups. These groups are called swarms when they are composed of winged adults, and bands when they consist of the young wingless stages, often called ‘hoppers’.

About 62% of the dry weight of an adult Desert Locust consists of proteins, 17% as fats, and the remainder as inorganic constituents (Si, Cu, Fe, Mn, Na, K, Ca, Mg, Ti, Ni, P, S).

Chitin is the most important constituent of the cuticle or exoskeleton of the Desert Locust. The production of chitin is a continuous process and increases throughout the life of a Desert Locust, varying from about 1.7% (of fresh weight of a locust) during the hopper stage to 2.2% in the young adult and 4% in a two month old adult.

Mating. The male locust mounts the back of the female, applies the tip of his abdomen to hers and passes sperms into her reproductive tract. The sperms are stored in a sperm sac in the female’s abdomen, and as the eggs pass down the oviduct during laying, the sperms are released and so fertilize the eggs. All locusts are hemimetabolous insect.

Eggs. After mating, the female lays her eggs in (an egg pod) warm, moist sand following a rainy spell. She pushes her abdomen down into the sand, extending the membranes between the segments, and burrowing to a depth of 50 or 60 mm. In this burrow, 50 to 100 eggs are laid and mixed with a frothy fluid, which hardens slightly and may help to maintain an air supply round the eggs. In 10 to 20 days depending on temperature and moisture, the eggs hatch and the nymphs make their way to the surface and emerge as ‘hoppers’.

A solitary female lays about 95 – 158 eggs whereas a gregarious female lays usually less than 80 eggs in an egg pod. Females can lay at least three times in their lifetime usually at intervals of about 6 – 11 days. Up to 1,000 egg pods have been found in one square metre.

'Hopper'(nymph):

The eggs hatch within 10 to 20 days depending on temperature and moisture conditions. Afterwards the nymphs move to the ground and hop around as they have no wings. They then undergo the five/six hopper stages, also known as Instars. In each successive stage, the nymphs shed their skin to allow further growth. In addition they grow wing buds, which develop to full wings as they approach adult stage. The locusts spend four to eight weeks in the hopper stages and tend to congregate in bands.

Followings are the brief description of different instars :

| | |
|--------------|---|
| Ist Instar | Newly hatched are white but turns black in 1 – 2 hours. |
| IIInd Instar | Head is larger and pale colour pattern is conspicuous. |
| IIIrd Instar | Two pairs of wing buds projects on each side of thorax. |
| IVth Instar | Colour is conspicuously black and yellow. |
| Vth Instar | Colour is bright yellow with black pattern. |

Fledglings :

According to *Real Science*, due to the softness of their wings, the final molts of the nymphs are not being able to fly, according to *Real Science*. These flightless young adults are known as fledglings and their wings take at least a week or more to harden. During this stage the locusts consume lots of green food to boost wing development and egg production

Adults :

Adult is the final stage of the locust life cycle characterized by massive movement and feeding. The locusts at this level have fully pledged wings and can fly without problem. They tend to swarm together in areas with plenty of green feed and are destructive in gardens. They move in large swarms and migrate to new fields on exhaustion of current feeds. They have a lifespan of at most eight weeks during which they reproduce and die.

Life cycle parameters

| Stages | Egg, Hopper, Adult | |
|---------------|-------------------------------------|---|
| Duration | Egg | 10 - 65 days |
| | Hopper | 24 - 95 days (36 days average) |
| | Adult | 2.5 - 5 months |
| | Laying - fledging | 40 - 50 days |
| | Adult maturation | 3 weeks - 9 months (2 - 4 months average) |
| | Total | 2 – 6 months |
| Larval moults | 5 – 6 (Solitarious), 5 (Gregarious) | |
| Phases | Solitarious, Transiens, Gregarious | |

Environmental Factors on Life Cycle:

When conditions are favourable for reproduction, locust numbers increase and in unfavourable conditions, numbers decrease either by natural mortality or through migration.

For the Desert Locust, favourable conditions for breeding are -

- 1) moist sandy or sand/clay soil to depths of 10 – 15 cm below the surface,
- 2) some bare areas for egg – laying,
- 3) green vegetation for hopper development.

Often favourable conditions may exist in the desert but there are no locusts present. Therefore, the presence of moist soil and green vegetation does not automatically mean that there are locusts around.

Swarming behaviour :

The swarming behaviour of locust raises the important scientific question of how and why locusts collect together by the thousands in order to make a swarm. Insect biologists have long since known that the locust is by nature a recluse and a singleton, not mixing with others in the same group, Yet, when the harvest season arrives, these singletons team up with others as an army of swarms to attack plants for food. What is the mystery? What is the biological mechanism by which this sociological transformation comes about? If we know this mechanism, there can be novel ways of stopping this group rampage.

Stephen Rogers of Cambridge University, U.K. (and University of Sydney, Australia) is an acknowledged world expert in the study of how and why such swarms come about. In one of his papers, way back in 2003, he showed that when solitary locusts happen to come near each other (looking for food) and happen to touch each other, this tactile stimulation, even just in a little area of the back limbs, causes their

behaviour to change. This mechanical stimulation affects a couple of nerves in the animal's body, their behaviour changes, leading to their coming together. And if more locusts come nearby, the crowding starts, and what was once a simple looking insect becomes larger in size and shape, and its colour and morphology changes. In the next paper, his group showed substantial changes in some molecules that modulate the central nervous system of the locust, the most important among them being serotonin, which regulates mood and social behaviour. And putting all these together, they came out with a publication in *Science* in 2009 (<https://science.sciencemag.org/content/325/5>) that serotonin is indeed responsible for swarm formation. In this paper, they did a lab experiment wherein they placed locusts in container one by one, and as the numbers increased, the coming together triggered mechanical (touch) and neurochemical (serotonin) stimulations to make crowding ('gregarisation') occur within a few hours. Interestingly, when they started adding substances that inhibit the production of serotonin (for instance, molecules such as 5HT or AMTP), the crowding was significantly less.

Climate Change and Swarm of Locust

There are two meteorological drivers behind the current locust attack in India; One, unseasonal heavy rains in the main spring-breeding tracts in Arabian peninsula in March-April.

Two strong westerly winds from the Arabian peninsula of India.

According to meteorologists, a differential pattern of warming in the Indian Ocean (Indian-Ocean dipole) may be a trigger.

Stopping swarms:

Now, here is a potential way of stopping swarms from forming. We can work with the LWOs in Jodhpur and other places, spray serotonin inhibitor molecules as the swarm begins to form. Rogers had indeed hinted this in his *Science* paper. Is this possible or a quixotic idea? Let the experts tell us. It is well worth a try.

Finally, the insecticides (mainly malathion) sprayed on the swarms need to be looked at for side – effects. Though many studies have cleared it as not very harmful, we need to work on biopesticides which would be environmentally and animal/human health–friendly, using natural and animal products of India.

There are many reasons as to why it is difficult to successfully combat the Desert Locust. Some of these are:

- 1) The extremely large area (16 – 30 million sq. km) within which locusts can be found
- 2) The remoteness and difficult access of such areas
- 3) The insecurity or lack of safety (such as land mines)

- 4) The limited resources for monitoring and control in some of the affected countries
- 5) The undeveloped basic infrastructure (roads, communications, water and food) in many countries
- 6) The difficulty in maintaining a sufficient number of trained staff and functioning resources during the long periods of recession in which there is little or no locust activity
- 7) Political relations amongst affected countries
- 8) The difficulty in organizing and implementing control operations in which the pesticide must be applied directly onto the locusts
- 9) The difficulty in predicting outbreaks given the lack of periodicity of such incidents and the uncertainty of rainfall in locust areas.

Locust Plagues, Upsurges, and Incursions:

The attack of the desert locust used to occur earlier in phases of plague cycles. India witnessed several locust plagues, upsurges, and incursions in the past. About 12 locust plagues were observed in India till 1962. Since then no locust plagues occurred. Similarly, 13 locust upsurges were recorded from 1964 till 1997. Small scale localized locust breeding have also been reported and controlled during the period 1998, 2002, 2005, 2007 and 2010. This year locust create a huge problem to our farmers.

- Due to the 1926 – 1932 locust plague in India, the British government began research into the Desert Locust. Hem Singh Pruthi (1897 – 1969) is considered as the locust man of India.
- It then led to the establishment, in 1939, of a permanent Locust Warning Organization (LWO), with a station in Karachi (undivided India).
- Its main job was to keep an eye for a specific sub – species of the insect, the desert locust, that sprang into the region from the Thar desert.
- After independence, India established its own centre at Jodhpur, Rajasthan, as a part of the Directorate of Plant Protection Quarantine and Storage, under the Ministry of Agriculture.

Impact of Locust Attack:

- **Affecting Food Security:** If their breeding is coterminous with that of the Kharif crop, then it could well have a detrimental effect on rice, maize and sorghum.
- The Food and Agriculture Organization has warned that the locust attack could lead to a major threat to food security.

- **Affecting Farmers:** This means that locusts not only devour valuable standing crops but can also devastate livelihoods of farmers and those associated with the agricultural supply chain.
- **Affecting Urban Areas:** Due to the recent harvest of Rabi crops, there were no crops in the field, the desert locusts have been invading green spaces in Urban areas.
- Through locusts are unlikely to be a major threat in urban centres, still they can disrupt day to day life.
- Moreover, the effects of locust in urban areas may aggravate, as the national lockdown has made the availability and transportation of pesticide and labour difficult.

Way Forward:

- **Immediate Measure:** A proactive control of locust attack through aerial spraying of the optimum quantity of insecticides in all potential breeding sites, is required, along with continuous monitoring of the crops during the ensuing Kharif season.
- **Need for Systemic Study on locust.**
- **Strengthening Research Framework for Climate Change.**
- **Strengthening Decentralisation.**
- **Regional Cooperation.**

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Ferromagnetic ZnO: Effect of Defects

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Abstract :

Ferromagnetic semiconductor known as dilute magnetic semiconductor (DMS) is the base material of new age spintronics (Spin based electronics) devices. Naturally obtained ZnO is a diamagnetic material but delicate balance of defect states can convert it into ferromagnetic. Initially, theoretically it has been predicted that doped ZnO system can show ferromagnetic ordering. Experimental evidence of ferromagnetism in doped ZnO system has also been reported. Later both theoretical and experimental results indicates that introduction of certain defect states and there careful engineering can generate ferromagnetism in both doped and un-doped ZnO system. Till date the exact origin of observed ferromagnetism in ZnO is debated. In this brief review a comprehensive study of different theoretical predictions related to the origin of the ferromagnetism in doped and un-doped ZnO systems will be presented. Discussion over different methods of defect incorporation in ZnOlike systems and their possible effects in generating ferromagnetic ordering in these system will also be carried out. Different experimental observations of ferromagnetic ordering in doped and un-doped ZnO system will also be discussed.

Introduction :

Dilute magnetic semiconductor (DMS) systems have drawn enormous interest in the scientific community [1-10] in the last decades. This type of material has drawn so much of attention due to their potential of application in spintronic devices like spin-valve transistor, spin-light emitting diodes, non-volatile memory, optical isolator, ultra-fast optical switches etc. Quite substantial amount of work has been done with transition metal (tM) doped III-V semiconductor particularly Mn doped GaAs [6,7]. The highest reported ferromagnetic Curie temperature (TC) in this system is ~ 172 K, which is much lower than room temperature. The euphoria acquired momentum following the prediction by Dietl et al. [11] that magnetically-doped wide band-gap p-type semiconductors particularly in ZnO, GaN, GaAs and ZnTe can show high temperature ferromagnetism (FM). The exact nature of the ferromagnetic coupling of spins in such materials is a matter of debate till date. A good number of new theoretical approaches [11-13] have been developed to describe DMS systems, very often such theories contradict each other in their basic assumptions and final conclusions. On experimental side too, claims and counterclaims of FM in doped or un-doped ZnO are being published frequently [14,15]. However, one important understanding has evolved that lattice defects play crucial role in stabilizing the FM state in DMS systems. It has been observed that some specific type of defects or disorder favors ferromagnetic ordering while the others compete with this and try to destroy it. It has been reported that Zn vacancy (VZn) [16,17],

O vacancy (VO) [18,19] or Zn interstitial (IZn) [20] mediates FM in doped and undoped ZnO system. Another very interesting observation is that the defect species involved in inducing ferromagnetic ordering in one ZnO based DMS system may destroy the same in other [21]. The final and modified band structure of the ZnO host lattice depends on the optimizations of different factors like the site occupied by the dopant atom [17], its size, electronic configuration and defect decoration [22], lattice strain [23], band gap [24] etc. A delicate balance of several defect species is the most important factor for obtaining net ferromagnetic response of the system. The role of extended defects such as grain boundaries (GB) or dislocations in a polycrystalline material is important in this context [5,10]. It has been reported that ferromagnetic behaviour of pure and doped ZnO is controlled by G Band appears only if the grain boundary network (the “ferromagnetic foam”) is quite dense [5]. In this brief review a detailed study of different theoretical development will be discussed. The experimental evidence of ferromagnetic ordering both in doped and un-doped ZnO system will also be enlighten. Interaction of defects to generate FM in this type of materials will also be conferred.

Theoretical Developments :

The euphoria of tM doped ZnO based DMS system begins with the prediction of Dietl et al. [11] that magnetically doped wide band gap p-type semiconductor like ZnO, GaN, GaAs, ZnTe etc. can show room temperature (RT) FM. They have explained the observed FM by an exchange interactions weakly mediated by localised holes. Higher values of TC are predicted for materials containing greater concentrations of holes and magneticians or consisting of lighter elements. B. Sanyal et al. [12] has shown from the ab-initio modelling that Mn doped ZnO system shows ferromagnetic ordering in presence of VZn and antiferromagnetic ordering in absence of VZn. Coey et al. [13] has predicted that the observed FM in tM doped ZnO is not due to the doped ions but the surface defects or the defect reach areas are responsible for the observed FM in this type of systems and the role of doping with tM ions is to assist the local charge transfer necessary to bring the Fermi level up to a maximum in the density of states, and enflame exchange splitting. Straumal et al. [10] has contradicted the prediction of Dietl et al. [11] and predicted that, the doping of bulk ZnO with Mn, Co, Fe or Nidoes not make it ferromagnetic. The nanograined ZnO becomes ferromagnetic even without doping. The presence of grain boundaries is the essential and necessary condition for the FM of doped or un-doped ZnO. According to them the specific area of GBs, sGB has to exceed a certain critical or threshold value sth. The doping of ZnO with Mn, Co, Fe or Ni, indeed, facilitates the transition into a ferromagnetic state and decreases the respective threshold values sth. Also, the addition of few tenths of atom percent of Mn, Co, Fe or Ni drastically increases the saturation magnetization. Earlier Straumal et al. [5] predicted that crystalline ZnO grains are nonmagnetic and surrounded by a FM foam like GB network. Sluiter et al. [25] has reported from the first-principles electronic structure of tM-substituted ZnO, that hybridization based superexchange,

double exchange are responsible for the short- and long-ranged magnetic interactions in DMS. They further argued that long-range interactions necessary for FM in DMSs can be mediated by defect induced states. It has been shown theoretically that Co has the best potential as a Zn substitutional dopant in ZnO for producing DMS when combined with a hole dopant such as Li substituted at Zn site (LiZn) or an electron dopant such as Cu substituted at Zn site (CuZn) or IZn. There are also reports show from electronic structure that the general condition conducive to dopant-donor/acceptor hybridization at the Fermi level, and hence to high-TCFM, are approximately thermo-neutral dopant–defect resonances energetic proximity of the reduced or oxidized dopant to the semiconductor band structure. Behan et al. [14] proposed that there are two distinct mechanisms that can give rise to RTFM in doped ZnO: magnetic polarons and carrier-mediated exchange. These two mechanisms give rise to Dilute Magnetic Insulators (DMI) and DMS behaviour respectively. Coey et al. [13] have analysed the high-temperature FM in dilute magnetic oxides in terms of a model of indirect exchange via shallow donors, treated in a two-sublattice mean-field approximation. High TC require hybridization and charge transfer from a donor-derived impurity band to unoccupied 3d states at the Fermi level.

From the above discussion it can be observed that different theoretical views have emerged to explain the observed ferromagnetism in the doped or un-doped ZnO systems. Very often one view contradicts with another. But most interestingly most of these theoretical views supports defect mediated ferromagnetism in these type of systems.

Methods of Defect Generation :

Defect can be incorporated into the material both intrinsically and extrinsically. Self-interstitial or vacancy type defects are intrinsic and can be formed naturally in the sample. However, defect generation can also be possible by some external processes. Controlled incorporation of defect can be possible by high temperature annealing, substitution, mechanical milling and irradiation by energetic particles. The first three techniques are the processes of generation of equilibrium defect configuration (from requirement of the free energy minimization) in the system, whereas fourth one namely energetic ion beam irradiation is a very efficient technique to introduce non-equilibrium defect states in solid materials.

There are a number of techniques through which probing and characterizations of defects can be possible very efficiently. Positron annihilation spectroscopy (PAS) is one of the leading and efficient techniques among them. It is a non-destructive nuclear solid state technique. Using PAS, one can study the electronic structure, defect properties, electron density distribution (EDD) and electron momentum distribution (EMD) in materials, e.g., metals, alloys, ceramic, oxides, polymers, superconductors, magnetic materials, semiconductors, nanocrystalline materials etc. The three main operations of PAS are

- i) Positron Annihilation Lifetime (PAL) Spectroscopy, used to understand the EDD inside the sample.
- ii) Coincidence Doppler broadening of positron annihilation radiation line shape (CDBPARL) measurement, very efficiently probes the EMD inside the material under investigation.
- iii) Angular correlation of annihilation radiation spectroscopy is used for better understanding of the EMD in a material.

It is possible that high-density point defects affect the band structure of the materials. Hence, optical parameters can be related with the defects or disorder present in the system. So, defect characterization is possible through optical spectroscopy also. In real experiments, exponential dependence of optical absorption edge is observed and it is a well-known characteristic of crystalline and amorphous semiconductors as well as insulators. Commonly, it is known as band tailing effect. From the tailing of band one can estimate the degree of disorder is associated with strains, dislocations, lattice imperfections, defects and the effect of grain surface of the system.

Photoluminescence (PL) measurement is another very efficient optical technique for characterizations of defect states in semiconducting materials. When different defect states are introduced into the material, they create different deep and/or shallow donor and/or acceptor energy levels within energy band gap. Electrons in the ground states are excited with a suitable excitation from some laser source. These excited electrons make transitions between these levels and between the defect levels and excitonic levels. These different transitions give rise to different defect level emission bands in PL spectrum. Careful analysis of these defect level emission bands provide a clear picture of the different defect states within the material.

Detailed discussion on the incorporation, characterization and defect property interrelation is beyond the scope of this article and one can consult the reference [2] and the references therein for the same.

Experimental Developments:

Prediction of Dietl et al. [11] that tM doped ZnO can show FM with TC higher than RT instigates the experimentalists to realize the ferromagnetic ZnO in reality. P. Sharma et al. [1] probably the first to obtain the ferromagnetic ordering with curie temperatures well above 425 K in uniform and homogeneous Mn doped ZnO bulk ceramics. According to them

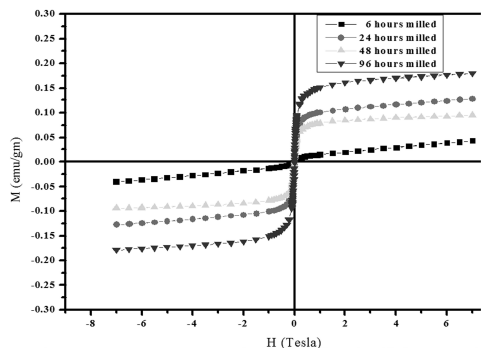


Figure-1: Room temperature Hysteresis loop of differently milled 2 at% Mn d.

Mn simply substitutes for Zn in the basic structure and is in a +2 valence state. Such a capability to produce RT ferromagnetic powder, pellets, as well as transparent thin films of Mn-doped ZnO. Series of experimental results have been published after that showing ferromagnetic [1-4, 8, 9, 12, 14, 16-20, 26] behaviour of tM doped ZnO. Though there are few reports showing absence of ferromagnetism in tM doped ZnO [15], there are also reports of ferromagnetism in un-doped ZnO [3,16]. Ramachandran et al.[18] has reported low and RT ferromagnetic ordering in pulse LASER deposited epitaxial single crystal of ZnMnO sample with higher carrier concentration but absent FM at RT even in low temperature has also been observed in samples with lower carrier concentration. They have predicted that the observed FM is either carrier mediated or VO type defect mediated. VO mediated ferromagnetic ordering has also been predicted by Hakeem et al [19]. He has prepared Mn doped ZnO powder sample using solid state sintering method by annealing the sample at 5000 C and 6000 C and found that ferromagnetic response decreases for samples annealed at higher temperature due to decrease of defects and concluded that the defects playing the key role in stabilizing the ferromagnetic ordering in this type of samples. To explain the observed low value of saturation magnetisation it has been proposed that strong anti-ferromagnetic coupling is also present in this type of samples along with the ferromagnetic coupling. Presence of anti-ferromagnetic coupling along with the ferromagnetic coupling has also been suggested by Neogi et al. [27]. Schwartz et al. has suggested IZn mediated double exchange type mechanism is responsible in Co doped ZnO thin films. Yan et al. [17] reports ferromagnetic ordering in Mn doped ZnO thin film prepared through MOCVD with TC above room temperature. They relate the observed FM with formation MnZn (Substitution of Zn by Mn) and VZn type defect complex. Khalid et al. [16] also reports VZn mediated ferromagnetic ordering in pure ZnO. Chattopadhyay et al. [4] has found room temperature ferromagnetism in 2 at% Mn doped ZnO powder sample prepared through solid state sintering method using milling through different time with intermediate sintering. Clear Hysteresis loop has been observed in all the samples as shown in figure – 1. Using the positron annihilation lifetime spectroscopy data it has been shown very clearly that the remanent magnetization and saturation magnetization vary quite similarly as the average lifetime of positron (τ_{av}) (figure – 2). The τ_{av} is proportional to the concentration of the average defective states in the sample [2]. Hence the remanent magnetization and saturation magnetization varies exactly in the same manner as the average concentration of the defective states. Ghosh et al. [3] reports ferromagnetic ordering in 17 hours milled and differently annealed high

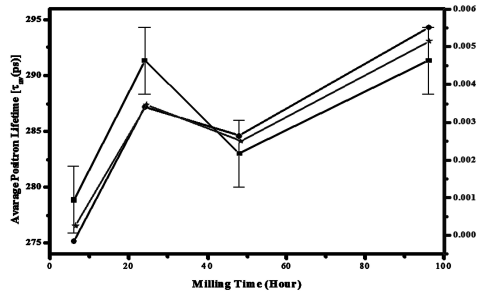


Figure-2: Variation of average positron life time (τ_{av}), Remanent Magnetization and Saturation M_s with milling time of 2 at% Mn doped ZnO

temperature ferromagnetic ordering in pulse LASER deposited epitaxial single crystal of ZnMnO sample with higher carrier concentration but absent FM at RT even in low temperature has also been observed in samples with lower carrier concentration. They have predicted that the observed FM is either carrier mediated or VO type defect mediated. VO mediated ferromagnetic ordering has also been predicted by Hakeem et al [19]. He has prepared Mn doped ZnO powder sample using solid state sintering method by annealing the sample at 5000 C and 6000 C and found that ferromagnetic response decreases for samples annealed at higher temperature due to decrease of defects and concluded that the defects playing the key role in stabilizing the ferromagnetic ordering in this type of samples. To explain the observed low value of saturation magnetisation it has been proposed that strong anti-ferromagnetic coupling is also present in this type of samples along with the ferromagnetic coupling. Presence of anti-ferromagnetic coupling along with the ferromagnetic coupling has also been suggested by Neogi et al. [27]. Schwartz et al. has suggested IZn mediated double exchange type mechanism is responsible in Co doped ZnO thin films. Yan et al. [17] reports ferromagnetic ordering in Mn doped ZnO thin film prepared through MOCVD with TC above room temperature. They relate the observed FM with formation MnZn (Substitution of Zn by Mn) and VZn type defect complex. Khalid et al. [16] also reports VZn mediated ferromagnetic ordering in pure ZnO. Chattopadhyay et al. [4] has found room temperature ferromagnetism in 2 at% Mn doped ZnO powder sample prepared through solid state sintering method using milling through different time with intermediate sintering. Clear Hysteresis loop has been observed in all the samples as shown in figure – 1. Using the positron annihilation lifetime spectroscopy data it has been shown very clearly that the remanent magnetization and saturation magnetization vary quite similarly as the average lifetime of positron (τ_{av}) (figure – 2). The τ_{av} is proportional to the concentration of the average defective states in the sample [2]. Hence the remanent magnetization and saturation magnetization varies exactly in the same manner as the average concentration of the defective states. Ghosh et al. [3] reports ferromagnetic ordering in 17 hours milled and differently annealed high

purity ZnO powder sample. Ghosh et al. [3] has reported RTFM in pure ZnO powder sample prepared by mechanically milled the sample for 17 hours and the annealed at different temperature. It has been shown clearly (figure – 3) that saturation magnetization has been increase linearly with increase of surface to volume ratio (1/D). Increase of surface to volume ratio is an indication of increase of grain boundary defects [2]. Hence the grain boundary defects are predicted responsible for the observed FM in this type of sample. Ion beam

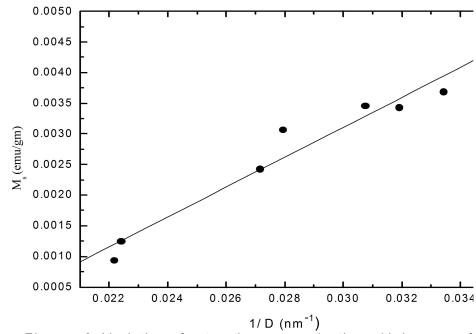


Figure - 3: Variation of saturation magnetization with inverse of

irradiation induced RTFM has been reported ZnO when irradiated with As and Cr ions while no FM observed when irradiated Ar ions [28]. They have concluded that the observed FM is mediated by the large grain boundary defects. Mal et al. [29] has also found ferromagnetic ordering in Ag irradiated un-doped ZnO and attributed the observed FM to the VZn type defects which gives rise to magnetic moments and VO type defects forming bound magnetic polarons couples these magnetic moments leading to long range magnetic ordering. Ferromagnetic ordering has also been reported in Co implanted ZnO thin film. They have also reports increase in ferromagnetic ordering with increase of irradiation dose. The observed ferromagnetism has been attributed to the Co substitution in Zn site.

Summary:

In summary it can be said that the diamagnetic ZnO can be converted into ferromagnetic material. The origin of observed ferromagnetism is still debated. But one thing has been evolved conclusively that the ferromagnetic ordering is mediated by the incorporated defect states. Manly highly defective foam like grain boundary possibly the main source of observed FM. It has also observed that different type of defects probe ferromagnetic ordering in different environment. The exact mechanism of ferromagnetic ordering and exact defect state required for it still under intense debate. In future details in depth study of these systems is required to conclude the debate.

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PRODUCTION OF A POSSIBLE ANTITUBERCULAR AGENT FROM THE MICROBES ISOLATED FROM SUNDARBAN ESTUARY

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Abstract :

A marine Actinobacterium isolated from the Sundarbans region (India) showed potent activity against Mycobacterium sp. Classical biochemical and morphological data analysis shows the producer belongs to Actinobacterium genus. Scale up of the production in a 2.5 L bioreactor shows that maximum amount of antimicrobial activity against Mycobacteria sp. is obtained in 48 hrs.

Introduction :

Marine microorganisms are recognized as potential sources of novel bioactive compounds (Sponga et al., 1999). With the emergence of multiple drug resistant (MDR) bacterial infections, there is a pressing need to develop new antimicrobial agents (Weber et al., 2003) and novel antibiotics from marine bacteria are attracting attention (Feling et al., 2003). The Sundarbans lies on the delta of the Ganges, Brahmaputra and Meghna rivers on the Bay of Bengal and is the world's largest tidal mangrove forest. It is the smallest of the 37 wilderness areas that represent 46% of the Earth's land surface, but are populated by just 2.4% of the world's population. This makes this region ideally suitable for bioprospecting. The biotechnological applications of the microbial biodiversity of the Sundarbans remained unexplored until we, for the first time, reported the production and purification of an antimicrobial compound as well as the taxonomy of the producer isolated from the marine environment of the Sundarbans (Saha et al., 2004). This paper describes the isolation of a marine Actinobacterium from the Soznehkhal Island of the Sundarbans in the Bay of Bengal. The extracellular antimicrobial activity has been studied, a molecular phylogenetic analysis performed and the bioprocess scaled up in a 2.51 bioreactor.

Materials and Methods :

Microorganism: Isolate MS310 was obtained from the sediments of the Soznehkhal Island (Lat. 2207/ N, Long. 88050/ E) of the Sunderbans at a depth of about 3 m. It was isolated in an enrichment medium (all units in g/l-1, K₂HPO₄ 0.5, casein 3.0, starch 10.0, peptone 1.0, yeast extract 1.0, malt extract 10.0, agar 15.0, dist. water 500 ml, natural seawater 500 ml, pH 7.5) and designated as isolate MS 310. **Antimicrobial activity:** Antibacterial activity were tested against non-pathogenic bacteria and fungi as well as against pathogenic bacteria (obtained from the Peerless Hospital & B. K. Roy Research Center, Kolkata) indicated in Table 1. Antimicrobial activity was tested by the cup-plate method after growing MS310 in the production medium: (all units g l⁻¹) starch 2.0, glucose 2.0, soybean meal 2.0, yeast extract 0.5, NaCl 0.25, CaCO₃ 0.32, CuSO₄ 0.005, MnCl₂ 0.005, ZnSO₄

0.005, pH 7.2, dist. water 1000 ml for 96 hours. The test organisms (Table 1) were swabbed onto the surface of the appropriate bacterial solid medium and incubated at the suitable growth temperature. The determinations were performed at least thrice and the averages of the values are reported. The nutritional requirements of the microorganism were studied in shake flasks. Already reported media (Okami et al, 1976) were first chosen to select the suitable production medium, which gives maximum production of the antibiotic lead compound. As this microorganism is a marine isolate, the effect of natural seawater and sodium chloride on antibiotic production was studied. Glucose, a rapidly utilized carbon source, two slowly utilized carbon sources lactose and maltose and other carbon sources such as glycerol, sorbitol, sodium citrate and sodium acetate were tested to select the carbon source which gives maximum production of the antibiotic lead compound. In the same way, different nitrogen sources (yeast extract, soybean meal, wheat gluten, ammonium sulphate) were tested to determine the best nitrogen source. Effects of trace elements like (Ca⁺², Mn⁺², Zn⁺², Cu⁺²) were also studied. The production medium was designed based on the results obtained.

The level of antifoam and inoculum were also determined. For efficient running of the bioreactor a “scale down” study was performed in shake flasks containing different volumes of the fermentation medium (hence varied aeration regimes) and changes in medium pH, glucose concentration and antibiotic production were monitored at different time intervals. In this way optimal process conditions were selected. In all the experiments, the isolate MS 310 was cultivated in a shaker (200rpm) at 30°C. The determinations were done at least thrice and the averages of the values reported. *S. aureus* was used as the test microorganism. Identification of the producer microorganism: Identification of actinomycetes to genus level was conducted by first using morphological and molecular approach according to the guide described in Bergery's Manual of Determinative Bacteriology [Holt et al. 1994]. Cells on the cover slips were examined using a light microscope for the description of morphological properties.

Isolation and Purification:

The antimicrobial substance was isolated by cultivating MS310 in 8 l of the production medium (all units in g l⁻¹), glucose 4.0, yeast extract 2.25, CaCO₃ 0.64, CuSO₄ 0.005, natural sea water 500 ml dist. water 500 ml pH 7.2. The pH of the culture filtrate was decreased to 4.5, extracted with butyl acetate (3:1), the extract dissolved in methanol and stored at 0-4°C. The extract was applied to a silica gel column using the mobile phase petroleum ether-ethyl acetate solvent system (30:70) The active fractions were pooled, dried under vacuum to yield a brownish gum and applied to a semi preparative reverse phase HPLC (Shimadzu SPD 6AV) C18 column (length 32.5 cm, diameter 1.11 cm), mobile phase pure methanol (HPLC grade, SRL, Mumbai, India), UV detection at 442.6. The eluates with retention time of 3.618 min were pooled, dried and tested against *S. aureus*. The determinations were repeated to check the reproducibility. Scale-up of the process in a bioreactor:

The experiments in the shake flasks were scaled up in the Eylea MBF bioreactor (Tokyo Rikakikai, Japan), working volume 2.0l. The aeration rates, shaft speed, configuration of bioreactor were changed in order to identify the best operating condition. The temperature, pH and dissolved oxygen concentration were monitored with appropriate sensors. The pH was maintained constant by the operation of the pH controller and the aeration rate was altered manually. For every cultivation, 10 ml suspension of substrate and aerial mycelia was used as the inoculum. In the shake flasks were scaled up in the Eylea MBF bioreactor (Tokyo Rikakikai, Japan), working volume 2.0l. The aeration rates, shaft speed, configuration of bioreactor were changed in order to identify the best operating condition. The temperature, pH and dissolved oxygen concentration were monitored with appropriate sensors. The pH was maintained constant by the operation of the pH controller and the aeration rate was altered manually. For every cultivation, 10 ml suspension of substrate and aerial mycelia was used as the inoculum.

Off-Line Analysis:

The supernatant obtained from samples was tested for antimicrobial activity against *S. aureus* and residual glucose (by reaction with dinitrosalicylic acid). All the determinations were performed at least thrice and the average of the determinations reported.

Results and Discussion

Antibiotic activity profile of the isolate MS310:

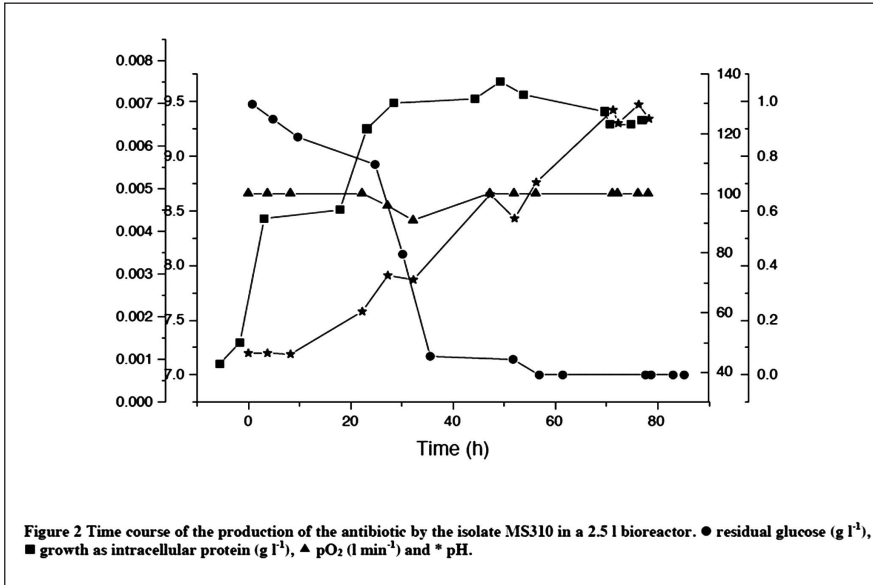
| Name of Strain | Resistant to Antibiotics | Diameter of Zone of Inhibition (mm) |
|--|--------------------------|-------------------------------------|
| Bacillus Pumilis (MTCC1607) | NA | 29 |
| Bacillus Subtilis (MTCC 441) | NA | 16 |
| Lactobacillus Lactis (MTCC 3038) | NA | 17 |
| Staphylococcus Aureus (MTCC 96) | NA | 30 |
| Mycobacterium Smegmatis (MTCC06) | NA | 35 |
| Micrococcus Leteus (MTCC 106) | NA | 32 |
| Arthrobacterprotophormae (MTCC 2682) | NA | 28 |
| Methicillin Sensitive Staphylococcus Aureus I (extract) | NA | 29 |
| Methicillin Sensitive Staphylococcus Aureus II (extract) | NA | 29 |

| Name of Strain | Resistant to Antibiotics | Diameter of Zone of Inhibition (mm) |
|---|---|-------------------------------------|
| Methicillin Resistant Staphylococcus Aureus III (extract) | Resistant to: Augmentin, Cefotaxime, Ceftazidine, Oxacillin, Cefoparazene, Cefuroxime, Piperacillin | 33 |
| Pseudomonas aeruginosa (MTCC 2453) (extract) | NA | 29 |
| Escherichia Coli 1 (extract) | Ampicillin, Amoxycillin, Kanamycin, Norfloxacin, Ceforaxin, Cotrimoxazole, Cephalexin, Ciprofloxacin, Nalidixic Acid, Ceflotaxine, Ofloxacin, Doxycyclin) | 23 |
| Escherichia Coli 2 (extract) | Ampicillin, Amoxycillin, Ceforaxin, Nalidixic Acid, Cotrimoxazole) | 24 |
| E. coli (MTCC 2939) (extract) | NA | 30 |
| Klebsiella pneumoniae (MTCC 618) (extract) | NA | 24 |

Table: 1 Profile of the antibiotic activity against non-pathogenic and pathogenic Bacteria

Scale up in the Bioreactor :

For further propagation of these results, it is necessary to select a medium for optimal production of the antibiotic lead compound. The Composition of Optimal Production Medium (OPM) is (all units g l⁻¹) glucose 4.0, yeast extract 2.25, CaCO₃ 0.64, CuSO₄ 0.005, natural sea water 500 ml, dist. water 500ml, pH 7.2. Figure XX shows the results of the best process operated at Aeration Initially 0.5 vvm for 8.25 hrs, then 0.75 vvm for 39 hrs and again 0.625 vvm for 31 hrs. (sparger was used, Agitation 100 rpm, Baffle was not used. Maximum antibiotic activity (39 mm diameter of zone of inhibition) was obtained against S. aureus.



This figure shows the maximum antibiotic production occurs after 48 hrs. when the glucose has been consumed and the isolate enters the stationary phase of growth. Antibiotic synthesis requires an air saturation of around 100% the medium.

CONCLUSION

Tuberculosis is a unique serious disease in that unlike other diseases associated with AIDS, it may be spread by airborne transmission to adults and children who are not at risk of AIDS. The risk of developing tuberculosis among AIDS patients is over 100 times higher than among normal individuals. (CDC and ACET report USA 1989). Evidence arising out of the antibacterial activity against Mycobacterium, the molecular phylogenetic analysis and antibiotic synthesis by the marine isolate MS310 in the presence of NaCl show that the marine environment clearly holds an enormous potential for providing new leads for the development of antitubercular agents. The identification of new structural classes active against M. tuberculosis will provide undescribed mechanisms of action and better treatments for resistant strains. (Khalid et al. 2000). Therefore, elucidation of the molecular structure is planned for the future.

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Śabara – Nishāda - Pulinḍa, the Forest People in Early India

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The forest was seen in multiple ways, and historical changes altered the focus. When the demands of civilization began to impinge on the forest, the perceptions of the forest and its people also changed. Scholars have largely tended to look at forest as a space for exile, asramas, hunt, state control, resource exploitation etc. While delving in these, forest people were talked about and they became an important part. Thus, in spite of voluminous literature on forest and their perception in texts and other sources, there remained a scope to focus wholeheartedly on the kinds of people that were a part and parcel of the forests. Directly and indirectly, we are linked with the forest life. From the ancient time, forest and forest people indirectly helped us in the progress of our civilization and their debt and inner bond with us. In this perspective we may discuss the lifestyle of forest people like Śabarās, Nishādas and Pulinḍas and changing perceptions of forest and forest people from ancient to early medieval period.

Keywords: Āṭvikas, Daṇḍkāraṇya, aranyachara, Śabarās, Paṛṇa Śabari, Pulinḍas, Nishādas, Parivrajākas and Uchchakalpas, Vindhvasini.

History is a record of human probabilities, causal and effectual impacts of human activity. A historian has been using history as a mirror to guide us in shaping the future¹. Posed with problems in the present we are inclined and eager to probe the past. At terrible environmental crises relating to forests, wild life and floral habitation, the question arises as to how the ancient forest dwellers linked themselves with nature and what relationship they had struck with the state. Directly and indirectly we are linked with the forest life. From the ancient time, forest and forest people indirectly helped us in the progress of our civilization and their debt and inner bond with us. In this perspective I try to discuss the changing perception of forest and forest people from ancient to early medieval period and their relation with state power and also the common people.

Through this essay I want to explore the lifestyle and habitation of some group of forest people (Śabara, Pulinḍa, Nishāda) in ancient India and how they influenced the state power or common society through their extraordinary skills, physical prowess, medicinal knowledge and environmental concepts. Undoubtedly, this is very important in our present situation.

In 'Perceiving the forest', Thapar brings to the table a clear historical perspective that refines how textual references to the forest can be seen as part of a continuum as well as a part of change in terms of the forest and its inhabitants. There are four major ideas that Thapar's articulates : i) an initial fear of the forest. ii) the forest as a site for exile, conquest and hunt iii) as a zone for setting up asramas and iv) as a target for continual state intervention and control².

In ancient India where the king was the source of total power, we found some people living in the boundary of the state or in the wild track. Kauṭilya identified them as 'Aṭavika'. They lived in the forest and their socio economic life was deeply associated with forest. Sometimes, they enjoyed autonomy in their sphere. Mainly these forest people or Āṭavikas were Śabara, Pulinḍa, Nishāda, Kirāta etc. Some people were also very much associated with forest but they are not identified as Aṭavika, like Lubdhak, Bāgurika, Swagani, Chanḍāl, Uthpathik. Etc.

According to Patrick Olivell, the term Aṭavi is often used metonymically with reference to tribal people living in the remote forest areas. Here they appear to be at same level in the service of the state. It is unclear whether they are simply tribals recruited for this purpose or actual state employees who are forest wanderers³. The Sanskrit works refer Rakkshas, Yaskha and Kinnar, Pulinḍa, Śabara, Nishāda or Bhil, Kirāta, repeatedly. In most case, the Sanskrit scholars have used these words synonymously. Most of them were residents of forests and their daily existence was linked to the forest. Here I select four types of forest people who are identified as a Aṭavika. They are Śabara, Pulinḍa, Nishāda and Kirāta etc.

In Sanskrit the term Śabara means a corpse. Cunningham has traced the origin of the term Śavara from the Scythian word Sagari meaning an axe⁴. Shyam Shastry, however, translates the terms Śabara and Pulinḍa as occurring in the Arthasāstra as archer and hunter, respectively⁵. It may be presumed that the people who were in the habit of always carrying axes came to be called Śavaras or Śabara. Even today a Śabara man can hardly be noticed without an axe in his possession⁶. Besides, Sava means dead body, and Savara or Śabara may consequently denote a carrier of the dead body, implying thereby perhaps their evil and ignoble occupation⁷.

The Aitareya Brāhmaṇa (8th to 5th century B.C.E) has traditionally accounted the origin of Śabara and other similar tribes. It describes the Śaoras as the descendants of the eldest sons of Viśvāmitra. They were cursed to become the progeny of the most abject races such as the Āndhras, the Punḍras, the Śabarās, the Pulinḍas and the Mutibas⁸. The Rāmāyaṇa also confirms them to be of non-Āryan origin⁹. From Arthasastra we come to know that interior of the kingdom shall be watched by trap-keepers (vāgurika), archers (Śabara), hunters (Pulinḍa), chandālas, and wild group of peoples (aranyachara)¹⁰. According to Kauṭilya, Sabaras were the successors of Sudra men and Villi women¹¹.

Regarding the location of the Śabara people, various information are provided by literary accounts of ancient India and foreign writers. Megāsthenes, Pliny and Ptolemy have provided reference to their habitats. From their accounts it appears that the Śabara were originally settled near the Indus during the times of the Mauryas¹². Cunningham observes that it places the Saoras to the south-west of the Gangetic delta and at a short distance from the sea-coast¹³. Yule considers

that the Saoras must have been further north in Dosarene, towards the territory of Sambalpur which produced the finest diamonds in the world. In the Epics, they are seen to be dwelling in the territory to the south of the Danḍaka forest (near modern Ganjam district)¹⁴. In the Purāṇas they have been mentioned as dwellers of the Vindhya range¹⁵ while the Brihat Saṃhita has referred to them as occupying the western¹⁶ region as well. We got evidence from Harshacharita¹⁷ and Kādambārī¹⁸ by Bānbhatta the Śabarās group of people lived in the Vindhya forest. Kāthāsaritsāgār also gives the same information¹⁹. The Matsya Purāna includes among the *Dakṣiṇa-patha-janapadas* those of the Aīśkas, the Āṭavikas, the Śabarās, the Pulinḍas and the rest.²⁰ According to all evidences the Śabarās had moved from South India and spread out to Vindhya region, central and south eastern region of India.

The Bṛhatasaṃhitā (4th to 5th century C. E) has some notice of Śabarās confirming, on the whole, the statements in the Rāmāyaṇa that they were found in the southern regions and in Central India. The western and South-eastern homes of the Śabarās and the Nishadas, together with the habitat of a particular branch of the Śabarās called the 'Nagna-Paṃa- Śabarās', are given in the Bṛhatasaṃhitā. The same expression Nagna-paṃa-Śavara occurs also in the Markandeya-purana²¹. Bṛhatasaṃhitā refers to two branches of the well known Śabara people as Nagna Sabara (the naked Śabarās) and Paṃa Śabara (the leaf – clad Sabara). It is interesting to note that there is a Buddhist deity called Paṃa Śabarī, apparently named after the Paṃa Śabarās. We got the name of Buddhist god as Sabarī and Paṃa Śabarī²², the worship of Paṃa Śabarī, it is believed, is effective in preventing out-breaks of epidemics.

Mahābhārata provides us with lots of information about Śabara, their origin, socio economic life, religious life etc. From Ādi Parba we come to know that Śabarās were born from the dung and urine of Nandinī, the cow of Vasiṣṭha, which reflect their lower position in society. From Aswamedhikā Parba we get the another view of the origin of Śabara. Here we come to know many Kṣatriyas lived for many years hidden in caves for fear of Paraśurāma, and as they had no association with Kṣatriyas during the period, they became Śabarās.

Śabara is not only a group of people but also a territory of these specific people. But they don't have more social dignity because Sabara was representing here with the Śudra, Robbers etc. But Barāhamihira tried to make the Śabarās and Pulinḍas aware through his predictions on natural calamities like heavy rains etc.

In the Amarakosha (Sudravarga) there is an expression : Kirāta-Śabarah-Pulinḍas-Mlechchhatayah. It is thus evident that the Sabarās have been allies with the Kirātas, the Pulinḍas and other tribes, and that they have been classified as Mlechchhas.

It is said in Nāṭyashastra that women of inferior birth and the Pulinda and the Śabara tribes are to have gaits natural to their community²³. Śabara refers to one of the seven “minor dialects” (*vibhāṣa*) of language used in dramatic composition (*nāṭya*)²⁴.

There are admirable sketches of the Śabarās from the pen of Bānabhaṭṭa. He describes the Śabarās who lived in the forests of the Vindhya. Bānabhaṭṭa in his prose Kādambarī gives a description of this group, who were moving in a forest in a day to day hunting activity. He very precisely describes the life style of forest dwelling communities mainly Śabarās and Pulindaś in his texts²⁵.

We get various information of the lifestyle of Śabarās. They live a life devoid of knowledge. They do not take any formal education or they have no interest in the knowledge. Their lifestyle is condemned by the wise men. Human sacrifice to the god is their religious activity. They eat flesh, honey etc, which is forbidden in the civilized society. Their physical exercise is hunting. Their religious texts are the cry of jackals²⁶. They decide good and evil from the voice of owls. They propitiate their gods with the animal blood and offer the flesh. Their intelligence lies in understanding the nature of the birds. Their inmates are the dogs²⁷. Their kingdom is the lonely forest. Their friends are the bows which impart the cruel deeds. Their supporters are the poison tipped snake like arrow. Their songs are those which attract to captivate the deer. Their wives are those women who have been captured. They live with the cruel animals like tiger. Their ornaments are the jewels of cobras. They used to decorate themselves with ornaments of fruits and seeds. They used to tie hair in a top knot. They use the elephant juice as body lotion and used sandalwood dust as powder. Drinking together is their festival. They uproot and destroy the forests where they live²⁸. They collected hair and skin of deer and elephant tusks, lion skin, feather of peacock, venomous teeth of snake, and also fruit and roots from forest. This is clear that the life style of the Śabarās is not appreciated by the upper strata of society. But Harshacharita portrays Śabarās as living in a settled society within the forest.

In the last chapter of Harshacharita Bānabhaṭṭa gives a heroic description of a Śabara boy²⁹, named Nirghata. On the other hand we get another heroic description of one of the Śabara leaders, named Mataṅga in Kādambarī³⁰.

We get various type of stories of Śabara in Kathāsaritsāgara. (c. 10th to 11th Century A. D) The story of Śridutta and Mrigankabati represents a concoction of royal blood and forest people. Here a Śabara leader took an important part in the internal affair of a royal family³¹.

The Śabarās were extremely religious, and their religious beliefs and practices are similar to those of other kindred tribes. They were in the habit of worshipping various deities like Durga and Chaṇḍika. In the Kathāsaritsāgara we have got the reference of devi Chandikāi various stories. In this connection, a particular reference may be made to the great deity Vindhyaśini, the mountain goddess of the Vindhyan region.

The Pulindas were an ancient tribe of India, likely resident in the environs of the Vindhya Range of Central India³². The Rock Edicts of Ashoka (269 BCE – 231 BCE) mention the Pulindas, their capital Pulinda-nagara, and their neighboring tribes, based on which their capital is sometimes located in present-day Jabalpur District of Madhya Pradesh state³³. Though debated, it has been hypothesized that Pulindas may have been the word from which modern-day Bundelkhand derives its name.

Though clearly associated with the Vindhyan region, the Pulindas are sometimes believed to have had multiple tribal branches that ranged up to the Himalayan region and Assam³⁴. In the Himalayan region, ancient Indian literature often mentions them in conjunction with the Kirātas³⁵.

The names Pulinda and Śabara, in particular, seem to have become generic names for barbarian tribes. The Ptolemy uses the curious expression ‘agriphagoi’, the eaters of wild things, in describing the Pulinda, and locates them to the east of Mālava. The Pulinda may have migrated from the Mathurā region to the Vindhyas for the same reasons as did the Kirātas. They too are described as being dwarf-sized, black in complexion like burnt tree-trunks and living in the forest caves.

One of the Parivrajaka king Mahārājā Hastin governing the kingdom of Dabhālā, or Dahālā, which had come to him by inheritance, together with all the country included in the eighteen forest kingdoms (āshtādaś-ātavi-rājya)³⁶. Dabhālā, or Dahālā, are undoubtedly the older form of Dāhala, Dāhāla, Dahalā or Dahala, which seem to represent the modern Bundelkhanda, and which was in later times a province of the Haihayas or Kalachuris of Tripura near Jabalpur.

Till now, these eighteen forest kingdoms are not properly identified. Probably these forest kingdoms were a tribal state because we get another evidence from the Navagrama Copper plate inscription of Mahārāja Hastin, the year of 198 where the reference to ‘*Pulinda-rāja-rāshṭra*’³⁷. The present inscription indicates that the domination of the chief of the Pulinda must be located within the territory of the *nripati* Parivrajaka family, and is probably the region which comprised the northern slopes of the Vindhya range.

We get Pulinda troupe in the Kādambarī. The well-known story of Jimutavahana in the Kathāsaritsāgara (Taraṅga XXII) mentions a gang of robbers who were foresters and one of whom was the Śabara chief Pulindaka. It is also indicated here that when the beautiful lady of Pulindas came to Pampa River for bathing then the water of the river became white by the sandalwood dust used by them.

The term Nishādas has been derived from ‘*Nishida*’ meaning ‘sit down’. In other words, the term perhaps implies the meaning of ‘settled down’. This contention is supported by its derivative meaning as well, ni (down) and sad (settle)³⁸. The Nishādas are first named in the Rudrādhyaya of the Yajurveda along with the *Vrātas* (nomads), etc³⁹. Yaska’s Nirukta excludes Nishādas from the four Varṇas or castes

and designates them as forming the fifth caste⁴⁰. According to the statement of the Padma-purāṇa, the Nishādas, the Kirātas, the Bhillas, the Nāhalakas, the Pulinḍas and other Mlechchha tribes were addicted to vices⁴¹. It would not be thus unjustifiable to presume that the Nishādas were the most scorned or evil people.

Sāntiparvan of the Mahabharata have been also depicted as having short stature, reddish eyes and black hair⁴². A description of the Nishādas (Vyadh) is also to be found in the Cchadanta-Jātaka The Vayu-purāṇa while narrating the story of the Nishāda describes him as dark and dwarfish . The same Purāṇa and the Mahābhārata describe the Nishāda as *Lambakarna*, i.e., long ear like that of an ass or goat⁴⁵ . The Garuḍa-purāṇa states that Nishāda was dwarfish or short and black⁴⁶.

As for instance, the word Nishādas occurs in the Vājsaneyī-Saṁhita as meaning a Bhilla or Bhi⁴⁷. They are also synonymously used with the Chaṇḍālas and the Pāraśavas. But According to Nārada 12.103-113.— “The son called Niṣāda springs from the union of a Kṣatriya with a Śūdra woman. A Śūdra woman obtains from a Brāhmaṇa a son called Pāraśava, who is superior to the Niṣāda”. According to Kautilya, Nishādas were the successor of Brhāmaṇa men and Śūdra women⁴⁸. In the opinion of Manu (X. 8) the Nishāda is the offspring of a Brhāmaṇa and Śūdra woman⁴⁹. In the Baudhāyana-Dharmasūtra, Vaśiṣṭha-Dharmasūtra, Mahābhārata, Yajñavalkya, Arthaśāstra, Usanas-Saṁhita and Vaikhānasa-Saṁhita, the Nishāda has been made an issue of a Brāhmaṇa male and Śūdra female⁵⁰.

A perusal of most of the Dharmasūtras and other related texts would reveal that both the Nishādas and the Parasavas originated from a union of a Brāhmaṇa male and a low caste female. It is significant to note that in both cases the Brāhmaṇa has been made the father of the Nishāda excepting in one instance in the Mahābhārata. This has been of course the result of Brahmanization when the Brahmanas had to take wives from the non-Aryan communities during their migrations and settlements in various parts of India⁵¹.

According to the Puranic story, the king Veṇa was greatly hostile to the performances of Vedic sacrifices, and as such, there was a war with the Aryans⁵². The king Veṇa was, however, defeated and killed by the Aryans. But from the left thigh of the dead king sprang out a short, dark, broad nosed and ugly man who was ordered: ‘Nishida’, and as such, the descendants of this man came to be called ‘Nishādas’⁵³. In the Garuḍa-purāṇa, a similar story has been narrated. It is true that the Nishāda was not got support from the sagacious society but it is true that the Nishāda was upraised from *Kshatriya* origin. We already know that Bena was a bad king. But as a human being he had a two entity positive and negative, here Nishada was his negative entity and Prithu was his positive entity. In the Buddhist texts, they have been included within the Hina Jatis. In the Suttavibhāṅga, the Nishādas along with the Chaṇḍālas, the Pukkusas, the Ratha-kāras, etc., arc Hinanāma Jātis⁵⁴ .

We also got a positive portrayal of a barbarian king in the Mahābhārata. The Dasyu Kapavya, a wise and brave ruler of the Nishādas, is said to have attained perfection. He was a great victor who followed the Kshatriya dharma and had metal weapons. He ruled well and righteously, established laws, was learned, and free from cruelty⁵⁵. Ekalavya, the king of the Nishadas always used to challenge Vasudeva Krishna to battle, but he was slain by Krishna in battle. The account of the Nishada king Guhaka as related in the Rāmāyaṇa⁵⁶. It is learnt that the Nishāda king Guhaka became a friend of Rāma and accorded a hearty reception to him, Sita and Lakshmana during their sojourn to Daṇḍakarāṇya⁵⁷.

According to the Mahābhārata, the Nishāda had also their kingdom round about the drying bed of the Sarasvatī⁵⁸. Bṛhatsamhita refers to '*Nishāda-rāshṭrāṇi*' on the South-eastern side of Madhyadeśa⁵⁹. Garuḍa-purāṇa place them (Nishādas) in Western parts while others like the Harivaṁśa refer to their habitat in both East and West of the country⁶⁰. The Nishāda country may be also placed between Sindh and Pāriyatra (Western Vindhya)⁶¹. Sircar equates this kingdom with the region about the Western Vindhya and Āravalli ranges⁶². So the Nishadas seem to have settled themselves over the wide-spread area, as various ancient texts have described them inhabiting regions in the West, East, South and North. On the basis of the evidence derived from the junāgarḍh inscription⁶³ (c.A.D. 150).

It may be said that the Nishādas were primarily food-gatherers engaged in hunting and fishing. They lived on killing wild animals. In the Pāli texts, the Nishādas have been actually described as wild hunters and fishers⁶⁴. In the Jātakas, the Nishādas are also represented as hunters⁶⁵. It is significant to note that the Cchadanta-Jātka gives an interesting portrait of the Nishādas whom it calls Luddhakas⁶⁶. The Nishādas were also very good fighters, and in fact, they played a very prominent part in the Kurukshetra war taking the side of the Pāṇḍavas, Once they were defeated by the great hero Karṇa in the war⁶⁷. The Kathāsaritsāgara similarly records that the Nishādas were fishermen. main occupation relating to hunting and fishing. There are also references to their skill and excellence in craftsmanship. The intimate contact of the Nishādas with water and forest made them expert boat-builders and ferrymen. The Nishādas were also expert players on musical instruments. This becomes evident from Usanas who refers to the Nishādas earning their living by playing on musical Instruments⁶⁸. From the above discussion it may be presumed that the Nishādas were not simply nomadic food-gatherers. Some of them might have also pursued different crafts as well.

The Nishāda villages are frequently mentioned in the Buddhist texts. In the More-Jātaka there is a reference to a Nesāda village near Benares⁶⁹. The Nishādas also established kingdoms in different parts of the country. Sahadev conquer the land of nishada at the time of his expansion of kingdom⁷⁰. The Brahmāṇḍa-purāṇa refers

to the Nishāda kingdom⁷¹. The Bṛhatsamhitā (XIV. 10) refers to the Nishāda Rāshtra in the South-east of the Madhyadesa. It has been already stated that the Junāgaḍ inscription refers to the conquest of the Nishādas by Rudradamana. The Udayendiram grant No. 2 records that Udayachandra defeated the Nishāda king Pṛithivīvyaghra who was accompanying the Aśvamedhaturāṅgama⁷².

Regarding their religious beliefs and practices very little information is available. They were, however, worshippers of some primitive deities. According to Usanas, tire counterparts of the Nishādas, namely, the Pārsavas, were worshippers of the deity Bhadrākali⁷³.

The epic heroes frequently encounter natives of the forest. The generic terms used for these people include mleccha and dasyu. There also references to specific forest dwellers, and among these, the most prominent are the Nishādas, Śabaras, Kirāta etc. They are among those defeated in the course of the Pāṇḍava prince's expedition. But they are also combatants in the great war as allies of the Kauravas. Kirātas also joined in both side.

Some forest people may be influence by state power and extended support to the state. But another part did not agree to merge with main stream. They were not ready to give up their autonomy in forest area. Probably they enjoyed an autonomy in a state. According to Kautilya there are seven elements of the state. These are King (Swami), Officers (Amatya), fort (Durga), wealthor treasury (Kosh), Army (Bala), Territory (janapada), friend (Mitra). If we try to find out the same element in the forest territory then we find out these six elements in this spear. We may identify forest chieftain as a *Swami*, the specific forest territory may be identify as *Janapada*, Kauṭilya himself identified forest is a natural fort or Durga. On the other hand the forest fort of the state maintained by forest people and sometime king and his family took shelter in this fort with the help of the forest people. It means the forest people were well aware of the fort. Forest people collect their wealth or *Kosha* from forest. Sometime they collected wealth through robbery or selling out the forest products and they create their army or bala by their own people. This is sometime used by the king for his own benefit. Kauṭilya was aware that the chiefs of the forest tribes create friendship or mitrata within them, because Kauṭilya advise that same like a heads of *Ganas* it is needed to create disunity between forest chieftains. It indicates that the leader of forest people had created unity among themselves and probably attacked the state power. That was the most fearful aspect to the state.

List of king or chief of forest people according to the ancient texts.

| Text | Time Period | Description |
|------------------|---|--|
| Rāmāyaṇa | 3rd Century B. C. E – 3rd Century C. E. | Guhaka, Nishād king |
| Mahābhārata | 4th Century B.C.E – 4th Century C. E. | Nala, Nishāda King Ekalavya, son of Nishāda King Hirṇyadhanu, Kapavya, a wise & brave ruler of Nishādas Ketumat, son of Nishāda king |
| Priyadarshikā | 6th Century C. E. | Vindhyaketu, Forest King |
| Kādambarī | 6th Century C. E. | Mātanga, a Śabara <i>Śenāpati</i> |
| Kathasarit sagar | 10 -11 Century C. E. | Śabara chief King Māyāvaṭu, Sīṃhadamṣṭra Śabara chief Pulinḍaka, Śabara chief Srichanḍa, Śabara chief Muktālatā, Nishāda king |

So the state was built with the composition of six elements and these same element we found in the forest area. That’s why when these two power means state and forest people triumph over each other’s the results was conflict between them. The state got cooperation or help of the forest people, but their talent and power were always suppressed. State was fearful of the power of forest people because they had power to destroy the state. But till now we don’t have any example that forest people destroyed the state power or raised a forest state, it is not stated in the literary works or not to be exposing by the authors of ancient India knowingly or unknowingly.

So the forests were shown in multiple ways and historical changes altered the focus. We have seen that different kinds of sources offer diverse representations of the forest and forest people. Again within the texts, there are variations in perception. We have seen how with the passage of time the attitude of the state changed towards the forest and forest people.

The location of the forest is an important factor in the perception of forest. As forests were generally near habitation sites a situation of mutual dependence as well as conflict could be perceived. Thus forest was not a physically distant place though distant in concept. *Āśramas* were seen as intrusion into the forest and so we have seen in the epics that ashramas were attacked by *rākṣhasas* and heroes were requested to quell these attacks but in the *Harshacharita* we have a completely different picture where we find that *āśramas* belonging to different sectarian

affiliations peacefully co-existed and there was no threat from the forest people. Moreover, instead of being a space to be afraid of it became a space to seek protection or refuge as seen in the texts of Bānabhaṭṭa. In our period of study, therefore, state utilized the near proximity of forest to settlement and donated lands to bring it under cultivation and thereby pave the way for expansion of agriculture and settlement. It was thus now less alien and was beginning to be looked upon as a variant of *grāma*. Hence, a change in the perception could be noticed.

The inscriptions of the Parivrajakas and Uchchakalpas are interesting examples where we find conversion of the Vindhyan region from forest to kingdom, from vana to *kṣhetra*. We are yet to understand whether this change reflected accommodation or contestation. The bringing in of a tribal goddess into the brahmanical fold is also an important example.

The economic importance of forest while studying the attitude towards forest cannot be ignored. Therefore, we have seen how the middle category market centers like *Maṇḍapikā* and *Pentha* referred in the inscriptions and the products that were found there were largely forest products.

Bānabhaṭṭa's Harshacharita describes a forest in the Vindhya Range where king Harsha goes in search of his sister. Here we have a different perception of forest; from the epic as instead of hunt and exile we have the representation of large and well stocked villages in the forest where we have active farming families and blacksmiths, fowlers, hunters etc. as a part of that world, active. Here we see forest products being sold at nearby villages and such a constant interaction with settled hamlets. Gone were the days of *apsarās* and *rākshasas*. This is economically a different scene. Thus the economic importance of forest while studying the attitude towards forest cannot be ignored. Moreover, we have seen how the middle category market centers like *Maṇḍapikā* and *Pentha* were referred to in the inscriptions and the products that were found there were largely forest products.

If we go through the nature of forest people, we will observe that some group of forest people accepted the Brahmanical cultures, became a part of common socio-political structure. Uchchakalpa and Paribrajaka dynasty are the example. But most of the forest people did not merge themselves and influenced the state power and common people from outside.

We got some contradictory features of Aṭavika or forest people in the administration and politics of state. Some time the Aṭavika is very much acceptable for state power but sometimes they were identified as an enemy of the state. Sometimes, the Aṭavika is a reason of fear for state, but some time they are one of the main powers for the state. We also know that Aṭavikas were detached from the main stream of the state or they were detached by the state. So in this different socio economic aspect how the Aṭavikas directly or indirectly influence the state power and became the weapon for the state, that should be create a new aspect of the ancient Indian political and administrative history.

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Digital Divide, Online Education and Library Services

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Abstract :

We are sometimes claiming that we are living in the age of Information Society. But in the ground reality we have found that many people of under developing countries are not in the limelight of Information Society. Paperless Society is our destination. But socio-economic imbalance, digital divides and lack of infrastructure for online education create barriers to achieve our goal. Teachers are playing crucial roles in online education. Library services are also changing their modes. Library professionals with others are also thinking about the remedies and work for the upcoming society. This article finds the digital divides and different aspects of online education and librarian's role in the changing world regarding library services. It also suggests some recommendation for improving the environment for online education.

Keywords : Digital Natives, Digital Immigrants, ICT, E-learning

- 1. Introduction :** Our life and livelihood have been very much centred on machine since the Industrial Revolution. And we have come into the Age of Information or Digital Age in the 1970s. The basic need of this age is the transformation of required information freely and quickly for the benefit of its consumers. Information and Communication Technology (ICT) enhances the ability of a human being. Now it is obvious that we can't take a single step without ICT towards our destination. But truthfully, the ground reality is not the same which we demanded or expected. Information rich and information poor countries or states or individuals are facing different impact in itself. Digital Divides makes many strata among the people. We can't but agree that digital divides create Digital Immigrants. All round development of the society is not possible without the participation of all people in our society. Online Education is a natural phenomenon in this age. But it also true that due to the pandemic situation, worldwide, government and educational institutions have to alter the way of teaching and learning through online. Digital divides and other factors create barriers against smooth functioning of online education. Library plays a vital role in the education system and society. It is called the heart of and academic institution. Public libraries are called People's University. Libraries are also changing their modes of services to cope up with the new demand and requirement of the users. We know that change is the only truth. If we change our attitude we can change the world we dream about. We must think about a sustainable development. This article is very much close to the Indian scenario.

2. Digital Divide : The word Digital Divide was occasionally used before 1995 by different media. But in early 1995 it got momentum when the American Government used this term frequently. We use different digital gadgets, techniques and communication channel to access or to provide information in a very short period of time so that the beneficiary gets real-time possession and makes it a meaningful one. But some issues or factors create barriers between or among the users of information and the information providers. These barriers generate disappointment, underdevelopment, victimization, poor and marginalized social groups or individuals. Besides this, some people get the benefits of ICT and different gadgets etc. So we can find there are differences among the people in a society in respect to using digital resources or media. It is not desirable. Our government, as a whole the society, should take measures so that communities or individuals can connect with others through phone, internet, ICT access, gadgets like mobiles, laptops or PC.

World Wide Web Consortium (W3C) stated – “The web is fundamentally designed to work for all people, whatever their hardware, software, language, location or ability”. World Wide Web starts its journey aiming universal accessibility to information. In 1997 at Washington DC, Tim-Berners-Lee, W3C Director and Inventor of WWW said that the power of the Web is in its universality. Access by everyone regardless of ability is an essential aspect.

2.1 What is Digital Divide : Definition

Digital divide refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to both their opportunities to access information and communication technologies(ICTs) and to their use of the internet for a wide variety of activities (Glossary of the statistical Terms, accessed on 5/10/2020)

A digital divide is any uneven distribution in the access to, use or impact of information and communications technology (ICT) between any number of distinct groups, which can be defined based on social, geographical or geopolitical criteria or otherwise. (Wikipedia, accessed on 5/10/2020).

2.2 Why Digital Divide : Factors leads to Digital Divide

The two main factors responsible for creating gaps among individuals are economy and education. Here, in a more generic way, we can say that economy is the income of an individual. These two primarily lead to digital divide. Besides these, there are many important factors also which we will discuss here briefly.

2.2.1 Education : Education has the power to tackle any and every issue. Proper education is the only way to eradicate all social and technological barriers. Each and every society should give priority to education. Education

is for all. We could say we are all for education. Illiteracy is a challenge against development. In India, as per the Education Statistics At a Glance (ESAG) 2018, literacy rates in 2014 (National Sample Survey) were Rural Male 72.3%, Rural Female 56.8% and Urban Male 83.7%, Urban Female 74.8%. There are some confusions in statistics in ESAG report in this regard. As per the report of All India Survey on Higher Education (AISHE) 2018-19, number of Universities is 993, Colleges 39931, and Stand alone Institutions 10725. 60.53% of the colleges are situated in Rural Areas and 10.82 % colleges are exclusively for girls. In spite of that, we are lagging behind in terms of literacy. Education creates empowerment. Many people are very much dependent due to lack of literacy. Illiteracy leads to digital barriers. Illiterate persons would not be able to take all opportunities of digital environment. As per the AISHE 2018-19 report, number of State Public Universities in 2017-18 was 351 and in 2018-19 was 371. And number of State Private Universities in 2017-18 was 262 and in 2018-19 was 304. So we feel increasing privatization is a normal phenomena. It creates barriers for the economically backwards people. Therefore, poor becomes poorer. This report reveals that pupil-teacher Ratio is 29 (in 2018-19). It is apparently good but it also shows the rapid growth of private universities.

2.2.2 Economy : Economy is everything. Economically backwards people cannot get the benefit of information society. It's a big challenge to every society. Our labour class people suffer the most. In this time of pandemic, 191 countries have been facing economic crisis. Loss of job creates a big damage to the society, poor becomes poorer. Government of India reports reveal nearly 12 crore people lost their jobs in April due to lockdown and nearly 48 crore family members have become distressed. Skilled labourer or semi skilled labourers are compelled to take new jobs for meeting their needs. And in this situation most of the institutions are thinking of introducing online education. Some of them started already. But many students do not have the affordability to access information, or to participate in online education. Rural people are suffering a lot due to their economic incapacity.

2.2.3 Electricity : Modern society is fully dependent on electricity. Lack of electricity generates a big gap towards digital or information society. No one can reach their destination without it. Mostly all digital gadgets require electricity, whether it is from the power grid or directly from sunlight. Rural people are mostly affected due to lack of electricity. Ministry of Power's, annual report (2018-19) shows that 100% electrification of villages had been done by 28 April, 2018. Many schemes have been introduced like IPDS, UDAY, NEF to make the nation more powerful. Sadly, BBC News, as on 30/04/2018, said that a village is considered electrified if 10% of its homes and all public buildings are connected to grid. World Bank figures show around 200 million people in India still does not access to electricity. It is really unbelievable

that around 20 crore (in 2018) were in the darkness in India after the 70 years of independence. But the situation is ever changing. We believe our dream will come true.

- 2.2.4 Telephone:** Telephone connectivity is still a dream to certain remote villages. Due to lack of connectivity they are staying outside of main circle of the enlightened society. As per Sept. 2019 report of TRAI – total number of subscribers in India is 1195.24 million (Urban 677.95, Rural 517.29) that means 119,52,40,000 people have telephone connection. As per World Bank data (2019) Indian population is 136,64,17,750.
- 2.2.5 Internet Access:** As per Sept. 2019 report (TRAI), total number of subscribers is 687.62 Million, Urban 439.99, Rural 247.63. Total 52.08% people of Indian population have Internet connection, urban 104.25%, rural 27.57%. So the rest of nearly 48% of the total population (including the children and old age) people do not have internet connection. Number of narrowband subscribers is 62.20 million and number of broadband subscribers is 625.42 million. So it is clear that Internet access is a big factor which leads to digital divide among country people.
- 2.2.6 Language:** Language is also an important factor. Most of the information sources, Open Educational Resources are in English. It is obvious that English gives the potential to communicate worldwide. But we know mothertongue is the best for education and learning. Vernacular languages should be given emphasis. More resources should be generated in vernacular languages. In this pandemic situation academicians and policy makers are also taking this issue with interest. Besides this language phobia is an important issue. First and second generation learners are afraid of English as second language. They become very unesy in this issue. Due to a lack of fund and illiteracy in the family, most of the rural community learners do not have proficiency in English language.
- 2.2.7 Socio – Cultural Approach, Psychological Attitude and Generation Gap :** Due to various interrelated issues and their sub-issues, social cultural approach towards accepting new technology has become a challenge to the community people. Fear, inferiority complex work side by side. Awareness of the technology has become very low among rural communities. Sometimes they feel technology or digital environment is a curse to humanity. This kind of attitude should be changed. Generation gap cannot be ignored.
- 2.2.8 Population :** When population is high, fullfilment of their requirements, information needs are also difficult for the society as well as the government. But the government, the policy makers can't stay indifferent, they have to design possible remedies. More population means better infrastructure. Failing to meet the needs of the community creates digital divide. As per

census data 2001, total number of villages in India is 638,365. Nearly 68 % people live in villages. As per ESAG report in 2018 (actually in 2011) is 121.06 (Crore) and out of them number of males is 62.31 crore and females is 58.75. So it is needless to say that the development of village people is very crucial.

Population in selected Countries as per World Bank Data in 2019

| Sl. No. | Country | Population |
|---------|------------|------------|
| 1 | China | 1397715000 |
| 2 | India | 1366417750 |
| 3 | USA | 328239520 |
| 4 | Bangladesh | 163046160 |
| 5 | UK | 66834400 |

2.2.9 Race : There should not be bias among the different races in case of development. Ignoring a particular race is dangerous for the society and it also creates social as well as digital divide.

2.2.10 Gender : Gender equality is highly desirable. But it is true that inequality in gender leads to multifaceted problems including digital divide. As per ESAG report 2018, literacy rate among Indian population(in 2011) is nearly 73% out of which literacy in males is 80.9% and females is 64.6%. So many initiatives are to be taken for the girls and women. Beti Bachao, Beti Padhao Yojana, Sukanya Samriddhi, Kanyashree (WB) schemes are few among them, that have been taken by central and different state governments. ESAG report also reveals that the percentage of female teachers in primary level (in 2014) – 49.49%. It is good but we need more steps to be taken. We can produce a statistics following ESAG report. Level of education at the age group of 18-23 (Projected population in higher education in 2017, provisional) is as follows :

| Gender Wise | All | SC | ST |
|-------------|-----------|----------|----------|
| Male | 73121000 | 12490000 | 5879000 |
| Female | 68708000 | 11703000 | 6134000 |
| Total | 141829000 | 24193000 | 12013000 |

2.2.11 Geographic Location : This is also a very distinct variable in respect of digital divide. Obviously plain areas and hill areas do not possess equal convenience. But a government cannot overlook the needs of the remote villages or inaccessible villages due to many factors. Mainstream of society or the mainlands get more opportunities. Besides this, rural community is suffering from darkness not only due to lack of electrification but also different interrelated factors.

2.2.12 Skills, Age and Disability : Skill, education, age and disability are very much interrelated. A certain age group is possessing skills. Children and aged people have lack of skill. Skill is derived from education, not always depending on academic education. A farmer’s child may have better knowledge on agriculture. Mahatma Gandhi, Rabindranath Tagore and many other reformers took many initiatives to develop skills among country people. Our governments also have many schemes for skill development and minimizing disability among learners. We may place a statistics in table regarding library and skill development centre in India following AISHE report 2018-19.

| Facilities | University | College | Stand alone Institution |
|--------------------------|------------|---------|-------------------------|
| Having Libraries | 94% | 98% | 98% |
| Skill Development Centre | 59 % | 47% | 49% |

This table reveals that more skill development centres or initiatives should be taken by the government or other stakeholders. Without skill development employment generation is not possible. Skilled people create a developed country. Physical and mental disability should also be lessened by targeted initiatives. We have found the number of UG Enrolment of students in 2015-2016 in Computer and IT is 2.50% where as in Arts /Humanities/ Social Sciences is 40.08% (ESAG report). And the number of passed out students in 2015-2016 in PG is 1404996 and in UG is 6331999 (ESAG report). The huge different in UG and PG passed out students should be taken into account. There many factors behind this issue. Library in every level of academic education and lifelong education for the people can play a vital role. Library and information literacy make people savvier with technological development. Library may also take initiatives for awareness generation. Community Library and Information Centre (CLIC) plays important role in providing information services to its community according to the need. Access to information and communication technology (ICT) be possible by skill.

2.2.13 Awareness : This issue should be addressed with importance. Lack of awareness, ignorance among people, and indifferent attitude among learners create digital divides. Awareness makes people safer, protected by lessening digital divides. Many of us are not aware of different government initiatives for eradicating digital divides. Our motto should be Know and Grow.

2.2.14 Transportation : The importance of transportation may be raised by following the proverb, necessity is the mother of invention, as transportation is the father of development. Lack of transportation creates bottleneck. Remote village are suffering a lot from this issue.

2.2.15 Socio-Political Peace and Harmony : Socio-political peace and harmony can be a measure for an all round development of a society. But instability in society due of socio-political imbalance creates lack of peace and harmony.

Prevailing situation in many communities and countries are not healthy for development. Political anger, religious intolerance, riots, misappropriation of administrative and political power, social and domestic violence are not suitable for growth, these make barriers and leads to digital divides. We should raise our voice for international peace also.

2.2.16 Health, Hygiene, Natural Calamity and Disasters : These factors also create division among people and leads to digital divide.

Besides these factors, there are many sublime interrelated factors behind digital divide.

3. Digital Natives : People who are very much accustomed with using digital gadgets like computers, smartphones etc. and can access information from internet are called Digital Natives in general. We may site two definitions.

1. A digital native is “ a person born or brought up during the age of digital technology and so familiar with computers and the internet from an early age” (Oxford English Dictionary)

2. A digital native is a person who was born during or after the general introduction of digital technologies and through interacting with digital technology from an early age, has a greater comfort level using it. (Wikipedia)

4. Digital Immigrants : There are many people in our society who are not accustomed with digital techniques and gadgets for information storage and access. This term is just the opposite of Digital Natives. Due to generation gap mainly, digital immigrant’s community is evoked. There should be some important initiatives for making them a member of Digital Native community.

5. Online Education : Our Destination: Online education is not the substitute of traditional education system, yet. Future holds the ultimate answer. But perhaps it is the most powerful supplementary aid to conduct educational programme. And academicians say it is the best way to cope up with the barriers of integrated teaching learning process in this pandemic situation and afterwards. It consists of teachers, learners, curricula, syllabi, academic institutions, digital gadgets, electricity and internet connectivity.

Online education is electronically supported learning that relies heavily on the connectivity of teacher/student interaction and the distribution of class materials. (Indiaeducation.net) Online education may be fully online or hybrid in nature. There are online courses which are part of a degree. E-learning is learning done by studying at home using computers and courses provided on the internet. (Cambridge Dictionary). To some extent all are synonymous in nature.

Teachers are playing a crucial role to cope up with the wave of digital technology in education. Many teachers are well equipped with this environment. They inspire the students community. They are designing new curricula. Many of them are engaging themselves in preparing e-contents, taking classes online, arranging group discussions, evaluating examinations paper online. Academic institutions should give them infrastructure and freedom for work in a healthy environment. We have a strong human resources. We need personnel training and motivation.

Teaching–Learning Management System (TLMS) are developing for the needs of academic community. Digital gadgets including PC or laptop, smartphone, software for video conferencing, printer, digital course material, open educational resources are needed. An android mobile set is not a substitute of PC or Laptop. Using mobile set as a substitute can cause many problems. All electronic gadgets have their own impacts on human body and mind. We found during this pandemic a very good numbers of children are suffering from ailments of the eye, head-ache or other health related problems.

A very common incident we are facing today that the learners could not connect with their teacher due to lack of internet connectivity. Sometimes a learner makes arrangement to stay on the roof top or on the top of a shed, or come out from home and stay in an open ground. It is not desirable. Besides, many students don't have PC or laptop or even android mobile handsets. We found some unfortunate incidents of self harm or suicide. Student's affordability and availability of these gadgets and internet connectivity should be ensured by the government. Students' community is the future of our nation.

Some teachers are also facing technical problems operating structured procedures. Personnel training are a must for overcoming this situation. Learners should also be guided by experts. For children, their parents are doing the job of connecting with academic institution. They should also be given proper training. Some initiatives have taken place from government and academic institutions. Policy for inclusive education procedure should be taken. Disability is of different types. Government should not deny this issue. Many schemes are there in paper works. Those should be implemented in reality.

We all are not tech-savvy. We are not well informed about gadgets specially computer. But truly speaking our new generation has the faculty to cope up with the technology. They should be given opportunity. They can easily do the banking work, business work, online shopping, they can fulfill their information needs from a smartphone. Awareness generation is also a must among academic community.

- 5.1 Benefits :** Enrolment process is very easy. Students could learn at their own time. There is no need of face to face meeting with their teachers. Learners can do their own business or other academic activities in their ways. It is comfortable because learners can educate themselves at their desks. It also encourages for getting foreign degree. It is economic, though the initial investment for digital gadgets is high. Online Education includes the benefit of realtime learning of e-learning and m-learning (Mobile learning). Both e-learning and m-learning are used interchangeably sometimes.

In realtime learning a learner gets his information or can learn a specific field of his requirement in a very short period of time at his own time. It is need based or on-demand. Modules are short in size. Learner gets ease of access. Pinpointed but nearly exhaustive study material like e-content, video clippings, are opted by the new generation. We know Audio and Video Materials (AVM) are more powerful. Online education saves the time of the learners. They don't need to travel to their institutions. It takes short period of time for arranging examinations and evaluation procedures.

- 5.2 Demerits :** Besides many benefits, it has some demerits also. It is fully technology-based. Fully dependent on internet access. Digital divides are creating its demerits. It does not allow interaction with friends circle. Initiatives are also been taken by some institution in these regards. A face to face interaction with teachers is more comfortable. It lacks human touch to an extent. It does not make a competitive attitude among the learners. Power of friendship at the time of traditional education is more than the online education system. It creates many health related inconveniences also.

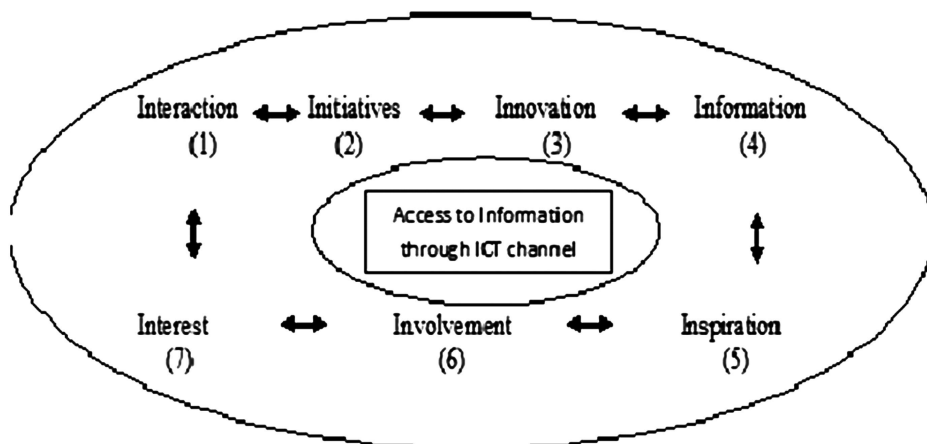
We can remove many demerits of online education by taking measures. And obviously our future generation will take its full advantages. It is worth saying that online education is our future destination.

- 6. Library Services :** In the Information Age, libraries of different types are also changing their modes of services to satisfy the user's need. Libraries are coming out from their traditional structures. Now we have e-libraries, digital libraries and virtual libraries. And many libraries are hybrid in nature. In this type of library we can get a blend of traditional library and e-libraries or digital libraries. Physical attendance is not always required to get the library services. Librarians are using different channels to communicate with their users. Traditional indexing and abstracting works are now done by machine. Users can get the required information in very short period of time. Many libraries have been fully automated. Some are in the transitional level. Fully automated digital library is our destination. Organisation of Open Educational Resources (OER) and creating awareness to access to its users is an important job now. Librarians are engaging in opening of Library Portals, Library Website, OPAC, Digital Archive, Information at Door

Step and many other job for providing web based services. Selective Dissemination of Information (SDI) Services, Resource Sharing, Library Consortia, Online conferencing, Virtual exhibition, Abstracting and Indexing Services, Services through Social Media are given more emphasis. User orientation programme becomes an important part of library services. Library and Information Literacy is very much appreciated by the users. Many of our users are engaging in searching information from internet. But could not able to find out the most appropriate one. Because they don't know the searching techniques. Library and information literacy could be a helpful for them also. Besides this Community library and information centres (CLIC) are working at the community fulfilling their need. Library and CLIC widen their services by providing services like online form filing, admission related work, print out or reprographic services etc. Libraries in the higher academic institutions, well equipped public libraries or CLICs obviously lessen the digital divide among their students and communities also. Online education is the blessing of information and communication technology (ICT).

- Conclusion :** We have many barriers in our ways. We believe our path to the destination is difficult but not impossible. Our prosperity is obviously depending on human resources and use of ICT. We are dreaming for an inclusive society. Where all individuals should be given importance no exclusion is done by anyway. Everybody can participate in the building of the nation. Participatory democracy is highly solicited. A inclusive society protects social inclusion, economic inclusion, political inclusion digital inclusion. Digital inclusion confirms access, adoption and application of information using digital technology in a digital environment.

Now we are proposing a model for lessening digital divide and make online education more effective. We have named it as 7i Model. (Routh, 2020) It works as follows –

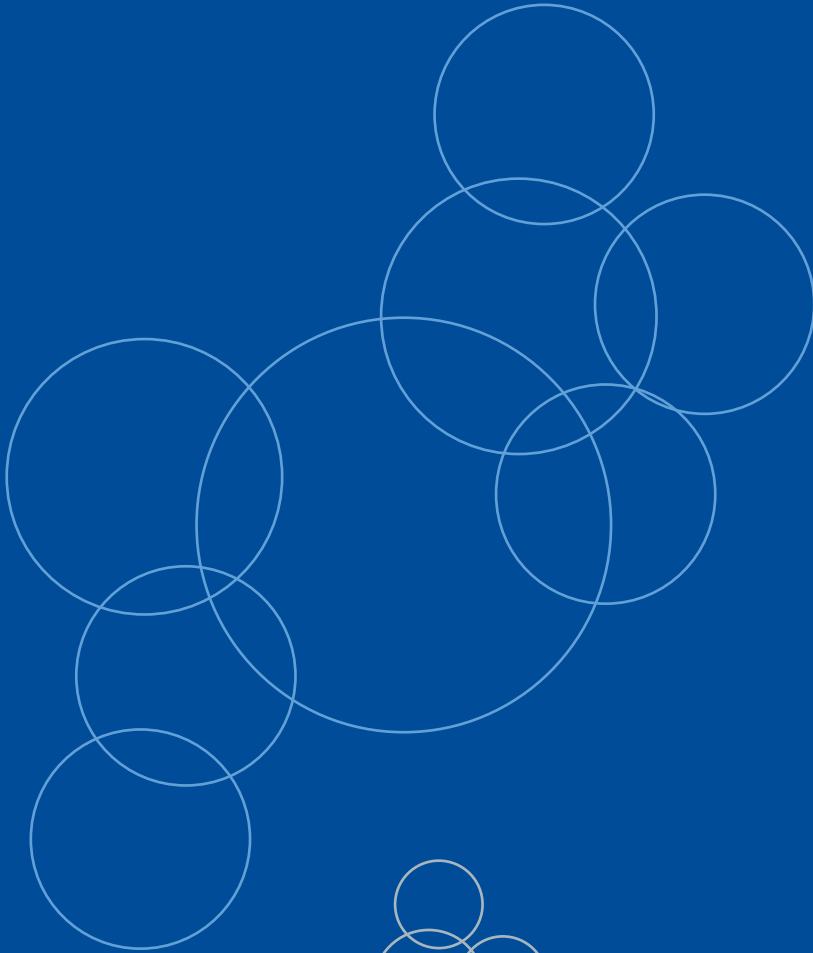


Interaction is to be done among the government, service provider, teacher, librarian and beneficiaries, then initiatives are to be taken mostly government and services provider and others, there should be proper information regarding government aim and objectives, awareness generation must be fulfilled, then government, teachers, librarian and other academic institutions make inspire the beneficiaries, mainly the learners community and their parents, then we expect involvement of teaching and learning community. Whenever we get involved we will find the interest or broadly the main objectives will be achieved. Necessary addition and alteration are to be taken into consideration. And lastly we must not forget the words – if we wish to change something, we will change our mind first.

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