DEATH AND DEATH DRIVE: AN ELUCIDATION OF THE FREUDIAN THEORY THROUGH THE POEM "THE TWINS" BY CHARLES BUKOWSKI.

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ABSTRACT

John Martin, Founder of the Black Sparrow Press, once told, 'Bukowski hated any kind of dishonesty. He hated deceit.' One cannot agree with the poetry of Charles Bukowski without understanding the truth that his is an extremely idiosyncratic, honest and autobiographical poetry. Bukowski inflects from being melancholic to angry and sometimes being funny and invariably humorous but always finds hope and beauty even in a desolated situation. In all his works Bukowski is more obsessive to point out his unhappy childhood with his parents. He believes that his strict parents are the ground cause for all his anger. This article probes the death drive of Bukowski through the death of his father, whom he hated with passion. The poem "the twins" unravels the repressed emotional state of Bukowski through the psychological phenomena, Repetition Compulsion. Bukowski replicates (repeats) the death of his father through dead and living symbols which is merely Life Instincts (Eros) and Death Instincts (Thanatos). The repressed traumatic experiences do not forbid to repeat the repressed substance as a present-day experience, rather than an episode within the past. Sigmund Freud considered that dreams are one of the ways to peek into a person's unconscious mind. Repressed feelings may turn up in the fears, anxieties, and desires that a person undergoes in the dreams. Dreams are an outlet for the unconscious mind. Instead of dreams, Bukowski's outlet of repressed emotions is writing poetry. The repressed emotions converge into a repetitive compulsion and take an obvious turn into the death drive.

Key Words: *Repression, Unconscious, Death Drive, Dreams*

"the twins" is a forty-three-line poem written in free verse and barely divided into four parts, within which there are discrete stanzaic forms. The title does not refer to a direct meaning of the substance of the poem; instead, it facilitates an unanticipated understanding in the last quarter, that the "the twins" alluded to are literally the poet and the poet's father. The poem is a transition from a habitual animosity towards his father to an exalted inner proclamation of dispensed humanity and mortality.

The majority of what Bukowski wrote was from his childhood. They had an influence in all his poems. Bukowski always had repercussions with his father. Life with his father was miserable when they moved to 2122 Longwood Avenue, what Bukowski later called, 'the house of agony, the house where I almost done in'. All the terrible incidents happened to Bukowski with his father started at this home. The anger loomed up when the situations got worse between the father and the son. They brawled because of the lack of mutual social exchange. It is his father's snobbery that irritated Bukowski from his early days. He enrolled Bukowski to a high class school in LA to fulfill his social fantasy. Though they had significantly less money, they joined Bukowski to the school for bragging around the neighbors.

The anger gets activated when the perceiver believes there is an unfair treatment of work, when the person's interests is not been respected, when not heard and when they are devalued for their actions. These social emotions personate a person's behavior from the early childhood stage to the adolescent stage. Bukowski repressed all these anger since he was child and these remained as domination in his future life."A string of reproaches against other people leads one to suspect the existence of a string of self-reproaches with the same content" (Freud 1997).

It is Bukowski's unconscious cognitive response to anger pushes the ordeal to repetitive compulsion. Bukowski and his father often rebuke at each other adversely for petty things. Bukowski's father was not diligent towards Bukowski, and, thus he inscribes his father as a cruel person and his childhood as 'a twisted childhood' in all his works and interviews. Later, he poured out his anger and wrote serious poems on his father whom he hated with passion.

"the twins" establishes one of the supreme motifs in Bukowski's poems - the fugacious nature of life and the

overemphasized import which human beings adhere to ephemera. The free verse in the poem helps the poet at ease to flourish all his ideas and does not force him into a preplanned metrical pattern. The opening section of the poem illustrates a sick and tired argument, one that has been walked through life and it is crammed together in a rush of prose. The nature of free verse is relatively fluid and that aids the poet to disclose the grief uncontrollably from anger to remorse. The inclination ensues as a deference when the death of his father drives his transcience.

Generally, readers will perceive a usual detachment between the parent and the child, whereas, the father and son, here, reproach at each other for not respecting each other's values. Bukowski's father has never been satisfied with Bukowski. He searches fault in all his routines and end up battering and bruising him with leather belt. Seemingly, they hated each other. He harks back the problematic memories with his father in the first stanza of the poem after his death. The commencing of the poem does not sound lamenting to his father death instead a revival of his dissimilarity with his father. This subsides in the end of the poem. Also, this recollection reminds the readers about the complexity and diversity between them.

I told him to listen
to Brahms, and I told him to learn to paint and
drink and not be
dominated by women and dollars
but he screamed at me, For Christ's sake
remember your mother,
remember your country,
you'll kill us all!...(Bukowski 2016)

Bukowski was into virtuosity and his father was into didactics. He wished his father was less somber and enjoyed music and life. His father lived a life of snoberry and always had an aim to satisfy the social fantasy among the elitists. Bukowski backed off this attitude, instead, he censured at these pompous people. Bukowski resented his father only in his poems and novels and had not confronted him in real. This because his parents had clutches over him for years. Also he was not rebel, initially. "The only time he felt safe was when he was alone in his bedroom, lying on the counterpane, following the patterns of the sunlight on the ceiling." (Bukowski ,1998.)

Freud believed that it is the unconscious mind that has a powerful influence on the personality and could possibly lead to psychological discomfort. Bukowksi's childhood events had grounds on his psychological distress. He repressed those emotions in his unconscious mind and divulged it in his writing. He used poetry as an outlet to let his fear, anger and desires into words.

The past tense, used in the first stanza bears out the poet's memory of the problem with his father. The remaining stanzas are written in the present tense, which holds up the here and now of his conscientious inspection of his father's personal effects.

I move through my father's house (on which he
owed me $8000 after 20
years on the same job) and look at his dead
shoes
the way his feet curled the leather, as if he was
angrily planting roses,
and he was, and I look at his dead cigarette, his
last cigarette (Bukowski 2016)

In the upcoming part itself, the poet unfolded his grief for his father's death by an act of perusal. Bukowski examined the belongings of his father and endures a separation of life from the object, thereby mentions, "dead shoes", "dead cigarette, his last cigarette." Also, he informs the readers that his death was not miserable. The angry face of his father sustained in his memory even after his death. The poet doesn't seem to be bothered about the rhymed pattern, but the poet minds the rhythm and stress which impede the narrative without leaving it as a prose.

The ego of the poet impoverishes and there is complete loss of anger when the poet devolves his anger into grief. Freud revised this as a precipitate of abandoned object-cathexis in his writings in *The Great War and in the ego and the Id.*

When the poet took a stroll throughout the house, the subdued guilt of him in the past takes a slot. The transformation of the poet's resentment on his father to goodwill gives a cue to the readers to explore Bukowski's unconsciousness. He turns up to mourn for his father's death after a tired argument of the past and faces his own mortality in the present. In the upcoming stanzas the poet sees the striking reality of death.

the last bed he slept in
that night, and I feel
I should remake it
but I can't, for father
is always your master
even when he's gone;
(Bukowski 2016)

Bukowski reconciles the basic bond between his father and him by harmonizing "a father is always a master even when he's gone." The poet faces up his mortality the second time, when he consoled himself the manners of his father's death. He is heartened that the way his father's death happened was not that pathetic unless it happens to him.

Freud affirms that the repetition compulsion is more instinctual than the pleasure principle and that the expressions of the repetition compulsion exhibit to a high degree as instinctual character. Bukowksi instinct reminds him of the mortality after encountering his father's death. "Our views have from first been dualistic, and to-day they are even more definitely dualistic than before now that we describe the opposition as being, not between ego-instincts and sexual instincts but between life instincts and death instincts" (Freud 1920)

to die on a kitchen
floor at 7'0 clock in the
morning
while other people are
frying eggs
unless it happens to
you (Bukowski 2016)

Bukowski couldn't stand the grief even though the traumatic events supervened him consciously. This pattern of repeating the behavior and reenacting endlessly are the key component of death drive. Bukowski reenacts the harrowing experience which evokes his unconscious desire to die. The latter, came up with the cpmpulsion of death and hence, the poem takes an elegiac form- a bereavement of grief and a desire of an easeful death.

The displeased events inside the home suffocates Bukowski and sends him outdoors to examine life he had with his father outside the house.

I go outside and pick
an orange and peel back
the bright skin;
things are still living:
the grass is growing quite
well,
the sun sends down its
rays circled by a Russian
satellite,
a dog barks senselessly
somewhere, the
neighbors peek behind
blinds. (Bukowski 2016)

He picks an orange, remarks the growing grass, a barking dog and people peep surreptitiously at him which connotes he is an alien to that place. The event took place in the present but there is a tinge of anecdotes connected to it. In his preteen days, Bukowski's father would order to him to cut and manicure the lawns 'perfectly'. If his father finds even a single grass 'sticking up', he would bash his legs with belt. And Bukowski had this inevitable punishment as a boy. The failure of doing any job 'perfectly' impacted his mind and behavior. Also to note Bukowski worked on several jobs and the boss would treat him like his father. Consequently, he collapsed in all the jobs he worked.

Bukowski knew these episodes in his childhood would hit him aftermath. But a conundrum arises to the readers whether he used the defensive mechanism to repress the horrifying incidents from his consciousness or sublimed it for good. Freud sums this as Retrieval-induced forgetting. It happens when recalling certain memories that induce the correlated information to be forgotten. So reiterating some memories forces the opposite memories to be inaccessible. Disturbing or unpleasant memories will be forgotten by salvaging more helpful ones to the conscious. At the moment Bukowski needed to grieve for his father's death. The death-drive inside

him constantly pushes his self to connect with the distressing events. Initially, Bukowski antagonized his father but led up to befriending him. Bukowski reexperiences the disassociated events and the instinctual conflicts of the past and connects it with the reality. Freud wrote:

> The patient cannot remember the whole of what is repressed in him, and what he cannot remember may be precisely the essential part of it. He is obliged to repeat the repressed material as a contemporary experience instead of remembering it something in the past. (Freud 1920)

The repressed material here would be the death-drive which rushes into a narrative of associating himself with a dead man. The third part continues and Bukowski now totally slided towards his father. The estranged son's honor as a rogue preceded him, for he finds himself as an uncanny person around the neighborhood.

> and they say he left
> it all to some women
> in Duarte, but I don't give a damn- she can have
> it; he was my old
> man
> and he died (Bukowski 2016)

Bukowski in these lines unveils the honest affection on his father, "for a father is always your master even when he's gone", "he was my old man and he died". Between these lines, Bukowski notices the striking reality. Being a loner and living a recluse life, Bukowski takes liberty on his father. This filial regard is one of the few authenticities in life.

The last part of the poem, allude to the title of the poem, "the twins."

> "inside, I try on a light blue suit
> much better than anything I have ever worn
> and I flap the arms like a scarecrow in the win
> but it's no good:
> I can't keep him alive
> no matter how much we hated each other. (Bukowski 2016)

`Bukowski finds his father's light blue suit and tries it on him. There is an resemblance of his father outside(body) but not inside(personality). He stood like scarecrow like his dead father. Even though he looked alike in the coat, like a twin, they couldn't find similarities. This coerces the old and new; the traditional and the contemporary. The animosity towards his father has diluted to an extent that he desires an easeful death like him. Bukowski uses "dead" symbols to exemplify this mortality.

The poem doesn't begin as lamentation for dead person, instead, the poem The poem is an modern Elegy, a modern representation of the ancient form. The common attribute of an Elegy is mourning the loss of a loved one as observed in John Milton's "Lycidas". An Elegy often contemplates the justice of the loss, the transient life of the poet, and it restates solace in distress; often the afterlife, as seen in P.B.Shelly's "Adonais" (1821) and A.L.Tennyson's "In Memorium" (1850) is disposed. But it has already been noted that Bukowski laments the death of his father and only confronts ho own mortality. What of justice and solace, though?

"In Memorium", Tennyson sympathized himself by perpetuating his faith on God, who was made obscure now by the development of Science and Technology. In Bukowski's world there is Supreme Being. He seeks solace in life, itself, in the bright skin of an orange, growing grass, barking dogs and in the rays of the sun and in any living things. "The opposition between the ego or death instincts and the sexual or life instincts would then cease to hold and the compulsion to repeat would no longer possess the importance we have ascribed to it" (Slade 2017). The sun supports life and is in no risk of receding from the Universe. The satellite, however was the greatest invention in the nineteenth century, the age of the Industrial and Scientific revolutions that so appalled Tennyson. One century later, Bukowski seem to be the literary heir of Tennyson. The lines of the last stanza shortens relentlessly revealing the ultimate intention of the poet.

very well. Grant us this moment: standing before a mirrorin my dead father's suit waiting alsoto die. (Bukowski 2016)

The import of death drive and of the repetition compulsion shows up when literary texts repeat specific signs and symbols and when these signs and symbols employs the idiosyncrasies that suggests there is nothing beyond the sign or symbol. "grant us this moment", Bukowski asserts this to the universe. Beholding in the mirror at the twins, the grotesque image of himself in his father's suit, the poet is waiting to die. The death drive is death become a certainty and a fortitude. In the clutch of the repetitive compulsion, the subject is in a condition of passivity where the poet's representation disappears and the character becomes a character who is, possibly, dead already and who wishes nothing but death.

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PRACTICE OF WOMEN RIGHTS AMONG WOMEN EMPLOYEES IN UNORGANIZED SECTORS IN ARAVAKURICHY TALUK, KARUR DISTRICT

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ABSTRACT

Women constitute half of the segment of population in India and can not be afforded to be kept out of the mainstreams. Most of the women live in rural areas and 27 per cent of the rural women live below the poverty line. Secondly women are vital and productive workers in India's national economy and make one third of the labour force. Thirdly the poorer family, the greater is the dependence on the women's economic productivity, enhancing women's economic welfare of 60 million Indian households below the poverty line fourthly there is a significant gap between women's especially rural women's potentiality and actual productivity. The present study aims to find out the Practice of Women Rights among Women Employees in Unorganized Sectors in Aravakurichy Taluk, Karur District. A samples of 100 respondents selected randomly were studied. A questionnaire method of survey was used to find out the Practice of Women Rights among Women Employees in Unorganized Sectors. The data were collected by using questionnaire as an instrument. Percentage analysis, cross tabulation was applied in the present study. The findings and observations are the result and outcome of the interpretations made during the study of analysis.

Key words: Women Rights, Women employees, Unorganized sectors and demographic variables

INTRODUCTION

During early vedic period women used to participate in many religious sacraments, especially, the yagya could not be performed until the wife accompanied the husband. There was the custom of swayambara in royal families, where bride used to choose her husband from a galaxy of suitors.

During the past two decades, empowerment practice in the human services has emerged from efforts to develop more effective and responsive service for women, people of colour and other oppressed groups. The goal of this method of practice is to address the role powerlessness plays in creating and perpetuating personal and social problems. It can be distinguished by its focus on developing critical awareness, increasing feelings of collective and self-efficacy and developing skills for personal, interpersonal, or social change. Within our increasingly diverse. Society, empowerment has emerged as one perspective or practice that can be inclusive and supportive of diversity.

Equality and empowerment of women are necessary to bring about the egalitarian human society. Societies cannot succeed by suppressing the talents of half of their members. Promoting gender equality and empowerment of women was declared as an important millennium development goal adopted by the millennium summit held in New York in September 2010.

As in other parts of the world there are large disparities in the economic, social and political opportunities available to men and women in India. Gender discrimination begin early in life, with female infants having a lower chance of survival owing largely to parental neglect. The discrimination continues as the female child grows over first in the form of smaller rations of food and nutrition and later in the form of fewer schooling opportunities as compared to boys. As women enter the labour force, they face discrimination in the labour market as well, primarily in the form of lower wages.

In 2010, the committee on the status of women produced a significant document, highlighting women's declining status, role and participation. The report revealed that majority of women in India did not enjoy the rights and opportunities guaranteed to them by the constitution. The socio-cultural setting restricted her role in the family and the society and kept her in the backwaters of politics.

The national perspective plan 2005-2010 clearly admits that the development policies have failed to give justice to women. Laws, education, health, family planning and communication all reveal a sexist bias. The plan acknowledges the necessity to get her

more space and create an egalitarian social structure.

Women will given empowerment only when both men and women recognize that women should be respected and society should contribute to empower them when all men and women respect women and accept their contributions whole heartedly there is no doubt that women will gain momentum for empowerment.

The term empowerment of women has been used at different times under different circumstances to mean different things for some it implied imparting of skills to enable a women to be economically independent. In other cases it has been taken to mean assertion to her human rights. In yet another situation it has implied political participation for political empowerment.

The impact of women in politics is mixed. Though improved status can be visible in certain respects, overall their situation is not good. The status of women varies enormously from the part of India to another. Discrimination on the ground of sex is visible on the status of girl children, continuing practice of dowry and dowry killings, on the area of health, education and political representation.

In India Empowerment of Women is not so easy. There is no easy solution also. The real solution will be a holistic approach that should be dealt with all major interrelated issues of social and economic, justice, health and tradition. So for such change women should be self-equipped, have knowledge and ability to handle self and surroundings.

Women will gain empowerment only when both men and women recognize that women should be respected and the society should contribute to empower them when all men and women respect women and accept their contributions whole heartedly there is no doubt that women will gain momentum for empowerment.

Women Empowerment can be viewed as a continuum of several interrelated and mutually reinforcing components.

- Awareness building about women's situation, discrimination and rights and opportunities as a set towards gender equality. Collective awareness building provides a sense of group identify and the power of working as a group.
- Capacity building and skills developments, especially the ability to plan, make decision, organize, manage and carry out activities to deal with people and institutions in the World around them.
- Participation and greater control and decision-making power in the home, community and society.
- Action to bring about greater equality between men and women.

Social Empowerment

Social empowerment means equal status, participation and power of decision making at the household level and also at the community and village level. Social empowerment of women enables them to participate in the decision making process in democratic institutions. The members of the Self Help Groups are persuaded to attend the self help group meetings regularly. The women those who rarely come out of their houses slowly begin to enjoy the gatherings and start participating in the discussion about financial matters, health and family problems. In the end it leads them to discuss about politics too. This awareness which is unknown to the poor rural women till now, leads to social empowerment.

Economic Empowerment

Economic Empowerment is the initial aspect of women development and greater access to financial resources inside and outside the household, reducing vulnerability of poor women to crisis situation like famine, flood, riots, death and accidents in the family and significant increase in women's own income. It gives women the power to retain income and use it at her discretion. It providers equal access and control over

various resources at the household level. Financial self-reliance of women both in the household and in the external environment lead to empowerment of women in other spheres.

Political Empowerment

Empowerment of women in all spheres in particular the political sphere is crucial for their advancement and foundation of a gender equal society. It is central to the achievement of the goals of equality, development and peace. Women's political empowerment is premised on three fundamental and non-negotiable principles (a) The equality between women and men (b) Women's rights to the full development of their potential (c) Women's right to self-representation and self determination. In empowerment the key indeed is 'power'. It is power to 'access', 'control' and make 'informed choices'.

REVIEW OF LITERATURE

Tapan, Neeta (2010) has revealed in her study need for women empowerment for that certain hindrances that come in the way of female literacy are poverty, early marriage, household work, social traditions, distantly located schools, etc. These impediments are responsible for non-enrolment and dropouts of girls from schools. Empowerment of women would not be possible unless they are properly educated.

Singh, O.R. (2011) conducted study on education and women empowerment and pointed out that empowerment of women rough law is no doubt necessary but for the improvement of the status of the women, change in the attitudes and roles of both men and women are essential. If women are mightily educated they can contribute to economic growth and development in all spheres. Several factors, such as ignorance, economic dependency and lack of organized effort hinder women from realizing their potentiality in the society. Women can harness community resources for general well-being provided they are empowered in the right direction.

Prabhar Vani (2014) made a study "**Women in Rural India"** and stated that women's dependent position is the result of a rigid distinction between men's role and women's role in the society. This leads to exploitation of women. In rural areas, they are the landless agricultural labourers members of family with uneconomic holdings, traditional menial servants and workers in traditional village and cottage industries. According to the author "what needed is awareness generation in women, their mobilization and training for their new political roles. They have to know about themselves, their rights, nature of their political system, the myriad problems facing the country, the political process through which decisions are made and policies formulated.

Arundhabti Chattopadhyay (2015) has discussed in his article **Women an Entrepreneurship** that social empowerment of women is a long and difficult process, as it requires a change in the mindset of the people. Entrepreneurship development among women case be considered a possible approach to economic empowerment of women. This will also uplift her social shows significantly. Through Entrepreneurship development a women will not only generate income for herself but also will generate employed for other women in the locality. This will have a multiplier effect in the generation of income and poverty alleviation.

Mishra Shambhu Deo and Alam Masood (2016) conducted a study on **Empowering Women in India** and pointed out that women's development is directly related to natural development. A large numbers of programmes initiated for women's development by emphasis on providing equal opportunities to women by empowering women and creating self-reliance. "The three aspects of gender empowerment-health and education of women, eradication of gender barriers in employment and full participation of women in democracy must be given maximum attention which could help bring about transformation of many millions of women of India in the main stream of natural development.

Yadav Krishnanand, et al., (2016) have stated that empowerment of women does not mean setting women against men. It means making men and women realize their changing roles and status and develop a consensus for harmonious living. The authors have further said that women must realize that they have constitutional rights to quality health care access to education economic security, employment opportunities,, pay quality and political power. Now, is the opportunity to invest in India's future, which lies in the emancipation of women. "For, when a woman thrives, her family thrives, when family thrives communities flourish and the nation reaps the benefits." The authors have suggested that empowerment of women can be achieved through education, employment and their organizations. The barriers that hinder women's access to education, health and economic independence must be broken.

Awasthi, Arvind, et. al. (2016) have emphasized that against in equality literacy with technical skill for rural women can be a tool for empowerment, which can be strengthened through dissemination of information regarding agriculture and other sectors. This can be done through audio-visual and mass media communications which will facilitate them to improve their earning potential. Another boon is electrification by rural areas which would have the way for building infrastructure and creation of micro enterprises that would enhance access to finance for rural poor.

Kathryan (2017) explores in his article that the fit between the lived reality in entrepreneurial organizations and but list concept of the bodhisatlva in order to see weather just opposition of these two very different realities earn shed light on the impact of spiritual values in the work place. It is conchoids that it was not easy to go behind the stories to the way they constricted realities. Some spoke very concretely about what had happened in their lives. Other landed to expound Buddhist teaching. Still others used the opportunity to effect on the deeper issues brought up by the nature of entrepreneurship in U.S. culture when worked at along side Buddhist practices.

Shandilya, Tapan Kumar (2017) made a study on **"Gender Equality and Empowerment of Women**" and stated that all round development of a nation depends on the socio-economic, political and cultural; activities performed by both men and women. As earthly life and living is enriched by women to make it more enjoyable, empowerment of them is an urgent need. Women empowerment requires empowering them economically, socially and politically so that they make break male domination claim equality with them. They have suggested that for empowering women efforts by all. The sections of the society including the voluntary organizations and the government must be made. For increasing women empowerment micro-enterprises for women should be set, up and their skills and technical knowledge must be developed.

Singh, et al., in their study on Gender disparities in Rural Workforce (2017) suggested various measures to strengthen women's empowerment and rural development which include development of entrepreneurial abilities of women by organizing special types of training, effective planning at the micro-level, adequate representation of women in women related development planning, development of infrastructure facilities, encouragement to women through formal and non-formal education to involve themselves in the service sectors, establishment of women's organizations such as, co-operative societies, mahila mandal, self-help groups, etc., aware of women about the technical and financial assistance available to women entrepreneurs encouragement by government for research and development to find out high income generating activities suitable for women etc. The authors have concluded that "experience, awareness, education and competence, willingness, confidence, self-motivation, encouragement from family and society contribute to empowerment of rural women.

Khullar K.K. (2017) has emphasized in his book entitled **Mahila Samakhya**

Empowerment of Women through Education that removal of women's illiteracy is essential for empowerment. The author has discussed the Mahila Samakhya Programme of the Ministry of Human Resource Development (HRD) that has transformed the lives of the women folk in 14000 villages in 60 districts of nine states of India namely Karnataka, Gujarat, Andhra Pradesh, Kerala, Bihar, Assam, Jharkhand, Uttar Pradesh and Uttranchal. This programme was started as an awareness programme in pursuance of the National Policy on Education 1986 as updated in 1992. Today this programme has entered the areas of education, health, human rights and governance with the objective of creating a gender jurt society. The Mahila Sanghs in these villages run schools, banks, dispensaries, and market and participate in Panchayat Raj Institutions. A number of studies have concluded that the programme is Gandhi and both in concept and implementation. The researcher referred the above said research works carried out in National and International level and understood No study has been conducted on the present research problem. Review of research is very much helpful to frame the research problem.

OBJECTIVES OF THE STUDY

- To study the work life of the women employees in the unorganized sectors.
- To study the awareness of labour legislations by the women employees
- To analyze the utilization of labour rights among the women employees and
- To scrutinize the impact of labour laws among the respondents.

METHODOLOGY

A sample design is a definite plan for obtaining a sample from a given population. It refers to the technique or the procedure the researcher would adopt in selecting items for the sample. The size of the sample refers to the number of items to be selected from the universe to constitute a sample. This is a major problem before a researcher. The size of the sample should neither be excessively large nor too small, it should be optimum. The universe of the present research consists of the women employees working in textile shops, canteens, groceries shops, hotels, sweet shops, bag works, and small and cottage factories located in the Aravakurichy Taluk, Karur District. Agricultural laboures are not included in this study as the nature of the problems faced by them is not similar from the problems of other unorganized sectors. 50 women employees were identified by adopting purposive sampling technique**.** The researcher wishes to collect the data from all the sections of unorganized sectors for good results. It is proposed to adopt a well-structured interview schedule for gathering the necessary primary data from the respondents. The researcher proposed to meet each and every women worker and thereby establish a good rapport through which necessary information can be obtained from the respondents. The respondents are expected to Extend full co-operation for successful data collection. The collected data will be classified and tabulated. It will be done by preparing a master table. Through which sub tables will be drawn according to the requirement of the study. The result of the study will be mainly interpreted with the help of simple percentage analysis. The present study has been conducted among women only with 100 respondents in Aravakurichy Taluk, Karur District because the work places are always busy, the workers are doing their respective works and have no time for interactions.

ANALYSIS AND INTERPRETATION

Table 1 Awareness of certain legislative measures

Sl. No.	Legislative Measures	Yes		No		No Idea		Total
		No.of Res	Per cent	No.of Res.	Per cent	No.of Res.	Per cent	
1.	Awareness of the dowry rights	46	92	4	8	-	-	100
2.	Awareness of the	46	92	4	8	-	-	100

	property rights							
3.	Awareness about women commission	22	44	25	50	3	6	100
4.	Knowledge about inter-caste marriage	4	8	42	84	4	8	100
5.	Awareness about work protection	37	74	13	26	-	-	100
6.	Knowledge about maternity benefits	12	24	38	76	-	-	100
7.	Provision of rights to child home	-	-	43	86	7	14	100

The above table No.1 represents about the awareness of certain legislative measures by the respondents. Out of the total most of the respondents (92 per cent) said that they knew about rights against dowry. This is very important legal rights in the modern society. But it is shocking to note that a few (8 per cent) working women in unorganized sector in the study area did not know about the precious rights of dowry.

It is observed that awareness should be created among the women in general particularly among the illiterate women. Out of the total most of the respondents (92 per cent) said that they knew about property rights. But it is note that a few (8 per cent) working women in unorganized sector in the study area did not know about the precious rights of property. It is observed that awareness should be created among the women in general particularly among the illiterate women.

As for as about the awareness of the women commission is concerned This is very important legal right in the modern society. The most of the respondents (44 per cent) said that they knew about the women commission and (6 per cent) of the women said that No idea of the women commission.

When discussing about the awareness about intercaste marriage protection by the respondents.

Out of the total most of the respondents 84 per cent said that they did not aware about the inter-caste marriage protection measures. A few respondents 8 per cent said that they knew about the inter-caste marriage protection and 8 per cent rest of the respondents said that No idea about the intercaste marriage protection.

Out of the total most of the about the awareness of about work protection. The most of the respondents 74 per cent said that they knew about work protection and very few 26 per cent of the respondents did not know about the work protection.

As far as Knowledge about maternity benefits is concerned. Most of the respondents 76 per cent did not know about the maternity benefits and very few 24 per cent of the respondents said that they knew about it.

Regarding the provision of rights to child home most of the respondents 86 per cent did not know about it and 14 per cent of the respondents said that no idea about it.

Table - 2Awareness of certain legislative measures

Sl. No.	**Legislative Measures**	**Yes**		**No**		**No Idea**		**Total**
		No.of Res	**Per cent**	**No.of Res.**	**Per cent**	**No.of Res.**	**Per cent**	
1.	Knowledge about holiday rights	47	94	3	6	-	-	100
2.	Provision of water/food facilities in	46	92	4	8	-	-	100

	work place							
3.	Provision of intervals on it time and other benefits	44	88	6	12	-	-	100
4.	Awareness of rights to equal wage	4	8	46	92	-	-	100
5.	Provision of first aid at work place	37	74	13	26	-	-	100
6.	Provision of fire service at work place	18	36	32	64	-	-	100
7.	Provision of home facilities	2	4	48	96	-	-	100
8.	Facilities of child education	47	94	3	6	-	-	100

The above table No.2 represents about the awareness of certain legislative measures by the respondents.

Regarding the awareness of the knowledge about holiday rights. The most of the respondents (94 per cent) said that they knew about holiday rights but it is note that a few (86 per cent) working women in unorganized sector in the study area did not know about the precious do holiday rights.

Out of the total respondents most of them 92 per cent were aware of the legislative measures of responsibility of owners to provide good drinking water, snakes and food stuff at lower rate, should be supplied to them to work place. It is observed that as most of them are educated they have learned the legal measures which are available for them. But a meager 8 per cent respondents did not know about this legal measures.

As for as legal measures of intervals during working hours and over time wages & benefits are concerned the vast majority 88 per cent respondents were aware and remaining 12 per cent of them did not know about those legal measures. It is understood that intervals, working hours rest at working place are not displayed properly in the industrial establishments.

As far as about awareness of the equal wage to men this concerned. 92 per cent of the respondents said that they did not know about the equal wage to men.

Regarding the awareness of the provision of first aid at work place. The most of the respondents 74 per cent said that they knew about it and 26 per cent working women in unorganized sector in the study area did not know about it.

About the provision of fire service at work place. Most of the respondents 64 per cent of working women did not know about it and 36 per cent of the respondents said that they knew about it.

When asked the provision of the home facilities. The 98 per cent of the respondents did not know about it. Regarding knowledge about child education. Most of the respondents 94 per cent said that they knew about it and very few 6 per cent of the respondents did not know about it. It is understood through observation that they do not have idea about their owners responsibility to provide assistance for their children's educations.

Table 3 The utilization of the certain legal rights by the respondents

Sl. No.	**Legislative Measures**	**Yes**		**No**		**No Idea**		**Total**
		No.of Res	**Per cent**	**No.of Res.**	**Per cent**	**No.of Res.**	**Per cent**	
1.	Dowry	15	30	34	68	1	2	100

2.	Property	17	34	33	66	-	-	100
3.	Women commission	16	32	33	66	-	-	100
4.	Inter-caste marriage protection	2	4	6	12	42	84	100
5.	Protective measures	12	24	38	76	-	-	100
6.	Maternity care leave	11	22	38	76	1	2	100
7.	Child home	6	12	38	76	6	12	100

The above table represents about the utilization of certain legislative rights by the respondents. Out of the total respondents 30 per cent said that the utilization about rights against dowry. This is very important legal right in the modern society but it is shocking to note that 68 per cent vast majority of the working women in unorganized sector in the study area did not utilize dowry rights and 2 per cent of the respondents said that no idea about it. It is observed that awareness should be crated among the women in unorganized sector.

Out of the total respondents 66 per cent of the working women they are not using the rights of the property sharing and 34 per cent of them are using the rights most of the women do not claim property from their parents and husbands even among the educated they are not ready to claim property.

Out of the total respondents 66 per cent of the working women they are not using the women commission and 34 per cent of them are using in the women commission a considerable respondents have contacts with the women activists.

Regarding rights of inter-caste marriage protection. The most of the respondents 84 per cent said no idea about it and 12 per cent of them do not using the rights but, the 4 per cent of them using the rights about it 84 per cent most of the young unmarried women workers do not know and utilize the benefits of special marriage Act 1954.

As far as protective measures is concerned of most of the respondents (76 per cent) do not use it, and 24 per cent of the respondents was using them protective measures are the important for health of the respondents protective measures not needed like textiles shops.

Regarding for maternity benefits most of them 76 per cent regarding are not using it and 22 per cent of them are using the leave, and 2 per cent of them said that no idea.

As most of the respondent are unmarried the cannot avail maternity benefits. Use creche 12 per cent of them respondents using it and 12 per cent of them said that no idea.

Table 4 The utilization of the certain legal rights by the respondents

Sl. No.	**Legislative Measures**	**Yes**		**No**		**No Idea**		**Total**
		No.of Res	**Per cent**	**No.of Res.**	**Per cent**	**No.of Res.**	**Per cent**	
1.	Weekly leave	47	94	3	6	-	-	100
2.	Drinking water/ food facilities	39	78	11	22	-	-	100
3.	Tea/ food intervals	37	74	13	26	-	-	100
4.	Equal wage	46	92	2	4	2	4	100
5.	First aid	33	66	17	34	-	-	100
6.	Fire service	19	38	29	58	2	4	100
7.	House facility	2	4	45	90	3	6	100
8.	Child education	05	10	45	90	-	-	100

Out of the total respondents most of 94 per cent of them use that the weekly leave but (6 per cent) of the respondents do not using the rights.

Out of the total respondents most of them 78 per cent are using the legislative measures of good drinking water, snakes and food stuff at

lower rate supplied to them of work place. But a meager 22 per cent of the respondents said that they did not use the right or they are not adequate.

Out of the total respondents most of them 74 per cent use the intervals and 26 per cent of the people do not using the rights. As far as equal wage is concerned most of the respondents 92 per cent of the rights to equal wage and 4 per cent of the respondents do not use the rights and 2 per cent of the respondents said no idea about it.

Regarding the first aid at the working place. Most of the respondents 66 per cent them using the rights and 34 per cent of the respondents did not use the rights.

Regarding the fire service at the work place. Most of the respondents 58 per cent do not using the rights and 38 per cent of them using the rights and 4 per cent of them said no idea about it most of the work place fire extinguisher is not provided. Through the management do not provide education facility for children is provided by the government. Unorganized sectors are not ready to attract their workers as there is availability of human resources.

Regarding house facility extinguish is provided. The most of the respondents 90 per cent of them do not using the rights of house facility and 4 per cent of them are using the rights and 6 per cent) of them said no idea about it. The management do not help in any way for the housing of the respondents. The utilization of rights about the child education. Most of the respondents 90 per cent of them using the child education and 10 per cent of them are using the child education rights.

MANAGERIAL IMPLICATIONS AND CONCLUSION

The following suggestions are given to effective use of social legislations for women empowerment. i) Integrated approach by government and NGOs to create awareness about labour rights among the women, ii) Govt. should take stringent action against the owners who do not implement the labour legislation iii) Establishment of women commission, in micro levels and counter against government officers, who act against labours interest iv) women organizations and associations should be encouraged to set up their branches in rural area and report any type of harassment or torture to legal institutions, and v) Govt. should take steps to establish small and large scale industries to provide employment to women. vi) equal wages and living wages provisions should be intensively implemented among the unorganized sectors to avoid exploitation of the employers. The valuable legal rights for women empowerment are not availed and enforced by the woman. The democratic political system has created a myth that women get equality, freedom and justice. But all these are seen on paper only not in actual practice. Government has been taking steps to empower the women by providing all the required legal protection. Educational values and employment opportunities can make women to aware of their rights.

There is no small and large scale industries run by governed to provide employment opportunity for the SC and ST women.

Young women are forced to work in Xerox shops, sweet stalls, Textile centres hotels and other establishments. Due to poverty and ignorance the young girls donot prefer to go for higher studies even though educational institutions, scholarships, and other Government benefits are available in the study area.

The women working in unorganized sectors are not fully aware of the protective measures health facilities and welfare schemes. But they are aware of general legal rights, like dowry, property, marriage divorcee and other rights. Implementation of labour legislation by the owners of the establishments are very poor. Especially, minimum wages, maternity benefits welfare facilities and other important legal measures in the industrial establishments. The women working in unorganized sectors are not aggrieved of their owners and do not insist them for providing

any facilities. Because the unwritten terms and conditions of the employment between them and their management.

There are so many villages around the Aravakurichy Taluk, Karur District where number of women workers are available at cheaper rate. So that, women workers accept the meager wages and poor facilities and welfare measures provided by their employees. There is a gab between the enactment of labour legislations and acceptance and implementation of the owners of unorganized sectors. Based on the study certain suggestions are given.

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DEFENSE MECHANISMS DISPLAYED BY CELIE IN *THE COLOUR PURPLE* BY ALICE WALKER

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ABSTRACT

Alice walker was an American novelist whose books and poems never cease to explicitly portray the reality that African American women had to face. 'The colour purple' by Alice Walker is a story about an African American woman's oppression inside her community which leads to her transformation in the end. The work won the Pulitzer Prize in 1983. The novel portrays the traumas and violence inflicted on young teenage girls. Defense mechanisms are commonly used by the human mind to tackle unfavorable situations in their life. Even in literature, fictional characters use defense mechanisms to handle their inner conflicts and traumas. This paper focuses on analyzing the defense mechanisms used by Celie in Alice Walker's novel 'The colour purple' in tackling her traumas and oppression. Celie is a perfect example to show how psychoanalysis can be carried out in detail with fictional characters. Many neurotic and mature defense mechanisms can be identified with the character. Celie tries to cope up with her conflicts and situations with defense mechanisms like repression, sublimation, fantasy, passive aggressive behavior and intellectualization which will be discussed in the paper.

Introduction

Alice walker was an American novelist whose books and poems never cease to explicitly portray the reality that African American women had to face. Her major works are The third life of Grange Copeland (1970), In love and trouble ;Stories of black women (1973), Meridian 919760, The temple of my familiar (1989), possessing the secret of joy(1992) etc. She has also written poetry collections like Once (1968), Revelutionary Petunias and other poems (1973), Collected poems (2005), Taking the arrow out of the heart (2018). She wrote her epic novel 'The colour purple', an epistolary novel in 1982. The book which won the Pulitzer Prize was adapted into a film in 1985, directed by Steven Spielberg. Later a musical version was released in 2004, starring Oprah Winfrey and Quincy Jones .'The colour purple' by Alice Walker is a story about an African American woman's oppression inside her community which leads to her transformation in the end. The work won the Pulitzer Prize in 1983. The novel portrays the traumas and violence inflicted on young teenage girls. Celie, a young teenager narrated the novel as a series o0f letters to god. This started when her father Alphonso, rapes and threatens to kill her mother if she ever reveals this to anybody other than god. At the age of 14, Celie gives birth to a child which is taken away by Alphonso, just like he had once done earlier. A widowed man called Mr. __ (Albert) asks for Nettie's hand in marriage. Alphonso offers Celie since she is the eldest and is a burden to the family. Soon Nettie fled from Alphonso and lives with Celie for a while, after which she had to leave that place as Mr__ starts to pursue his interest on her. Celie then befriends other black women. She first befriends Sophia, Mr __ daughter in law, who fights back as her husband Harpo tries to beat her. Celie then befriends Shug Avery, a beautiful and confident singer who was Mr__ 's former mistress. The two start a close relationship and finally fall in love. Celie discovers that Albert was hiding the letters that Nettie had been sending her. Nettie had joined Samuel and Corrine with their adopted children Adam and Olivia, who are actually Celie's children. After knowing this truth, she loses her belief in god and starts addressing her letters to Nettie. She then moves with Shug and her husband to Memphis. After the death Mr __ , Celie inherits the house, gets reunited with Nettie and meets her children. Defense mechanisms are employed by humans' in order to tackle the unexpected situations in life. Even fictional characters employ these mechanisms to deal with their traumas and problems. This paper discusses the defense mechanisms that were employed by the major characters of Alice Walker's 'The colour purple'.

The foundation of psychoanalysis was laid down by Sigmund Freud in the 20th century. According to his theory, the mind which is

divided into conscious and unconscious . It works mostly with processes that are guided by the latter. Even the sexual drives and behavioral pattern of a person are involuntary actions lead by the unconscious. There are two concepts that he introduces in the book. The first is 'Nachträglichkeit' which means working through and second , 'Uncanny'. The first is applied in the story of the wolfman who accidently witnesses his parents having sex and is traumatized until he comes to know about it in the adulthood. The second concept is applied is applied E.T.A Hoffman's work 'The sandman', where the child is threatened that he will lose his eyes if he disobeyed. As a consequence,he began related all lawyers to sandman who would pull off his eyes. (3)

Chapter 1

Concepts 'Nachträglichkeit' and 'Uncanny' through Celie

Both concepts of 'Nachträglichkeit' and uncanny can be found out from Celie's experiences. In her first letter to god, she states "Maybe you can give me a sign letting me know what is happening to me" (Walker, 2003, p. 1). She feels burdened and dilemmatic with the sin of having sexual relations with her father. But this trauma was worked through and the burden was released as she realizes that he was just her stepfather and not real one. The concept of uncanny can be noted with the fact that she relates all men that came into her life with her step father, 'Remind me of Pa' for each man (Walker, 2003, p. 22). Even as she is tortured, beaten up and raped by her new husband, Celie accepts it as a part of her life. According to Cori, "the maltreatment in the early relationship with the parent(s) naturally leaves you defenseless and vulnerable to the similar relations with the other(s)" (Cori, 2018, p. 170). Childhood plays an important role in every person's life. The treatment that he/she receives is detrimental in molding up the character of the person. Here as Celie is mistreated, tortured and burdened with responsibilities, she believes that her whole life would be like that. (3)The mirror stage, as mentioned by Lacan is the stage when a child identifies itself in the mirror and starts a journey towards selfhood. The mirror stage for Celie according to Ross, however happens in her youth when Shug Avery asks her to see her vagina in the mirror. This was the beginning of self-discovery and acceptance of her body to Celie, thus changing her life forever' (p. 70). Until that moment, Celie had associated her body as a token of her traumas and physical pain from childhood. She was convinced that she was ugly and did not meet the conventional standards of beauty. According to Ross, 'because the female body is the most exploited target of male aggression, women have learned to fear or even to hate their bodies' (ibid., p. 70). As Levi Strauss States, women's bodies are exchanged as a sign of binding them together. (Lévi-Strauss, 1969). Celie was married off to Mr__ without her consent. This is an example of how men in African American societies treat women bodies.Celie chooses to express her feelings only through letters to god. This very act can be interpreted as a schizoid fantasy because she hopes that 'god 'will give her all the answers. She tries to resolve all her conflicts through this method. Another defense mechanism is enacted by Celie on her wedding night to withstand the unpleasant sexual act she encounters. "I lay there thinking about Nettie while he on top of me, wonder if she safe. And then I think bout Shug Avery. I know what he doing to me he done to Shug Avery and maybe she like it. I put my arm around him" (Walker, 2003, p. 12). She imagines herself as Shug Avery and tries to enjoy the act while in reality it might have been traumatic and painful to her. According to Vaillant "defenses reflect integrated dynamic psychological processes for coping with reality rather than either a deficit state or a learned voluntary strategy" (1994, p. 45). Another instance can be noted when the family comes together to discuss the release of Sophia from jail. When other members think of logical ways through which she would be released, Celie fantasies of Sophia being carried home by angels. , "I don't know what she thinks, but I think bout angels, God coming down by chariot, swinging down real low and carrying ole Sofia home. I see'em all as clear as day.

Angels all in white, white hair and white eyes, look like albinos. God all white too, looking like some stout white man work at the bank. Angels strike they cymbals, one of them blow his horn, God blow out a big breath of fire and suddenly Sofia free" (pp. 90-91).

Chapter 2

Repression, Sublimation and Passive aggression portrayed by Celie

Passive aggressive behavior is exhibited by Celie. When Harpo asks Celie for advice in taming Sophia to behave like a 'normal 'woman, Celie advices him to 'beat her' (ibid., p. 36). When Sophia questions why she advised so , Celie responds "I say it cause I'm a fool, I say. I say it because I'm jealous of you. I say it cause you do what I can't" (ibid., p. 40). As Shug Avery comes to Mr__'s home with her husband Grady, Celie gets frustrated because she is doing something that Celie cant. Even when her husband is by her side, Shug never ceases to flirt with Mr___(Albert) "Shug laugh and laugh when he got anything to say. Show teef and tits aplenty. Me and Grady try to carry on like us civilize. But it hard. When I hear Shug laugh I want to choke her, slap Mr._face. All this week I suffer. Grady and me feel so down he turn to reefer, I turn to prayer" (ibid., p. 119). Her prayer is another defense mechanism. She uses **sublimation**, with which her anger and negative feeling is converted into positive. (5)There are many neurotic defenses that Celie shows throughout the novel. When Mr___ beats with her accusing her of being stubborn, Celie thinks that she is a tree and tries to stay like wood. "He beat me like he beat the children. Cept he don't never hardly beat them. He say, Celie, git the belt. The children be outside peeking through the cracks. It all I can do not to cry. I make myself wood. I say myself, Celie, you a tree. That's how come I know trees fear man" (Walker, 2003, p. 22).Celie is so accustomed to suffering and torture that whenever a positive thought comes to her mind, she makes sure to repress it. Celie thinks that her hopes for change and better life are never going to be true and thinking about it might cause more pain. The mechanism of **repression** is used here "I think bout my sister Nettie. Thought so sharp it go through me like pain. Somebody to run to. It seem too sweet to bear" (Walker, 2003, p. 65). Other neurotic defense mechanisms like **fantasy and intellectualism** can be seen through the words of Celie. She believes that struggling against these harsh conditions and standing up for herself might cause pain and despair. As Nettie leaves Celie in Albert's home, she compares it with being buried after death,. But Celie thinks that it was better to be buried so that she wouldn't have to do household work and look after anybody. Never mine, never mine, as long as I can spell G-o-d I got something along" (p. 17). Even then, she finds peace in the concept of god. When Albert's sister visits them and tries to empower Celie into claiming her rights and breaking out from being a slave, Celie says that thinks "I don't say nothing. I think about Nettie, dead. She fight, she run away. What good it do? I don't fight, I stay where I'm told. But I'm alive" (p. 21). She has connected death with resistance. Celie believes that Nettie's efforts for getting a better life is what caused her life. Celie finds ways to rationalize her slavery and finds solace in such justifications. Three mechanisms of maturity out of the five mechanism (altruism, anticipation, humor, sublimation and suppression) as proposed by Vaillant are applied in her life. Out of all the defense mechanism, the most dominating and interesting one is **sublimation**. The feeling of helplessness, anger, despair etc is transferred into prayers in her life. All of her coping mechanisms are suppressed with her real anger as she finds out that Nettie's letters were hidden from her by Mr __. "[a] needle and not a razor in my hand, I think" (p. 147). As she fantasizes if killing her husband with a razor with which she shaves him, Shug asks her to continue sewing. She transfers the anger that she feels into a new life when she opens a boutique to sell that unisex pant that she had sewn. She deserts her oppressor and leaves with Shug Avory and her husband to Memphis. In another instance, when Harpo asks if she smokes, she replies"Do I look like a fool? I ast. I smoke when I want to talk to

God. I smoke when I want to make love. Lately I feel like me and God make love just fine anyhow. Whether I smoke reefer or not" (p. 220). The transformation of Celie from a suppressed slave to a liberal who has the audacity to joke about love making and god is very evident. The last defense mechanism altruism can be found out within the interaction between all the characters of the coloured purple. All the family members helps Sophia get out jail and helps Henr5eitta fight her disease. As Celie got pregnant with her father's child, and her mom got infuriated and started enquiring about the child's father, Celie says that god is. Even as the baby is took away, Celie believes that it was god who took it. The psychological method of projection is used here in diverting the real fact that she was impregnated by her father and the baby was kidnapped. 'She ast me bout the first one whose it is? I say God's. I don't know no other man or what else to say. When I start to hurt and then my stomach start moving and then that little baby come out my pussy chewing on it fist you could have knock me over with a feather.'(9)The readers come to know the reality that Celie knows in her second letter to god where she confesses that the father took her second boy and sold it to a man in Monticello (10)As soon as Celie comes to know about Shug Avery, she is overpowered with her boldness and beauty. She stares at her cheerful and confident photograph the whole night (13). All throughout her life Celie represses her real feelings and blames everything on god, deep inside Shug Avery is a person she wants to be. Her stepfather says that Celie says lies. Her lies are actually defense mechanisms to prevent getting punished and also to deviate from her own reality. As we take the character Alphonso, he is a frustrated man. He uses misuses Celie as an outlet to get out his frustration. The defense method of **displacement** is clearly seen here. Celie is an object with which Alphonso compensates his anger. As far as he was concerned, Celie's mother was clinically depressed after her husband's death. The woman showed signs of anger and deprtession all throughout her life, which affected Alphonso. Celie is considered as an epitome of all the bad things in his life. Blaming her gives him a kind of pleasure. He says that Celie might give away all his things if he was not watchful. He believes that Celie is a bad influence on his other girls (14). She was forcefully taken away from school and was epitomized as being dumb. It is to be noted that Celie's dignity and self-respect crumbled with her destructive relationship with her stepfather. She has an Oedipal fixation which doesn't go away even after she is married. Her character had been molded in a way as to bear violence and suffer in silence. She is stuck up in a dilemmatic situation where what is the right and wrong could be defined. Celie continues to believe that 'she was born that way'. Her primary motive is just to survive and not to live (11). Resistance is not even thinkable for Celie who has been mentally handicapped with threats. Her mind has been infused with ideas like speaking out the truth would result in disasters like her mother's death. Situations that brought her up inflicted a low self-esteem that restricts her from behaving like other normal people. Celie begs her father 'to take her', when their new mammy was sick for the protection of her little sister. Celie marries Mr__ with no resistance due to the same low self-esteem. Alphonso degrades Celie's character, says that she is not fresh and has been spoilt twice, she lies and would give away his things if he was not watchful. To all these accusations, Celie remains mump. Celie accepts her husband's mistress without any resistance unlike other women. As discussed earlier, Celie's main aim is survival. (11)

Conclusion

Celie is a perfect example to show how psychoanalysis can be carried out in detail with fictional characters. Many neurotic and mature defense mechanisms could be identified with the character. Celie tries to cope her conflicts and situations with defense mechanisms like repression, sublimation, fantasy, passive aggressive behavior and intellectualization. Celie was psychologically tied up with her step father's threat that shw received whyen she was a child. The threat which she internalized became a frame with which Celie viewed the whole world. She

diverted her anger and defnse into prayers. A clear case of repression can be found out from .The turning point of Celie's life is when Shug Averie asks her to see her private parts in the mirror which began the process of self-discovery in her. From an objectified and colonized body, Celie begins considering her body as her own. Cheung (1988) argues that, '[t]he problem with God is that he never answers Celie's letters. Worse still, trust in him leads her to accept the status quo' (p. 166). Her defense mechanism of blaming and hoping that god would give her answers and solve all her problems ceases there. The threats that her father posed on her crumbles at that point and Celie began addressing her letters to someone living and close to her, Nettie. According to Vaillant 'the symptoms of personality disorder are a means of copying with reactions to unbearable people-in past or present time' (1994, p. 45). Until then Celie needed edefemnse mechanisms to repress her true self, but then she matures and becomes a fearless and independent woman.

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A FACELESS SHELL: REPRESENTATION OF WOMEN IN JAYANTA MAHAPATRA'S *TEMPLE*

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ABSTRACT

Jayanta Mahapatra (b 1928), is one of the most significant bilingual poets from Odisha. A Physics teacher by profession, he started writing poetry in his mid-forties. From his first collection Close the Sky Ten by Ten (1971) to Hesitant Light (2016), Mahapatra has been consistently preoccupied with the problems of Indian women of all ages. This paper is an attempt to analyze the representation of the same in Temple (1989), the only book length poem of Mahapatra. It is argued that Temple presents a bleak and realistic vision of life that women face, punctuated by poverty, social injustice, traditional constraints, negative images of bodily processes, violation of the female body and attack on privacy. Temple does not, in anyway attempt an idealization of women, on the contrary it is an attempt to show how far from the ideal the condition of women is.

Keywords: *Menstruation, Rape, Religion, Suicide, Womanhood.*

Introduction

The concept of woman in Mahapatra's poetry is a vital link in understanding his tragic vision. *Temple*, in many respects, continues this vision which made its appearance in his first collection of poems. In Mahapatra's poetry, woman is constructed through two concepts, gender and sex, that provide a realistic picture of womanhood. The self in his poetry which confronts womanhood is devoid of all illusions and the consummate expression of the concept of woman that he holds is to be found in *Temple.* The title is sarcastic and ironic and it illumines a particular aspect of the male consciousness which has its root in the adolescence of the male mind of all times, namely, the romantic phase which tends to idealize womanhood. This concept of the romantic is coupled with the image created by religion and the resultant image tends to throw up a number of questions regarding the credibility of such constructs and the need for the same so as to bring out the instabilities in such constructs.

The concept of the female body in the world of Mahapatra's poetry as it appears in *Temple*, does not have anything Lawrentian about it and is well within the structure of religion that sees the body as a burden. The phases of physical development and experiences specific to womanhood impinge upon the consciousness as dictated and produced by society. The desire-existence equation that runs through *Temple* tends to reflect the interdependence of such concepts. The gradual erosion of life based on the desire-existence philosophy is caused by a space that is economic and social to the core. The failure to understand the nature of the above mentioned conditions, Mahapatra suggests, makes the life of the Indian women, particularly rural women, miserable.

Mahapatra's poetry in general and *Temple* in particular, creates the impression that all the phases of the life of a woman are a "long play toward nothing". The events in *Temple* are placed between two incidents which bear the distinct flavour of the concept of "event" that bears a number of connotations like the publicizing of happenings and a corresponding interest of the public for such news items. In this universe, events are consumed by a public that is indifferent to the train of social scenario in which suicide and rape, occur and with little sympathy or desire to know the causes of sorrow and injustices.

Embedded between suicide and rape, the extremes of human existence stem from social problems, that need urgent attention. *Temple* opens and closes with images of violence that span both extreme old age and late childhood, presented in the form of news from the print media. The suicides of Chelammal and her husband Ramanujam with which the *Temple* begins and which introduce the central character and ends with the news of the gangrape and murder of a nameless twelve-year-old girl whose beheaded body is recovered by the police, offer the reader an idea of the extent of the violence in the tragic vision that Mahapatra presents.

In what is titled Prologue, the poet presents a newspaper item dated March 24, 1980 that informs the reader of the suicide of an octogenarian couple from Kumbakonam. From this bare and factual newspaper item, Mahapatra constructs imaginatively the life of Chelammal. Beginning from the moment of the decision to commit suicide, the narrative goes back to Chelammal's childhood, adolescence and youth. In what may be called a flashback Mahapatra is able to capture not just the life of Chelammal, but possibly all those women of a particular period of south India whose life carried more similarities rather than differences. Chelammal thus assumes a larger frame of reference and becomes the representative of all those women who lead lives of quiet desperation. Her life, and death by suicide offer the poet an opportunity to present the social forces that drastically restrict the lives of women. The cause of suicide is given as poverty and isolation, conditions that are rooted in the social spheres of existence and the latter seen as the result of the former allows the poet to elaborate the societal conditions that Chelammal in particular and women in general faced at a historical point which make *Temple* a social critique of considerable relevance.

The prologue moves rapidly to the imaginative reconstruction of the moment of decision to take one's life, in this case to die together: "Everything had been planned, yet it was not plan / it was as though the darkness had been washed away/ by his one command" (1). Called a "girl of eighty, with cheeks loose and toothless gums", the poet sorrowfully wonders whether she didn't think "of the next day's light, / about the sun's blissful skim on treetops, its gleaming / on the diamond stud in your rich neighbour's nose?"(1). The social disparity appears as neighbour's diamond stud. The neighbour's affluence and the richness of a sunny day, the poet tragically realizes, did not deter the couple from taking their lives. The aged body of both the couples appear in the narrative as his "parenthetic look of eighty-five years" and the "mocking flap of the weary breasts" (2). The poem is divided into the "Hall of Dancing", the "Hall of Offerings" and "Sanctum Sanctorum" and these divisions become the different images of female existence which fuse the feminine concept of dancing, of woman as gift to be offered for the realization of her identity, and the paradoxical position of the woman as a goddess. Mahapatra offers in *Temple* two voices, that of the omniscient narrator and the voice of Chelammal. This reliance on two voices results in greater credibility since the imaginative build up does not go unchecked, but is continually counterpointed by the realistic voice of Chelammal.

Temple rests on the idea of the woman as an object to be venerated and as an object to be sacrificed in front of a God that is more often a man in His guise. This world has inculcated in the mind of woman, the need for the identification of God with the male to such an extent that the woman is not conscious of being manipulated by the male. The structure of the poem is again indicative of the limits of the horizon of the meanings and concepts associated with women because of the final episode of the news item of rape which is a description of the violence against women which is both psychic and physical in nature. The structure of the poem thus shows the precarious existence of a sanctum sanctorum lying close to a physical violence that has extremely serious consequences and the irony of such designations. The proximity to violence thus represented in *Temple* testifies to what Sylvie Frigon notes: "Typically, violence done to women, but not violence committed by women, is representable" (4) Further the introduction of the theme of rape through the newspaper item addresses the need to reassess the claims of feminism: "The mainstreaming of feminism and the presumed liberation of women appears to stand in contradiction to notions of everyday sexual victimisation and the continued inequalities that underpin it"(Lazard, 2020, p. 8).

The woman that Mahapatra presents in *Temple* is acutely conscious of the changes that time brings about on the body and the insults and assaults to which it is subjected. A sense of unease prevails in moments of such awareness as a feeling of being alienated from one's own body runs through this inner universe of woman. The darkness of the

future is reflected in the imagery that the poet employs. A woman's life is often conceived in terms of darkness which proves to be apt as the future unrolls the vistas of pain. The violation of the private space happens early in this world: "By the old well the first darkness / Caught her unawares in the failing light / perhaps she was thirteen" (15) The world that Mahapatra presents is not safe for women. Violence appears early in life; it is almost concomitant with adolescence. Underneath / here growing breasts two swells of pain / felled the first touch (15). This traumatic incident foreshadows the final image with which the poem closes i.e. two different news items of rape. Rape is a constant theme in Mahapatra's poetry, both in works like *Dispossessed Nests* (1986) that preceded *Temple* and a later work like *Hesitant Light* (2016). Written in 1989, *Temple* takes a direct approach in its treatment of rape by vocalizing rape which has often remained silenced. The fear of rape and rape that remains within the domain of the unspoken is now a clearly identified concern:

> Rape and sexual assault, as with all violence against women, remains a significant social problem. The true prevalence and incidence of rape and sexual violence is very difficult to measure, largely because sexually violent acts most often happen in private spaces (Stanko and Williams 2009; McMillan 2011). It is also the case that rape is one of the most under-reported crimes, therefore statistics about reported crime betray the true prevalence of rape, which is likely to be much higher (Koss and Harvey 1991). (McMillan, 2013, p 72)

With reports of child abuse and gang rape appearing in the print media and visual media every day, the ubiquitous nature of rape has almost blunted an urgent response to it, though it has not stopped feminists from analyzing the response to rape victims:

> A pattern of derogatory judgements about rape victims has been documented at every level of society, prompting researchers to analyse how and consider why people respond to rape victims so negatively in comparison to victims of other criminal offences (Krahe 1991). Although most people would recognize in the abstract that rape is a morally unjustifiable act, it seems that rape victims are nevertheless particularly likely to be monitored for their `innocence' and the degree of that innocence in the incident itself (Lee,1984). Public declarations of rape are scrutinized and debated in the media and in everyday interaction. (Anderson & Doherty, 2008, p 4)

In the world of *Temple*, an awareness of the deeper passions that appear as part of growing up is looked upon as moment of agony, fear and utter loneliness creating a sense of disjointed existence. The imagery that builds up this picture does not point towards a healthy acceptance of body. The body's response to powerful passions is conceived in unhealthy images: "... evenly it spread / its humid fever into the waiting brain" (15). The landscape is in accord with the emotion evoked. The animal imagery makes the setting appropriate for the unhealthy picture of the body that controls the natural processes of the mind:" the flood graved village / ran briskly on and halted and stared / like a chameleon faint with fear in the sun" (15). This mingles with the fear of the woman, the importance of chastity, the failure to break free of the concept of chastity as a presence, the awareness of being caught within the mesh of religious purity and of identity stemming solely from purity. The woman in *Temple* is caught in "the fear of the four thousand years of time" and "the earth-taste under the skin" the former standing for culture and religion and the latter for a social reality firmly rooted to the earth to which she belongs (16).

The woman in *Temple* is haunted by an acute sense of social reality that she learns to live with from a very early age: "One nostril bored for the warming stud she never wore" (16). The adolescent body remains the point of concern when he writes of the "new-born breasts' slow rise" (15). The impossibility of the definition of womanhood independent of religion is seen in "... small flames of vermilion played / upon the shrine of her bare bone" (16). Mahapatra allows social markers of class through oblique suggestions: "Those pouting hands patted

platters of dung / on her hovel's mud walls" (16).

The unravelling of the universe of the hitherto unknown body, is handled in a tragic and realistic way, denying any possibility of a positive beginning. The position continues to be one that conforms to the view of the body and the specific experiences of the female as a curse, a need for a certain degree of introvertedness associated with the outward flow of the body towards womanhood which is to some extent prescribed by society:

> then, when the curse came, everyone
> could tell it by the way she shrank into herself
> the mask settling on her face,
> her body seeming heavier than what it was
> the world passing into flames under her feet, (16-17)

The description of the first period that Mahapatra presents conforms to the long tradition of representation:

> When menstruation is mentioned, it is rarely spoken of directly but more often euphemistically…. The silence about menstrual experiences in literature has, until recently, been broken only by accounts of a woman's first period. These accounts often recollect feelings of horror and confusion, or fear about apparently inexplicable bleeding Hence, they fit the dominant patriarchal discourse of menstruation as unexpected, painful, gushing blood. (Walker, 1997, p 3)

The bodily process of menstruation is situated well within the lunar cycle as Mahapatra notes: "And the moon hives in her body / her face a mask. / Crimson rivulets run in an epileptic dawn. (16 -17). Mahapatra here touches upon a concept that has very ancient roots:

> Menstruating woman… has historically been separated as a class pertaining to her reproductive difference, which has marked her dangerous, polluted and potentially hysterical, on the one hand, and magical, even sacred, on the other hand—exposing a dangerous binary at work in patriarchal cultures that must be overturned. Indeed, it is women's flow that has historically been most impeded, constrained and colonised globally owing to its anomalous character, which can be affirmatively re-articulated in relation to women's heterogeneous embodiment. (Dyer,2020, p 5)

Though Mahapatra does not explore the possibilities that Dyer senses, his description of menstruation as a curse acknowledges the existence of certain ideas in currency that carry only negative connotations which can be seen as the first step towards removing the shame associated with bodily processes. Mahapatra's poetry does not explore the possibilities of menstrual activism, a major aspect of the later phases of feminism, nor is it concerned with the dilemmas associated with it but it does not refrain from attempting an articulation of menstrual experience though it does not in any way re-present the same. The relevance of the need to open up and of its possible implications have received critical attention:

> It is transgressive to resist the norm of menstrual (and menopausal) concealment. With notable exceptions, across cultures and historical eras, we socialize this biological process — including serious inquiry into its form, function, and meaning — into hiding. This is shortsighted and at the same time deeply revealing, as it shines a bright spotlight on the need for change. After all, a dearth of attention to a fundamental reality and indeed a vital sign is not only a profound knowledge gap, it is an exposure of the power of misogyny and stigma to suppress knowledge production (Bobel, 2020, p 1)

By writing about the onset of menarche and how it is culturally received, Mahapatra reminds one of the words of the menstrual designer who produced *Beauty in Blood*:

> If I have learned anything over the past few years of producing *Beauty in Blood* it is that menstruation matters more than most people in society are willing to recognize; it is deeply embedded in our global body politics and is a major contributor to the vast gender inequity between men and women today. Institutionalized hierarchies maintain and support the outdated patriarchal belief that menstruation makes the female body

> inferior to the male body. (Lewis, 2020, p viii)

The onset of menarche which is often seen as the beginning of the possibility of a victory over time and chance, a sign of procreative capacity is eclipsed in a universe which is more death-like in its aspects. The significance of menarche has been pointed out in feminist scholarship: "Experiences of menstruation, while deeply personal and embodied, also have an external biomedical framing; menstrual blood is a private secret that is expected to be concealed yet menarche can have radical implications for a girl's lifestyle and mobility" (McCarthy & Lahiri-Dutt,2020, p 15).

The implications of menarche for Chelammal are negative. The universe with its whirlpool of death and decay, encompasses this significant event of life as Mahapatra presents an image of afternoon, with the river brooding over the burning corpses on the bleak bank. Rivers, which often stand for life and the flow of life are juxtaposed with death and final dissolution. It is in this context that Chelammal meets with the realization: "She saw it all, the shallow ponds / of her body strangling / to the mauve tissues of, hyacinth" (17). Negative images tumble out rejecting the possibility of any promise of life or anything good as the stanza closes with the images of the scattered footsteps of virgins about like cattle-bones, dry ordure" (17). The United Nations report (2019) on the negative impact of menstruation draws attention to the severity of the situation:

> The stigma and shame generated by stereotypes around menstruation have severe impacts on all aspects of women's and girls' human rights, including their human rights to equality, health, housing, water, sanitation, education, freedom of religion or belief, safe and healthy working conditions, and to take part in cultural life and public life without discrimination. (Winkler,2020, p 9)

The accumulation of the morbid images cancels out the traditionally positive association of youth. The traditional girl grows up surrounded by the presence of elders. The growth of Chelammal's body is exposed to turmeric and myth and the aroma of ritual" (18). The treatment of marriage in this universe does not differ from the attitude towards the impulse of the body for the affirmation of life. The poet does not lose sight of the large landscape against which such phases of life are presented. The landscape presented is one of social reality.

Marriage in *Temple* is firmly entrenched in social reality and the possibility of the romantic treatment of marriage as done by the older generation is looked upon with disfavour. The self-situated in "the turmeric and myth and the aroma ritual" is always conscious of the setbacks that marriage is bound to have (18). The gradual change that is bound to come over emotions that were once considered desirable is a part of the poetic universe of Mahapatra. The essential passion that is to be consummated within the framework of a marital relationship is conceived in images that do not have anything appealing about them. This universe is defined by the staleness and transience of such desires: "to resist with impassive face / the unappeased lust that shall slowly settle / like shallow back-waters in her mind" (19). These images of stasis which contradict the widely accepted nature of physical passions evoke notions of passivity and life denial. The imagery of stagnant water emphasizes the notion of lack of fertility. This contradicts the qualities traditionally associated with water. This is not the water of life. The sense of loneliness emanates from "the equation of flushed and / unflushed tides / of her body's promise" (19) The movement from the promise "of the laquered spread / of peacock feathers of her arm" to the pathetic "sense of a small stranded crab" mirrors the movement that is inevitable to all women in the world of Mahapatra (19). The image of a new consciousness of the body is lyrically presented. The gold dust air of mustard fields allows Chelammal one day where she discovers with the tenderness and compassion that "legs were mere things to run with" (20). This mood does not last long: "The sky of hidden footsteps / sprawling around the woken waist where she had concealed a copper coin / along with the saddened faces of an indiscreet shame" also carries with it the

harsh reality in which she is trapped and is placed beside an image that is distinctly different (20).

The voice of Chelammal builds a picture of her world which is conscious of her place in her home, an approach which is totally realistic. It is oriented towards the social reality in which she is embedded. The poverty and squalor of daily life is supported' by "the cheap and benign gad in the corner" (22) which supervises "an earthen rice-pot simmer [ring] / over an impoverished flame" (20).

This universe has vital ties with the myth of feminine chastity. Mahapatra's poem provides instances of the inherent tension that arises out of this myth 'about womanhood. This sense of womanhood as a potentially privileged, but really limiting condition is promoted by religion and this creates a stifling sensation in the mind of the woman for whom the impulses of the body are quite real. The resultant sense of guilt, helplessness and rebelliousness are quite conspicuous in many sections of *Temple*: "Our minds were tied to the myth / that womanhood was pure, one / with the repose of the gods, (23) but this does not prevent Chelammal from raising the question: "But had I no right to dream? / which happiness is mine, if not this one? (23). The surging of a sense of renewed life can be heard in Chelammal's voice: "… my breath once again / startles me with its promise of paradise" (23).

The woman in Mahapatra's poetry is slowly gnawed away by an overpowering sense of reality that is both unpleasant and hostile. This reality is controlled by a society that is predominantly male. Her life is the darkness of the day that makes it "... smaller, sinking / through the slime of dead leaves and rot" (28). The existence of woman in this world does not have the support of a past. Mahapatra insists that the present is a continuation of the past with little variation. This world impinges on the mind of the woman, certain religious beliefs that tend to snuff out all her desires and wishes. This world cannot be a place for constructive and soothing relations. Woman is seen only as a means, a non-entity. Woman has come to live with the image of herself as a commodity "and the fall of a hand on the shoulder / was seed of mere repayment / recompense that brings only pain" (29).

The woman tries to seek solace in God. Religion cannot offer her solace: she looks "to the god waiting on her old torn calendar"(29). But religion fails to unload her burden. Religion is only a mean voice / circling like a stubborn fly around her rotting loss" (29) The image of woman that Mahapatra constructs in his poetry is that of a trapped animal, her fate controlled and charted by a male-dominated society. The helplessness and fragility of the woman surface soon : "For like the fish spawned in rice fields / wasn't she fated to be caught / when the terraces were finally drained ?" (29).

The woman in *Temple* is surrounded by the rough noose of ownership and has internalized a system that makes her accept the "quiet bait of blood" as a sort of duty and her frightened existence is nothing but "frail of paper like an origami crane in the wind" (31). She had stopped functioning somewhere in the past. Mahapatra's attack is directed at a system that turns womanhood into an insignificant faceless being that has only marginal importance: "She simply fuses into a pale thick smile, / a faceless shell on a beach" (31). The psyche of the woman in Mahapatra's poetry goes through a process of realization which makes the woman cling on to the memories of the past. To fight the "dream dark of the present" she has to walk with the lighted lamps of the past life. The woman is forced to dream the dreams, the older generations have given here, dreams which return "like the strange voices of swans that return without fail / in the time of wandering of autumn on the Ganga. (32).

Yet the need to question the position assigned to her can only be stifled in this world because the Sacred Kingdom man evokes is based on the cowardice of women and lacking stronger foundations. This society has successfully inculcated in woman the belief that a woman's life is dependent on her sons and has nothing to do with her existence as such. Men are in fact the image makers and they are responsible for creating an inflated image of womanhood and then consciously

demanding more from the woman and then humiliating her. Woman is still a prey to the "incredible lie of tenderness" (33). Solitude is her sole companion and the "ashes of solitude scour her womb" (33).

The woman in Mahapatra's poetry has lost the will to long for, and she is in the "autumn of her longing" looking up towards "the dreamless dawn" of her fate (34). She remains among the males, moving backward in solitude to the realm of memory. The woman is caught in the trap of myth and she is made to conceive it with a sense of pity though it turns into a sense of captivity. Mahapatra asks the agonizing question: "Did her simple eye press against the piety of a myth's cage / like eager hands at the bars of some zoo? (34). The woman cannot escape from her fate but she cannot help wondering "what makes the dance of unreason go on / what bones kill the peace that flesh seeks / what plucks the words from the epics?" (36)

Man fails to understand the woman and tends to suppress her voice. And the suppressed voice comes in the dream as Chelammal's voice. This voice has come to believe that even her ill feelings are not to be expressed while physical relations fail to give meaning to life. The image conceived of woman is that of an animal destroyed and defeated by the male, with the help of tradition. The pain, despair and hopelessness become explicit when the voice of Chelammal admits: "they do not fear me / because I am in fear of them" (38). The fear that one may be assaulted any time is sadly part of a woman's life and has a long history: "From prehistoric times to the present, I believe, rape has played a critical function. It is nothing more or less than a conscious process of intimidation by which *all men* keep *all women* in a state of fear" (Brownmiller 15). She is the victim of a society which is addicted to the tragic rites of women's looks. The "bloodless eyes" of the society destroy women dressed in spotless white. This woman is caught in a space which is encircled by the "dust of lies" and the "scabs of myth" and she is trapped in an "ominous jungle" from which her quickened pace cannot save her. (40)

Woman, as presented in *Temple* is always at the receiving end and lacks mastery over the circumstances in which she finds herself. Existing in a space created by others, her life is controlled by them and is forced to bear the pain of experiences that she does not desire. The woman lacks vigor and vitality and she is one

> …with life enough for death
> to pass through
> lonely as an acre of farm land
> mist and mornings in its
> throat
> bursting with the rice it did
> not choose. (45)

The sense evoked in the above lines is one of helplessness of the woman. Mahapatra presents women who lack agency in life through the traditional image of the woman as a field, its presence and identity acknowledged and established only with the presence of man. The religious image of the woman which combines the divine with its destructive and benign aspects is in sharp contrast with the present condition of woman who is caught in the "monstrous haemorrhoids of beliefs" that construct her (54). Mahapatra suggests that a woman like Chelammal, completely circumscribed by the patriarchal system, cannot have what is generally designated as the divinely destructive aspect that is often part of popular imagination.

Conclusion

Temple, through the life and death of Chelammal thus convincingly puts forward the idea that from time to time, man has explained woman with his concept of "Lakshmana Rekha" which he constructs according to his need in diverse forms. So from the first heaviness of her body with its crimson rivulets running in an epileptic dawn to the "long afternoon" that set fire to her bones, she is a prisoner of an Idea, of society, of religion, and of even a lower God which is man (51). She is the victim of a peculiar concept of death with its potentiality of Moksha even in a paradoxical act which is both homicide and suicide, to pacify and make her inactive. It seems that the inculcation of such an idea would rather make

her remain within the framework that man has created for her without her knowing.

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EFFECTIVENESS OF STATUTORY WARNING ADVERTISEMENT IN KERALA

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ABSTRACT

This research study has given extensive coverage regarding the effectiveness of warning advertisements in Kerala, especially among young age people. The study has followed clear and concise objectives i.e., identifying the reason for using alcohol and tobacco products, smoking and drinking pattern of youth in Kerala and the effectiveness of warning advertisement among youth in Kerala. The purpose of statutory warning advertisement is to justify the formation of objectives because a warning advertisement was introduced to reduce the usage of tobacco and alcohol. But still, India has been witnessing a large quantity of legal and illegal tobacco and alcohol products supply. In this context, this study has attempted to find whether the warning advertisement is effective or not. Five highly populated districts were selected from three zones of Kerala as the study area by using the judgment sampling method. The study surveyed 792 respondents and those respondents were selected based on age criterion. The multi-dimensional analysis has given the exact perception of respondents regarding the presentation and content of statutory warning advertisement and also reveals the reason for starting smoking and drinking habit and reason for stop the same. Based on the consideration of these aspects and the analysis of collected data, it could be seen that warning advertisement is not effective among young age people in Kerala.

Keywords: *Statutory warning, tobacco, alcohol, drinking pattern, smoking, perception, inactive user*

Introduction

Tobacco and alcohol use is responsible for increasing health problems and death among people in Kerala and the usage of tobacco and alcohol are the leading preventable cause of death worldwide. As per the Global Adult Tobacco Survey report, on average, tobacco and alcohol users are losing 15 years of their life and most of the deaths are recorded on account of these products' usage. The report also says that most of the death is happening in middle and low-income nations, and worldwide almost 80 percent of the death is recorded on account of tobacco usage. According to the WHO report 2014, 38.3 percent of the world's population is reported to consume alcohol regularly and an individual's consumption of alcohol per year is 6.2 liters. Again this report also mentioned that 30 percent of the Indian population consumes alcohol regularly and 11 percent of the Indians are moderate to heavy drinkers. The average Indian consumes 4.3 liters of alcohol per year and the average rural Indian consumes 11.4 liters of alcohol per year (WHO- Global Status Report on Alcohol and Health, 2014). Alcohol and Tobacco usage lead to major health problems like chronic liver disease, cancers, cardiovascular disease, acute alcohol poisoning, lung disease, cancers, and cardiovascular disease (National Alcohol Abuse and Alcoholism, 2007). They repeatedly say that alcohol and tobacco usage is preventable, thus many governments have taken several measures for preventing the usage of alcohol and tobacco products, but still, people are using these types of products. In this context, this study has gone through a detailed review of prior studies and cases for giving proper background and to illustrate the reason for researching the effectiveness of statutory warning advertisements on Tobacco and Alcohol products.

Statement of Problem

Alcohol and tobacco use is the most dangerous preventable couple cause of death all over the world. In each year millions of death are recorded under alcohol and tobacco use. On average, tobacco users lose 15 years of life. Up to half of all tobacco users will die prematurely due to tobacco-related causes by any year or time estimation. Most of these deaths will be in middle and low-income nations, which would account for almost 80 percent of all tobacco-related deaths (WHO Report, 2008). The GAT (Global Adult Tobacco Survey) report indicates that 34.6 percent of adults in India were using tobacco in some form or the other. While 9 percent said they only smoked tobacco, 21 percent consumed tobacco in the smokeless form.

Later World health organization has conducted a Global Adult Tobacco second-round survey and this report indicates that 28.6 percent of adults in India were using tobacco in some form and among the current tobacco users in India, 87 percent are daily users, and the remaining 13 percent of them are occasionally using tobacco. The interesting fact is that 24.9 percent of all adults are using tobacco on daily basis and 3.7 percent of all adults are using tobacco occasionally (GAT 2, 2018). The GAT 1 and GAT 2 have revealed that numbers of tobacco users were decreased during the period between the two reports. The GAT 1 report says that in India there are 274.9 million tobacco users (age 15 and above) Among them, 197.0 million are males and 77.9 million are females; and 216.0 million are tobacco users from rural areas and 58.8 million are from urban areas. After seven years, GAT 2 report reveals that the number of tobacco users was reduced and now at present in India, there are 266.8 million tobacco users aged 15 or above. Among current users, 202.0 million are men and 64.8 million are women. (GAT 2, 2018). This indicates that the total number of tobacco users was reduced but male tobacco users were increased and female tobacco users were reduced. In this context, this research study has gone through the effectiveness of warning advertisements in Kerala focused on young age people to find out whether there is any significant evidence that warning advertisements (tobacco and alcohol) have any significant effectiveness among young age people from Kerala to reduce their usage because of warning advertisement.

Objectives of the Study

1. To identify the reason for using alcohol and tobacco products
2. To study the smoking and drinking pattern of youth in Kerala
3. To study the effectiveness of warning advertisements among youth in Kerala.

Methodology of the Study

The study has used both descriptive and analytical designs. Secondary and primary data were used in the study. Secondary data were collected from World Health Organization Report-Global Adult Tobacco-First and Second Round survey report (2010 and 2018), Global status report on alcohol and health, 2018 (WHO), Crime Records Bureau Kerala, National Crime Records Bureau, National Alcohol Abuse and Alcoholism, 2007 report, Ministry of Health and Family Welfare-India, Published thesis, article, and books related to tobacco and alcohol usage. Primary data were collected from young age people of Kerala, including males and females. A structured questionnaire was used to collect the opinion of sample respondents.

Based on their survey, it was found that most of the tobacco and alcohol users were from this age group. Hence, Age 15 to 45 was again categorised into three groups i.e., 15 - 25 years age group, 26 - 35 years age groups, and 36 to 45 years age group. Then 132 sample size was again equally distributed among the three age groups of rural and three age groups of the urban area i.e., sample sale from each age group (Urban 22×3 age group=66 samples, Rural 22×3 age group=66 samples). Districts were selected by the ng judgment sampling method with defined criteria. Criterion with as highest populated district total number of population was identified from 2011 census reported total sample size was fixed by using Neyman Sample size calculation purposive sampling method was again used to select sample respondents from selected districts. The criterion was sample respondents' age should be between 15-45.

Analysis and Discussion

This part is illustrating the analysis result of the collected data. A well-structured questionnaire was used to collect the data from 792 sample respondents. Collected data were recorded and coded with the help of the SPSS 25th version. Descriptive and Inferential statistics were used to analyse the data. The analysis tools were selected according to the nature of variables, research questions, and

especially like collected data. Percentage, mean, std. deviation, One Way ANOVA, Tukey HSD, Levene Statistic, CATPCA (Categorical Principal Components Analysis-Optimal Scaling), Welch were used to analyse the data.

Table 1Sample Distribution Based on Collected Data (Age-wise, District wise, Current Smoking, and Drinking Status)

	Active And Inactive Wise Distribution of Sample Respondents from Rural Area											
District	**15-25**				**26-35**				**36-45**			
	A	**I**	**IS**	**ID**	**A**	**I**	**IS**	**ID**	**A**	**I**	**IS**	**ID**
KD	12	5	4	1	15	3	3	1	12	4	4	2
MLPM	20	1	1	0	6	6	5	5	18	2	1	1
TCR	18	2	2	0	20	1	0	1	8	6	3	5
ERN	12	5	3	3	5	8	4	5	18	2	2	0
TVM	14	3	3	1	16	3	3	0	18	2	2	0
Kollam	18	2	2	0	7	5	5	5	6	8	1	7
Total	**94**	**18**	**15**	**5**	**69**	**26**	**20**	**17**	**80**	**24**	**13**	**15**
Active Users=328 (Including Inactive Smoker and Inactive Drinker)							Inactive Users=68 (Completely Stopped)					
	Active And Inactive Wise Distribution of Sample Respondents from Urban Area											
District	**15-25**				**26-35**				**36-45**			
	A	**I**	**IS**	**ID**	**A**	**I**	**IS**	**ID**	**A**	**I**	**IS**	**ID**
KD	18	2	2	0	13	4	3	2	10	5	5	2
MLPM	20	1	0	1	6	8	2	6	10	5	5	2
TCR	20	1	1	0	1	9	5	7	18	2	1	1
ERN	13	4	4	1	2	11	5	4	3	9	8	2
TVM	6	7	3	6	17	2	2	1	20	1	0	1
Kollam	14	3	2	3	10	4	4	4	15	2	3	2
Total	**91**	**18**	**12**	**11**	**49**	**38**	**21**	**24**	**76**	**24**	**22**	**10**
Active Users=316							Inactive Users=80					

(Including Inactive Smoker and Inactive Drinker) (Completely Stopped)

A=Active Users, I=Inactive, IS=Inactive Smokers, ID=Inactive Drinkers

Source: Primary Data

The table is illustrating the collected respondent's distribution according to Active user, Inactive user, Inactive smoker, and Inactive drinker. According to this study, Active user means the respondents who use both cigarettes and alcohol. Inactive user means the respondents who completely stopped the usage of cigarettes and alcohol. Inactive smoker means the respondents who stop smoking and currently have drinking habits.

Table 2Age of Respondents When they Started Smoking and Drinking

Age	Smoking		Drinking	
	Frequency	Percent	Frequency	Percent
Below 15	239	30.2	291	36.7
15-25	362	45.7	227	28.7
26-35	123	15.5	177	22.3
36-45	68	8.6	97	12.2
Total	792	100.0	792	100.0

Source: Primary Data

The table illustrates that 45 percent of the sample respondents were started smoking when their age in between 15-25 and 30.2 percent of them was started smoking when their age below 15. Meantime 36.7 percent of the respondents started their drinking habit when their age was below 15 and 28.7 percent of them started their drinking habit when their age in between 26-35

Table 3Mean Difference Among Three Age Group Respondents Regarding Smoking and Drinking Time Pattern

						Homogeneity of Variances		Welch Test	
	Age	N	Mean	SD	SE	Levene Statistic	Sig.	F	Sig.
Smoking time	15-25	201	1.47	.500	.035	.119	.888	4.268	.014
	26-35	159	1.56	.498	.039				
	36-45	181	1.62	.529	.039				
	Total	541	1.55	.513	.022				
Drinking time	15-25	215	1.89	.317	.020	6.868	.001	1.765 (457.773*)	.172
	26-35	201	1.84	.364	.025				
	36-45	146	1.83	.374	.024				
	Total	562	1.86	.352	.013				
Multiple Comparisons (Tukey HSD)									
	(I) Age		(J) Age		Mean Difference (I-J)		Std. Error		Sig.
Smoking pattern	15-25		36-45		-.152		.052		.011

Source: Primary Data

The table illustrates the result of significant differences among three age group respondents regarding their smoking pattern and drinking time. Levene's statistics were used to identify the homogeneity condition among three age group respondents. The result indicates that there is no significant difference among three age group respondents smoking time i.e., three groups have met homogeneity condition (L=.119, p-

value=.888<0.05), hence the study proceed with One Way ANOVA. The result indicates that there is a significant difference among three age group respondents smoking time (F=4.268, p-value=.014<0.05).

Table 4 Mean Difference Among Three Age Group Respondents Regarding Their Smoking and Drinking Pattern

						Homogeneity of Variances		**One Way ANOVA**	
	Age	N	Mean	SD	SE	Levene Statistic	Sig.	F	Sig.
Daily Cigarette Consumption	15-25	106	2.28	1.076	.104	.936	.394	4.592	.011
	26-35	70	2.54	1.176	.141				
	36-45	73	1.97	1.154	.135				
	Total	249	2.27	1.144	.072				
Daily Alcohol Consumption	15-25	28	1.32	.612	.116	7.983	.001	3.115[w]	.061
	26-35	34	1.79	1.321	.226				
	36-45	40	1.78	1.165	.184				
	Total	102	1.66	1.112	.110				
Multiple Comparisons (Tukey HSD)									
	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.				
Daily Cigarette Consumption	26-35	15-25	.260	.174	.295				
		26-35	.570[*]	.189	.008				

Source: Primary Data

The table indicates that variance is equal among age group (L=.936, p-value=.394>0.05) regarding Daily Cigarette Consumption of sample respondents, hence it is assumed that groups have met homogeneity condition and One Way ANOVA has been processed. The result indicates that there is a significant difference among age group respondents' Daily Cigarette Consumption (F=4.592, p-value=.011<0.05). At the same time homogeneity condition was not met by three groups regarding Daily Alcohol Consumption (L=7.983, p-value=.001<0.05), hence the Welch test has processed. The result indicates that there is no significant difference among the three age group respondents daily alcohol consumption (Welch=3.115, p-value=.061>0.05)

Table 5 Daily Smoking and Drinking Pattern of Sample Respondents

Smoking			Drinking		
No. of Cig.	Frequency	Percentage	Quantity	Frequency	Percentage
Only one	7	6.73	Only one peg	23	51.11
2-5	39	37.50	Quarter	10	22.22
One packet	23	22.12	Half	7	15.56
1 Packet<	46	33.65	Litter	5	11.11
Total	104	100.00	Total	45	100.00

Source: Primary Data

The table indicates that 37.50 percent of the respondents were used 2-5 cigarettes daily used. 33.65 percent of them were used more than one packet. In the case of Past drinking quantity, 51.11 percent of them opined that they were drunk only one peg daily and 22.22 percent of them were used a quarter daily.

Table 6 Model Summary of CATPCA Optimal Scaling

15-25 Age Group Respondents					
Dimension	**Cronbach's Alpha**	**Variance Accounted For**		**1/2**	**% of Variance**
		Total (Eigenvalue)[1]	**No. of Variables[2]**		
1	.946	8.826	17	8.826/17	55.166

2	.731	3.181	17	3.181/17	19.884
Total	.978[a]	12.008	17	12.008/17	75.050
26-35 Age Group Respondents					
1	.930	7.802	17	7.802/17	48.763
2	.871	5.461	17	5.461/17	34.131
Total	.986[a]	13.263	17	13.263/17	82.894
36-45 Age Group Respondents					
1	.976	11.743	17	11.743/17	73.394
2	.521	1.956	17	1.956/17	12.223
Total	.989[a]	13.699	17	13.699/17	85.618

a. Total Cronbach's Alpha is based on the total Eigenvalue.

The table shows the model summary of Optimal Scaling among three age group respondents. The result illustrates the internal consistency coefficient (Cronbach's Alpha) for two dimensions. The sum of internal consistency of two dimensions is .978 and it's calculated based on the eigenvalue. The total percentage of variance is 75.050. This indicates that 75 percent variance accounted for both dimensions. In the case of the second age group i.e., 26-35 age group, the internal consistency of both dimensions is .986, and a total 83 percent variance accounted for both dimensions. In the third group i.e., 36-45 age group, internal consistency is .989 and 86 percent variance accounted for both dimensions.

Table 7 Significant Difference Among Three Age Group Respondents Opinion Regarding the Reason for Start Smoking and Drinking

		Sum of Squares	df	Mean Square	F	Sig.	LS	Sig.
My father has been using cigarettes and alcohol	Between Groups	57.101	2	28.551	19.357	.000	2.218	.110
	Within Groups	1163.742	789	1.475				
	Total	1220.843	791					
Impatient/Anger	Between Groups	69.275	2	34.638	30.501	.000	1.535	.216
	Within Groups	895.996	789	1.136				
	Total	965.271	791					
Constipation problem	Between Groups	79.798	2	39.899	27.599	.000	1.560	.211
	Within Groups	1140.621	789	1.446				
	Total	1220.419	791					

Source: Primary Data

The table shows the One Way ANOVA result, Result indicates that there is a significant difference among three age group respondents opinions regarding the reasons i.e., My father has been using cigarettes and alcohol (F=19.357, Sig.= .000), impatient/Anger (F=30.501, Sig.= .000), and Constipation problem (F=27.599, Sig.= .000). This result is telling that there is a significant difference among age group but it's hard to identify which of the groups were significantly different, hence multiple comparison test (Tukey HSD) was further used.

Table 8 Multiple Comparisons

Tukey HSD				
Dependent Variable	(I) Age	(J) Age	Sig.	
My father has been using cigarettes and alcohol	15-25	26-35	.000	
		36-45	.000	
Impatient/Anger	15-25	26-35	26-35	.001
		36-45		.000
Constipation problem	15-25	26-35	.000	
		36-45	.000	

*. The mean difference is significant at the 0.05 level.
Source: Primary Data

The table illustrates that 15-25 age group respondents opinion is significantly different from other two age groups regarding the reasons father has been using cigarette and alcohol (Sig. .000) and Constipation problem (Sig.000), whereas 15-25 age group respondents opinion is significantly different from other two age group and 26-35 age group respondents opinion is significantly different from 36-45 age group regarding the reason impatient/anger (Sig. .001, .000)

Table 9 Robust Tests of Equality of Means

		Statistic[a]	df 1	df2	Sig.	Age Group Combination		Sig.	
Friends encouraged	Levene Statistic	19.876	2	789	.000	26-35	15-25	.459	
	Welch	3.930	2	518.202	.020		36-45	.031	
My cousins/Relative	Levene Statistic	65.447	2	789	.000	15-25	26-35	.000	
	Welch	63.250	2	518.135	.000		36-45	.000	
Heavy workload	Levene Statistic	6.181	2	789	.002	26-35	15-25	.000	
	Welch	11.373	2	525.525	.000		36-45	.000	
Frustration	Levene Statistic	40.541	2	789	.000	15-25	26-35	.000	
	Welch	18.293	2	516.143	.000		36-45	.000	
Restlessness or boredom	Levene Statistic	4.738	2	789	.009	15-25	26-35	.001	
	Welch	29.840	2	525.535	.000		36-45	.000	
Tiredness	Levene Statistic	8.797	2	789	.000				
	Welch	2.071	2	518.972	.127				
Work-based troubles	Levene Statistic	25.236	2	789	.000	26-35	15-25	.000	
	Welch	21.487	2	514.164	.000		36-45	.000	
Personal Problems	Levene Statistic	82.106	2	789	.000	15-25	26-35	26-35	.001
	Welch	353.903	2	506.187	.000		36-45		.000
Family problems	Levene Statistic	86.739	2	789	.000	15-25	26-35	26-35	.000
	Welch	27.324	2	511.965	.000		36-45		.000
Making social status	Levene Statistic	65.428	2	789	.000	15-25	26-35	26-35	.000
	Welch	24.947	2	486.928	.000		36-45		.000
Drinking habit	Levene Statistic	6.035	2	789	.003	15-25	26-35	.003	
	Welch	8.309	2	523.363	.000		36-45	.000	
Without any reason	Levene Statistic	11.719	2	789	.000	26-35	15-25	.000	
	Welch	131.652	2	523.045	.000		36-45	.000	
Excitement	Levene Statistic	43.104	2	789	.000	15-25	26-35	.021	
	Welch	3.256	2	511.223	.039		36-45	.172	

a. Asymptotically F distributed.
Source: Primary Data

The table illustrates the result of equality of variance (Levene Statistic), opinion significant difference (Welch), and multiple comparison tests. Levene's Statistic result indicates that illustrated reasons haven't met the condition of equality of variance, hence the Welch test is applied. The Welch test result shows that there is a significant difference among three age group respondents' opinions regarding 12 reasons and one reason is showing no significant difference i.e., Tiredness (518.972, .127). Hence multiple comparison tests were applied for 12 reasons to find out which of the groups were significantly different from each other.

Table 10 Respondents Opinion Regarding Advertisement Medium

Adv. Medium	**15-25 (%*)**	**26-35 (%*)**	**36-45 (%*)**

Television	79.2	73.5	72.0
News Paper	75.8	78.4	77.7
Movies at home	92.0	96.6	98.1
Theatre	86.4	81.1	78.0
Cigarette pack	73.1	69.7	71.2
Alcohol bottle	72.0	72.7	72.7
Billboards/hoardings	57.6	61.4	61.7
Source: Primary Data, *= Response percentage is calculated based on group total			

The table illustrates that majority of the three age group respondents are watching warning advertisements when they watch movies at home i.e., 92 percent (15-25), 97 percent (26-35), and 98 percent (36-45)

Table 11 Respondents Opinion Regarding the Reason for stop smoking and drinking

S. N	**Reasons**	**Response**	**%***
1	Health Problem	128	38.44
2	The doctor advised me to stop drinking and smoking	210	63.06
3	Family forced	167	50.15
4	Friend forced	32	9.61
5	My teacher forced	43	12.91
6	My lover forced	65	19.52
7	My wife forced	245	73.57
8	After attending an alcohol and drug awareness seminar	24	7.21
9	Without any reason, I quit smoking/ drinking	97	29.13
10	Advertisement about the dangers of smoking & drinking	19	5.71
11	Printed warning advertisement on a cig. packet & liquor bottle	32	9.61
Source: Primary Data, *= Response percentage is calculated based on group total (333)			

The table illustrates the respondents' opinions regarding the reason for stopping smoking and drinking. The majority (73.57 percent) of them opined that their wife forced them to quit smoking and drinking, 63.06 percent of them opined that their doctor advised them to stop, 50 percent of them opined that their family forced and 33.44 percent of them quit due to health problem. Based on the result it could be said that awareness seminars (7.21 percent), advertisements (5.71 percent), and printed advertisements (9.61 percent) are not

influenced them to stop smoking and drinking.

Table 12 Component Loadings

Age of Respondents ⟶	**15-25**		**26-35**		**36-45**	
Perception Statement	**Dimension**		**Dimension**		**Dimension**	
	1	**2**	**1**	**2**	**1**	**2**
These advertisements are irritating	.986	-.047	.962	.640	.988	-.053
It's very hard to see such an advertisement	.914	.523	.951	-.019	.988	-.052
Change the channel when I saw the advertisement on television	.912	.548	.943	.552	.988	-.051
Using the forward button while seeing movies	.906	-.239	.910	.570	.976	-.040
I look into my mobile while advertisements play in the theatre	.873	-.240	.748	-.090	.627	-.054
It's very hard to see the picture on a cigarette packet, hence I do not prefer to buy a packet of cigarette	.659	.781	.639	.750	-.106	-.808
It's very hard to see the picture on the cigarette packet, hence I purposefully ignore the advertisement	.403	.606	.710	.701	.549	.797
It's very informative, hence I bring other family members to see the advertisement	-.327	-.523	-.135	.462	-.025	-.668
I do not change the channel, I suggest to my children to see the advertisement	-.110	.506	.172	-.414	.025	.218

Variable Principal Normalization.

The table illustrates the component loading regarding 9 statements among three age group respondents. The coordinates for each item on each dimension (1st and 2nd dimension) shows in the table and scatter plot displayed below (Fig. 7 to Fig. 12). Here the result indicates that 4 statements have a positive coefficient of correlation among 15 to 25 age group respondents i.e., It's very hard to see such advertisement (.914,.523), Change channel when I saw the advertisement on television (.912,.548) It's very hard to see the picture on a cigarette packet, hence I do not prefer to buy packet cigarette (.659,.781), and It's very hard to see the picture on a cigarette packet, hence I purposefully ignore the advertisement (.403, .606), then took at figure 7, four lines were marked with red colour and these line representing above mentioned reasons and this four statement tend to coalesce together in the upper range of both 1 and 2 dimensions.

Table 13 Significant Difference Among Three Age Group Respondents Opinion Regarding Their Perception of Warning Advertisement

		SS	df	MS	F	Sig.
Advertisement is irritating*	Between Groups	2.836	2	1.418	1.050	.350
	Within Groups	1065.508	789	1.350		
	Total	1068.343	791			
It's very hard to see the picture on a cig. packet, hence I purposefully ignore the advertisement*	Between Groups	2.434	2	1.217	.828	.437
	Within Groups	1160.212	789	1.470		
	Total	1162.646	791			
It's very informative, hence I bring other family members to see the advertisement*	Between Groups	4.871	2	2.436	1.616	.199
	Within Groups	1189.129	789	1.507		
	Total	1194.000	791			

Source: Primary Data

*Leven Statistics (1.820, .163), (1.723, .179), (2.432, .089)

Table result One Way ANOVA illustrate that there is no significant difference among three age group respondents perception regarding three statements, because of F p-value is

greater than 5 percent significance level, hence, according to the null hypothesis rejection rule, it could be said that there is no significant difference among the age group. The statement and result are Advertisements are irritating (F=1.050, p-value=.350>0.05), It's very hard to see the picture on a cig. Packet, hence I purposefully ignore the advertisement (F=.828, p-value=.437>0.05), and It's very informative, hence I bring other family members to see the advertisement (F=1.616, p-value=.199>0.05)

Table 14 Robust Tests of Equality of Means

		Statistic[a]	df1	df2	Sig.
It's very hard to see such an advertisement	Levene	47.421	2	789	.000
	Welch	15.380	2	501.87	.000
Change the channel when I saw the advertisement on television	Levene	9.646	2	789	.000
	Welch	2.699	2	524.46	.068
Using the forward button while seeing movies at home	Levene	23.969	2	789	.000
	Welch	10.805	2	519.24	.000
I look into my mobile while advertisements play in the theatre	Levene	10.984	2	789	.000
	Welch	6.300	2	520.13	.002
It's very hard to see the picture on a cigarette packet, hence I do not prefer to buy a packet of cigarette	Levene	3.794	2	789	.023
	Welch	16.085	2	525.12	.000
I do not change the channel, I suggest others see the advertisement	Levene	27.264	2	789	.000
	Welch	10.263	2	520.22	.000

Source: Primary Data, a. Asymptotically F distributed.

The result indicates that there is no significant difference among the three age groups regarding one statement i.e., "Change channel when I saw the advertisement in television" (W=2.699, p-value=.068), hence it can be inferred that perception of respondents are almost the same when they saw the advertisement on television. The rest of the statement's p-value is less than at a 5 percent significant level (p-value<0.05). Here the nature of the last statement was a positive attitude towards the advertisement i.e., respondents will not change the channel when they saw the advertisement and will suggest others to see the ad.

Major Findings of the Study

Findings are the principal outcome of a research study, and findings illustrate the extracted data from the result without any bias. Hence, findings are presented here use to extract the relationship between the result and research questions. Since the starting stage, this study has followed warning advertisements to find out whether there are any changes noticed in the society and the people regarding the warning advertisement. The study has gone through a detailed analysis i.e., age-wise significant difference regarding the reason for starting, the reason for quit, pattern of smoking and drinking, perception of respondents regarding warning advertisement.

a) The study found that the majority of the respondents are educated i.e., Degree or Diploma completed (31.9 percent), Postgraduate or Professional degree completed (26.4 percent), +2/pre degree (22.5 percent), SSLC (10.5 percent).
b) The study found that the majority of the respondents have secured jobs i.e., Government employees (21.5 percent), and Private employees (40.3 percent)
c) The study result indicates that the majority of the respondents were starting smoking (Below 15=30.2 percent, 15-25=45 percent) and drinking (Below 15=36.7 percent, 15-25=28.7 percent) at a very young age
d) It is found that more than half (54 percent) of the respondents are occasional smokers; on the other side majority (81.85) of the respondents are also occasional drinkers
e) The study found that the majority of the active smokers are using 2-5 cigarettes

daily and a significant percentage of respondents are using more than one packet in a day. In the case of drinking, the majority of them are using one peg daily.

f) The study found that the majority of the inactive smokers was used cigarettes in the past at the time of drinking, talking with friends, Heavy workload, party time, and Leisure time. In the case of drinkers, the majority of them were used to drinking at party time, leisure time, and traveling time.

g) The study found that 15-25 years old respondents are indicating that drinking habits, impatience/anger feeling, and father has been smoking are the responsible reason for starting cigarette smoking. The study also found that there is a significant difference among the three age group respondents' opinions related to the reason for starting smoking and drinking.

h) The study found that the majority of the respondents opines that they quit smoking and drinking because of their wives. Their wives forced them to leave these habits. The next majority opines that doctors advised them to stop smoking and drinking. Half of the respondents opine that their family was forced. Only a few of them are supporting that visual and printed warning advertisement is effective in related to control tobacco and alcohol.

Major Suggestions

The study has conducted a detailed analysis regarding the pattern of smoking and drinking, the reason for starting, the reason for quit, and the perception regarding warning advertisement. Based on the findings, it could be clear that the presentation and visuals of the advertisement are not effective and people hated this advertisement, they felt that these warning advertisements are irritating, hence they intentionally avoid it. Therefore study suggests rethinking the current advertisement and it should be like the "Attraction-Distraction-and Attraction" model. The purpose of "Attraction" is to attract people to the content of an advertisement. The purpose of "Distraction" is to distract people with the content i.e., content must have the power to distract the people and this will reduce the usage. The third and final "Attraction" is related to the other side objective of advertisement. The first side objective is encouraging people to see the advertisement because active users have been running unhealthy life; the second objective is encouraging people to attain healthy life or attract them to a healthy life. The second suggestion is to plan a periodic family awareness campaign because the majority of the inactive users were stopped these habits by the influence of their family or family members and the majority of them are started these habits at a very young age and family can teach them to the importance of healthy life and the consequence related to smoking and drinking.

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'4A PLAN FOR INSTRUCTION' AND TECHNOLOGY MEDIATED TEACHING: ENHANCING ACADEMIC ACHIEVEMENT OF SECONDARY LEVEL LEARNERS AND TEACHING COMPETENCE OF PROSPECTIVE TEACHERS

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ABSTRACT

Recent researches in instructional planning and strategy developments are not new to the field of education. But its specificity lies where the political, economic and knowledge societies are in demand of new instructional plans and methods for the dissemination of knowledge and information. The teaching-learning society has changed its appearance from an information society to a knowledge society where interpersonal communication is mainly initiated through digital mode. The Indian education system is deeply indebted to the Gurukula system of education where a biological relationship is ensured between the teacher and the learner. But a drastic change is being noticed in our teaching-learning society especially after the outbreak of the COVID-19 pandemic. It is high time to think about learning strategies fit for multidiscipline as well as multi-platforms without changing the underlying principles of instructional planning. The investigator, being a teacher educator, felt the need for a comprehensive instructional plan befitting to both digital and actual classrooms, developed a suitable plan for multi-discipline and multi learning platforms. The instructional plan named '4A Plan for Instruction' was developed as part of her doctoral research. The researcher checked its effectiveness in teaching English and found it effective irrespective of medium of instruction, difference in learning environments and study-habits. Here the investigator utilises this plan for enhancing the academic achievement of secondary level learners in multidiscipline and to develop the teaching competence of prospective teachers. A quasi-experimental study was conducted among the first graders of secondary level in Kerala by the prospective teachers during their practice teaching session in the pandemic learning situation to teach science and social science. Its effectiveness is checked in terms of concept formation and achievement in learning. The major tools used for this study were lesson transcripts based on the instructional plan, achievement test and an open ended questionnaire for prospective teachers to report their experiences related to the lesson transaction through digital mode using '4A Plan for Instruction'. Through this study, the investigator ensures the dissemination of knowledge, professional development of teachers, and knowledge formation among students at secondary level.

Introduction

National Education Policy (NEP, 2020) envisions an India centred education system that contributes directly to transforming our nation sustainably into an equitable and vibrant knowledge society by providing high-quality education to all. Castells (2010) calls the emerging society as informational where the generation and transformation of information act as the fundamental source of productivity and power and caters to individual well-being and socio-economic development. Futurists in education predict that ICTs will have a pivotal role in global employment. But at the same time, a harmonious relationship between teachers and learners as in a natural learning ecosystem should also be ensured.

The outbreak of the COVID-19 pandemic has changed the perceptions of the world. One of the most radical among all changes has been noticed in the field of education. Online education has become the chief mode of curriculum transaction. It is a pointer to the future of education too. It reminds the governments, teachers, institutions, etc. of the necessity of a paradigm shift and stepping into the framework of e-learning ecologies. NEP of India aims at four years of multi-disciplinary study at secondary level where the major curricular and pedagogical objectives are to minimize rote learning and nurture holistic development and 21st-century skills such as critical thinking, creativity, scientific temper, communication, collaboration, multilingualism, problem-solving, social responsibility, and digital learning among the individuals. It is put into action when new models of lifelong learning are encouraged.

The proposed curriculum focuses on reorientation in subject-oriented pedagogy, on the child's natural, cognitive, emotional, and physical development and on the integration of new teaching-learning strategies. The thrust of new pedagogy reforms enforces real understanding through a metacognitive way of learning which would be more engaging, holistic, and experiential. It creates an

opportunity for discovery, discussions, and analysis. It is also recommended that teachers must have the autonomy to innovate and teach in the style that best suits their students and also have access to the latest advances in both pedagogy and content. As teaching in the coming days demands more interactive platforms, the teachers should be able to integrate appropriate technology for knowledge acquisition and dissemination. It will improve the quality of education. Here a comprehensive learning plan is demanded in the 21stcentury knowledge society especially when it is under the impact of a pandemic situation. Here the investigator developed an instructional plan named 4A Plan for Instruction and utilises it for concept formation and scholastic achievement.

Teaching is a joint venture where the professional development of teachers is always demanded. The teacher training programs for the 21st century proposes teachers' understanding of their learners including aspects of pedagogy, content knowledge and use of technology. Studies in instructional designs and strategies reveal that classroom activities are either blended or flipped in nature, which would be beneficial for the changing needs of knowledge societies. It is high time that education should respond to the challenges of knowledge societies and teachers are considered the assets of it. In order to prepare the teachers for a knowledge society, their views about the changes should also be considered as it acts as a catalyst for their professional development.

Studies Related to Instructional Designs/Strategies and Professional Development of Teachersin Knowledge Societies

The real concerns of every knowledge society are the continuous development of knowledge and competence. Here the term professional development will be replaced by lifelong learning (Fenwick, 2000). Day (1999) considers teachers as the most important asset in a learning society where they should be lifelong learners and engaged learning practice in teacher education colleges fosters learner autonomy (Bose, 2010). The governments of every nation consider the plea for a responsive approach to the challenges of the emerging knowledge societies and it is considered by their educational review policies (Jacoby, 2010). Day& Sachs(2005) identify teachers as the central figure in a knowledge society where professional development is considered as a strategy for empowering individuals and teams to improve their knowledge and pedagogy.

Martin (2011) defines instructional strategies as the science of developing structured instructions and specifications in designing the teaching materials. Mehra&Kaur (2010) point out that an experiential learning strategy composed of knowledge, activity and reflection helps in constructive learning. Li-Tze& Hung (2015) identified that e-learning is cost-effective and self-sustainable for learners. The combination of face-to-face and online learning is a common method of instruction where face-to-face learning is a complementary approach to maintain a good interaction between the teacher and learner. Hargreaves (1994) points out that teaching for today's knowledge society is more complex and it needs a base of research and experience. According to Borko and Putnam (1997) the present educational policies are student-centred. Hence the teachers prefer cognitive and social construction of knowledgeto the traditional transactions of knowledge.Mansour and Al-Shamrani (2015) suggest that the teachers should be given not only the opportunities to learn new knowledge, but also to explore new pedagogies to make the learners ready to face the changing situations of 21st century. The teachers' views about the change are inevitable if they need to face the demands of the knowledge society practice. In this context, Kelchtermans (2010) defines continuing professional development (CPD) as ''a learning process resulting from meaningful interaction with the context (both in time and space) and eventually leading to changes in teachers' professional practice (actions) and in their thinking about that practice''.

Mansour &Wegerif (2010) point out that education should be in line with the techno-social changes associated with knowledge societies. There is a need for 'learning to learn' throughout the lifespan and to identify the essential 21st-century skills for students and educators.Berger &Luckman (2021) noticed the proliferation of learning content in the virtual environment and concluded that this is the outcome of social constructivism and social constructionism. Deshpande, Kulkarni, &Metkewar (2017) propose the need for appropriate tools for knowledge sharing in academic research because every research is generating new knowledge.Majumdar (2009) points out that knowledge society is characterised by recognition of knowledge as the main source of efficiency, competitiveness, and economic growth. García-Peñalvo et.al (2017) opines that new trends in ICT based learning are dependent on the ability of content creators. The educators in 21st-century knowledge societies are in search of new content and methods which could be adapted to their teaching process and hence the learners have changed their roles from consumers to content creators. According to Singha Roy (2019),contemporary India stands on the threshold of a knowledge society, characterized by proliferation of ICTs, neo-liberal economic globalization, and use of knowledge and education in all domains of life. However, its access is limited in rural areas, because of spatial and social segregation. It is also noticed that higher socioeconomic status is closely related to the conditions of the knowledge society.

Lo et.al (2018) conducted a study based on the flipped-classroom approach and found that although the students in the flipped ICT course had similar learning outcomes to those in the non-flipped ICT course, the levels of student achievement were improved after flipping.Lekshmi (2018) conducted a quasi-experimental study among 292 secondary level students in Kerala by utilising an instructional plan named 4APlan for Instruction and an instructional module utilising activating strategies. The study tested the effectiveness of the package in English language teaching and found it effective, irrespective of the medium of instruction, differences in study habits, and learning environments.

Karthik et.al (2019) found that implementation of e-learning programs will be successful if they are based on sound instructional design strategies. As the eLearning settings lack an instructor's physical presence, it is the Instructional strategies that fill the gap. The same but well-structured content can be presented in multiple ways by the instructors but the choice of the strategy is dependent on the knowledge, experience, and learning environments. It stimulates the learner's cognitive structures and makes learning effective.

Bell and Gilbert (1994) suggest that self-empowerment is an aspect that helps teachers acknowledge their accountability, autonomy and self-directed learning. In such frameworks, they are able to increase their knowledge, infuse this knowledge into their classroom materials, and become more self-confident and involved in collaborative work. In light of the above reviews, the investigator attempted a study in the schools in rural areas of Kerala state where the benefits of knowledge societies are limited. This plan will help the prospective teachers get adapted to a new teaching strategy and it enhances their teaching competencies. It also nurtures the learning environment and activates participation of the learners on the digital platform through the principles of blended and flipped learning approaches.

Purpose of the Study

The investigator, being a teacher educator, felt the need for a comprehensive instructional plan befitting to both digital and actual classrooms and developed a suitable plan for multi-discipline and multi learning platforms. The changing educational scenario demands such a comprehensive plan for instruction which helps the policy makers in integrating a holistic and experiential approach to multidisciplinary learning. The revised educational policy of India proposes high-quality training for teachers in content,

pedagogy, and practice giving importance to multidisciplinary approach. It asserts "teacher preparation is an activity that requires multidisciplinary perspectives and knowledge, the formation of dispositions, and values and the development of practice under the best mentors and also being well versed in the latest advances in education and pedagogy". It highlights the importance of digital literacy among learners.

The present study analyses to what extent the prospective teachers find 4A Plan for Instruction is effective for concept formation and achievement in learning and how it caters to their professional development. The study analyses the effectiveness of 4A Plan for Instruction in teaching science and social science at secondary level with respect to pretest and posttest scores in the total sample and compares the effectiveness of 4A Plan for Instruction in science and social science at secondary level with respect to posttest scores.

Methodology

Phases of Instructional Plan

The investigator developed an instructional plan named '4A Plan for Instruction' as part of her doctoral research. The plan comprises four successive phases of lesson transactions. Phase I – **Acceleration** has two stages 1) Enhancing Prior Knowledge and 2) Strengthening Cognitive Structure. Phase II – **Acquisition** proceeds through 3) Activity for Establishment and 4) Acquisition of the Content. Phase III – **Affirmation** is meant for 5) Articulation of Ideas and 6) Reflection and Self Analysis among the students. Phase IV – **Amplification** is the final phase of lesson transaction which aims at 7) Strengthening Situated Learning Skills and help students 8) Reciprocate to Real Life Situations. The investigator checked its effectiveness in English language teaching and found it effective for concept formation and achievement in English.

Method and Sample of the Study

In the present research context, the investigator utilises the developed instructional plan for lesson transactions in multi discipline. The experiment was conducted to check the effectiveness of '4A Plan for Instruction' in science and social science such s Physics, Biology, History and Geography. The mode of transaction was digital. The method adopted was quasi-experimental in nature. 120 students from 9th standard in Kerala state are taken as samples. Stratified random sampling technique is used for the selection of samples. The prospective teachers, after being properly oriented towards the theoretical aspect of 4A Plan for Instruction, conducted online classes in concerned subjects. The teachers were also given instructions regarding lesson planning and achievement test preparation based on the developed instructional plan. The effectiveness of the instructional plan is the independent variable and the digital mode of teaching is the dependent variable. The students belong to Kollam and Pathanamthitta districts of Kerala.

Teaching Platforms Used for the Study

The prospective teachers used Google meet, Zoom, Google classroom, Google docs, Google slides, and Google forms etc. as the main platforms for online lesson transactions. The other apps utilised by the teacher trainees are Kahoot for game-based lesson transactions, blogs for reflection, Seesaw for feedback, Anchorfm for audio podcasts, fliphtml5.com for pdf creation, H5P tool for making interactive videos. The teacher trainees used virtual videos, simulated videos, powerpoint presentations, online quizzes and online group interactions using zoom 'breakout rooms.'

Research Tools and Statistical Techniques Employed

The major tools used for the study are teacher made, standardised achievement tests in physics, biology, history and geography (validity, reliability and inter-rater reliability of the tests were calculated), lesson transcripts based on 4A Plan for Instruction and an open-ended questionnaire for prospective teachers to report their experiences related to the lesson transaction through digital mode. The major statistical techniques employed for the analysis are measures of central tendency, measures of dispersion, test of significance, ANCOVA, etc.

Analysis of Data and Discussion

Table 1: Test of significance of pretest and posttest achievement scores of Physics in sub sample

	Control Group			Experimental Group			Critical Ratio	
	N1	M1	σ1	N2	M2	σ2	t	P
Pretest	30	10.90	2.79	30	11.07	2.45	0.25	0.01
Post test	30	17.47	3.46	30	22.07	3.70	4.98	0.01

The post test mean scores of experimental (22.47) and control (17.47) groups are greater than that of the mean scores of pretest in Physics of experimental (11.07) and control group (10.90). Since the mean scores show considerable difference, it can be inferred that the at the entry level, all students belong to the same academic level and the treatment given to the experimental group made a difference.

Table 2: Test of significance of pretest and posttest achievement scores of Biology in sub sample

	Control Group			Experimental Group			Critical Ratio	
	N1	M1	σ1	N2	M2	σ2	t	P
Pretest	30	10.40	2.40	30	10.03	2.71	0.56	0.01
Post test	30	15.50	3.52	30	20.93	2.50	6.89	0.01

Table 2 shows that there is no significant difference between the mean scores of experimental and control groups in pre test, since the 't' value obtained is 0.56 which is less than the table value at 0.01 level. So it can be inferred that the experimental and control groups were almost identical in their achievement in Biology before the experimental treatment. The post test score shows that the 't' value 6.89 is significant at 0.01 level. The mean score of post test achievement of the experimental group (20.93) is higher than that of the control group (15.50) after the experimental treatment. The difference may be due to the method of instruction through '4A Plan for Instruction'.

Table 3: Test of significance of pretest and posttest achievement scores of Geography in sub sample

	Control Group			Experimental Group			Critical Ratio	
	N1	M1	σ1	N2	M2	σ2	t	P
Pretest	30	10.70	3.20	30	11.10	2.62	0.53	0.01
Post test	30	16.87	2.63	30	21.33	3.20	5.90	0.01

Table 3 shows that there is no significant difference between the mean scores of experimental and control groups in pre test, since the 't' value obtained is 0.53 which is less than the table value at 0.01 level. So it can be inferred that the experimental and control groups were almost identical in their achievement in Geography before the experimental treatment. The post test score shows that the 't' value 5.90 is significant at 0.01 level. The mean score of post test achievement of the experimental group (21.33) is higher than that of the control group (16.87) after the experimental treatment. The difference may be due to the method of instruction through '4A Plan for Instruction'.

Table 4: Test of significance of pretest and posttest achievement scores of History in sub sample

	Control Group			Experimental Group			Critical Ratio	
	N1	M1	σ1	N2	M2	σ2	t	P

Pretest	30	11.63	2.32	30	11.40	2.72	0.35	0.01
Post test	30	17.73	3.09	30	22.37	2.74	6.16	0.01

Table 4 shows that there is no significant difference between the mean scores of experimental and control groups in pre test, since the 't' value obtained is 0.35 which is less than the table value at 0.01 level. So it can be inferred that the experimental and control groups were almost identical in their achievement in History before the experimental treatment. The post test score shows that the 't' value 6. 16 is significant at 0.01 level. The mean score of post test achievement of the experimental group (22.37) is higher than that of the control group (17.73) after the experimental treatment. The difference may be due to the method of instruction through '4A Plan for Instruction'.

Table 5: Test of significance of pretest and posttest achievement scores of Social Science in sub sample

	Control Group			**Experimental Group**			**Critical Ratio**	
	N1	**M1**	**σ1**	**N2**	**M2**	**σ2**	**t**	**P**
Pretest	30	22.33	3.13	30	22.50	3.69	0.19	0.01
Post test	30	34.60	3.56	30	43.70	3.03	10.65	0.01

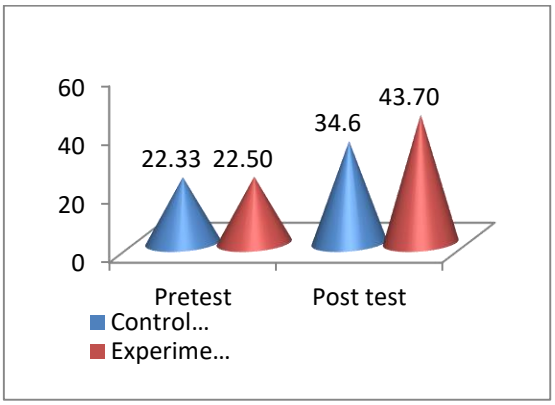

Table 5 shows that there is no significant difference between the mean scores of experimental and control groups in pre test, since the 't' value obtained is 0.19 which is less than the table value at 0.01 level. So it can be inferred that the experimental and control groups were almost identical in their achievement in Social Science before the experimental treatment. The post test score shows that the 't' value 10.65 is significant at 0.01 level. The mean score of post test achievement of the experimental group (43.70) is higher than that of the control group (34.60) after the experimental treatment. The difference is due to the instructional effect of '4A Plan for Instruction'.

Comparison of Gain Scores in Achievement of Experimental and Control Groups (Social Science).

The achievement scores of students in both the groups were compared by testing the significance of difference between the mean of the gain scores in achievement in Social Science. The data and results of the test of significance are given in Table 6.

Table 6: Test of Significance of Gain Scores in Achievement of Experimental and Control Groups (Social Science).

	Gain score					
Groups	**N**	**M**	**σ**	**CR**	**df**	**P**
Control	30	12.27	4.10	8.54	58	0.01
Experiment	30	21.20	4.00			

The mean score of the experimental group (21.20) is greater than that of the control group (12.27). The obtained 't' value is 8.54 which is highly significant at 0.01 level. Since the mean of experimental group is greater than that of the control group, it is

inferred that experimental group performed better than the control group.

Table 7: Analysis of Co-Variance of Pre test and Post test Achievement Scores of Experimental and Control Groups (Social Science).

ANCOVA							
	df	SSx	Ssy	Sxy	SSy.x	MSy.x(Vy.x)	SDy.x
among means	1	0.42	1242.15	22.75	1229.27	1229.27	3.26
Within Group	57	704.17	657.50	188.50	607.04	10.65	
	58	704.58	1899.65	211.25	1836.31		

Fy.x =	115.42

Group	N	Mx	My	My (ad
A	30	22.33	34.60	32.
B	30	22.50	43.70	41.

The obtained $F_{y.x}$ ratio shows that it is highly significant at 0.01 level ($F_{y.x}$ = 115.42; p <0.01). It is clear from the significant $F_{y.x}$ ratio that the two final means which depend upon the experimental and control variables differ significantly after they have been adjusted for initial difference on x. The adjusted means of post-test scores (x, y means) of students in the experimental and control groups were calculated. The difference between the adjusted y means was tested for significance. The significant difference between the adjusted y means indicates that the students of the experimental and control groups differ significantly in their achievement in Social Science. The adjusted mean of the post-test scores of experimental and control groups clearly show that the experimental group is superior in the achievement in Social Science when compared to the control group.

Table 8: Test of significance of pretest and posttest achievement scores of Science in sub sample

	Control Group			Experimental Group			Critical Ratio	
	N1	M1	σ1	N2	M2	σ2	t	P
Pretest	30	21.30	2.91	30	21.10	3.64	0.24	0.01
Post test	30	32.97	5.43	30	43.00	3.50	8.50	0.01

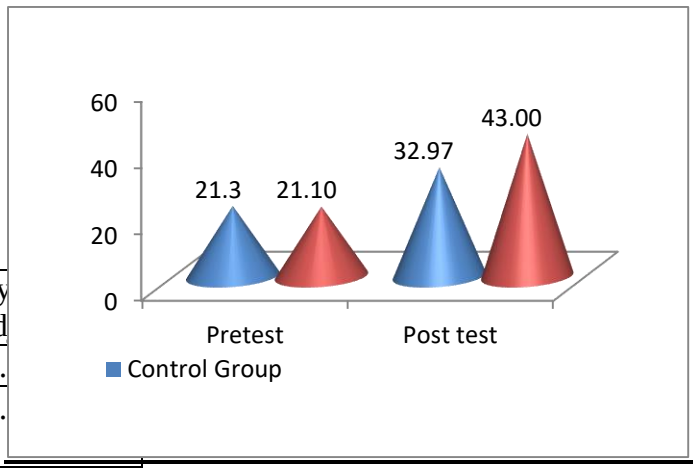

Table 8 shows that there is no significant difference between the mean scores of experimental and control groups in pre test, since the 't' value obtained is 0.24 which is less than the table value at 0.01 level. So it can be inferred that the experimental and control groups were almost identical in their achievement in Science before the experimental treatment. The post test score shows that the 't' value 10.65 is significant at 0.01 level. The mean score of post test achievement of the experimental group (43.00) is higher than that of the control group (32.97) after the experimental treatment. The difference is due to the instructional effect of '4A Plan for Instruction'.

Comparison of Gain Scores in Achievement of Experimental and Control Groups (Science).

The achievement scores of students in both the groups were compared by testing the significance of difference between the mean of the gain scores in achievement in Science. The data and results of the test of significance are given in Table 9.

Table 9: Test of Significance of Gain Scores in Achievement of Experimental and Control Groups (Science).

Gain score						
Groups	**N**	**M**	**σ**	**CR**	**df**	**P**
Control	30	11.87	5.43	7.68	58	0.01
Experiment	30	21.90	4.66			

The mean score of the experimental group (21.90) is greater than that of the control group (11.87). The obtained 't' value is 7.68 which is highly significant at 0.01 level. Since the mean of experimental group is greater than that of the control group, it is inferred that experimental group performed better than the control group.

Table10: Analysis of Co-Variance of Pre test and Post test Achievement Scores of Experimental and Control Groups (Science).

ANCOVA							
	df	SSx	Ssy	Sxy	SSy.x	MSy.x(Vy.x)	SDy.x
among means	1	0.60	1510.02	30.10	1503.72		4.68
With in Group	57	651.00	1252.97	53.10	1248.64	21.91	
	58	651.60	2762.98	83.20	2752.36		

Fy.x =	68.63

Group	N	Mx	My	My.x (adjusted)
A	30	21.30	32.97	32.40
B	30	21.10	43.00	42.44

The obtained $F_{y.x}$ ratio shows that it is highly significant at 0.01 level ($F_{y.x}$ = 68.63; p <0.01). It is clear from the significant $F_{y.x}$ ratio that the two final means which depend upon the experimental and control variables differ significantly after they have been adjusted for initial difference on x. The adjusted means of post-test scores (x, y means) of students in the experimental and control groups were calculated. The difference between the adjusted y means was tested for significance. The significant difference between the adjusted y means indicates that the students of the experimental and control groups differ significantly in their achievement in Social Science. The adjusted mean of the post-test scores of experimental and control groups clearly show that the experimental group is superior in the achievement in Science when compared to the control group.

From the above findings it can be interpreted that 4A Plan for Instruction is very effective in concept formation and achievement in subjects such as science and non-science. Hence it is found that the instructional plan is effective in lesson transaction for multidiscipline.

Responses from Prospective Teachers regarding the use of 4A Plan for Instruction in developing teaching competencies.

An open ended questionnaire was given to 4 prospective teachers who administered 4A Plan for Instruction during their practice teaching through digital mode. The responses can be summarised as follows. The prospective teachers opined that the instructional plan is suitable for digital platform for lesson transaction. The instructional phases help the learners to master the content effectively. Various online resources help them to go through the learning phases sequentially and logically.

The virtual environment was in effect collaborative in nature and hence the given instructional plan helped the teachers to build collaborative workspace and thereby promote ubiquitous learning. The prospective teachers were able to check the understanding of the students and thereby enhance the prior learning of the students. They were of the opinion that the cognitive structure of the students can be strengthened with the help of blended and flipped classroom strategies. The second phase of the instructional plan was also easy to administer in online platform. They were able to provide necessary online activities such online quizzes and tests for establishing the concept. It could help the students master the content. The third phase is meant for articulation of ideas and for reflection and self analysis. The availability of web resources helped the students to articulate their ideas and reflect upon their learning. The phase where the prospective teachers found it difficult to achieve the learning outcomes were the final phase of the instructional plan in which reciprocate to reel life situations was not practical during the pandemic situation and through this digital mode of learning.

From their free responses, it could be found that the instructional plan helped them to master the teaching competencies in them. The major skills and competencies they developed during the implementation stage of this instructional plan were proper lesson planning and lesson transaction, engaging the learners in meaningful learning situations, creating collaborative workspaces in digital learning, making the learning scenario flexible and adaptable.

The present instructional plan utilises the principles of flipped and blended learning. The computer-mediated instructional space in online classrooms is transformed into a dynamic, interactive environment that ensures collaborative and participatory learning. This plan is systematic, comprehensive and instrumental in nature. It does not always follow a researcher-oriented approach. It helps the teachers and learners to interact with each other effectively. Even though the study is experimental in nature, it is not a simulated one and instead ensures a natural learning environment in the digital mode of lesson transaction. This plan enables the learners to analyze information autonomously and helps them to assimilate the essential skills needed for 21st century knowledge societies. It follows a spiral approach to learning which is in line with the recommendations of NPE ensuring interactive classroom sessions contain fun, creativity, collaboration, and exploration for experiential learning.

Conclusion

Naisbitt (1986) states "the society that is emerging is a knowledge society, one which is characterized by new structures of knowledge, methods of dissemination, and a technology that permits and sustains unrestricted access to knowledge and control over it". The knowledge societies of the post-COVID era mainly focus on the generation, dissemination, and deployment of knowledge mainly through digital media. It is evident that the post-COVID educational scenario is susceptible to e-learning ecologies. The present study is designed for knowledge dissemination in multi-discipline through a single instructional plan named '4A Plan for Instruction'. The effectiveness of the plan in language teaching has already been analyzed and it was found effective for all students irrespective of their medium of instruction, the difference in study habits and learning environments. The behavioural learning outcomes expected of students in a knowledge society are their capacity to learn how to learn, to transform information into new knowledge and apply it in real-life situations. The instructional and nurturant effects of the plan help the learners to attain these outcomes and enable the learners to critically conscious of the demands of knowledge societies such as effective communication, collaboration, adaption to changes. The research outputs ensure aneasy transition from research to policy. It is strategic, evidence-based, and rational in nature. The selected plan strictly follows the major principles of instruction and it is innovative in terms of implementation, cost, learning experience and learning outcomes. It is in line with the decision-making factors of

educational policies and sticks to the motto adopt, adapt and act. It also enhances the professional development of teachers in knowledge societies.

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BREAKING THE CODES OF COURTESANS: REBIRTH OF MENAKA IN KAVITA KANÉ'S *MENAKA'S CHOICE*

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PREFACE

Mythologies are fundamentally male-centric narratives that signify, uphold and, idealize patriarchal values and ideals. Patriarchy uses mythological stories to regulate and control women's sexuality. Females are often treated as male possessions to be exchanged or enjoyed. Objectification of women's body is a common mytheme found in every mythology across the world, and India is not an exception. Apsaras, the immortal seductresses of Indra's court are the direct references to female objectification in Indian mythology. Inspite of being much significant and powerful, Apsaras play only cameo roles in Indian mythology stories. They never got a chance to be in the central stage and narrate their stories. But the Indian-English novelist Kavita Kané disrupts this tradition by making Menaka, the most beautiful and intelligent apsara of Indralok, as the protagonist of her novel Menaka's Choice. The present paper investigates how Kavita Kané lifts the veil patriarchy puts on Menaka's character as a celestial seductress and, how she recreates her as a woman of individuality by presenting a panoramic view of her life, highlighting the desires, motives and, aspirations of the character.

Key Words: *Feminism, Revisionist Mythology, Patriarchy, Objectification*

Introduction

Mythology is a fundamental force that has been producing and propagating social values, communal ideals and cultural images in a society. Myths are heralded neither as fictions nor as speculations but, as vital components of social life that will remain timeless for their universality.

It is an exceptionally influential tool as mythology can shape the culture and thus the general characteristics of a society. Most mythological stories are primarily male-centric narratives that signify, uphold and idealize patriarchal ideas and expectations. Patriarchy has thus been using mythology as an effective tool to consolidate its position by pointing out and establishing social hierarchy through portraying a wide range of characters.

Mythological discussions of women has predominantly based on the assumption that male is universally being the dominant gender and female is the subordinate one. These narratives produce and proliferate the gender stereotypes and reinforce the patriarchal assumption of woman as the "second sex". Being the ideological narratives of patriarchy, mythology also creates images of women to be revered and denounced in a society. As Kate Millet points out, "under patriarchy the female did not herself develop the symbols by which she is described. As both the primitive and the civilized worlds are male worlds, the ideas which shaped culture in regard to the female were also of male design. The image of women as we know it is an image created by men and fashioned to suit their needs" (Millet 1970). Patriarchy uses the same mythological stories to regulate and control women's sexuality. Females are often treated as male possessions to be exchanged or enjoyed. Gods' and heroic men's sexual dominance over women as well as violent sexual-based mythemes are integral structural components of misogynistic myths. Objectification of women's body is common mytheme found in every mythology across the world, and India is not an exception. Apsaras, the immortal seductresses of Indra's court are the direct references to female objectification in Indian mythology.

Apsaras, the Celestial Courtesans

Indian mythology makes multiple references to these celestial nymphs present in Indra's court as the eternal beauties capable to seduce men and gods alike. Apsaras are often sent to earth on the command of their master Devendra, the king of gods, to check the growing powers of his opponents by alluring them into the erotic

beauty of these ladies. Beguilingly beautiful and eternally young, apsaras are the most effective tools for Indra to destroy his enemies whether they are demons or ascetics.

Apsaras first appeared in *Rig Veda* where it is mentioned that Urvashi is one among the many apsaras present in Indra's court. Later, the epics *Ramayana*, *Mahabharata* and, the Puranas made multiple references by naming and describing many of them and their contributions in the businesses of men and gods. They are also mentioned as the wives of Gandharvas, the musicians of Indra's court. In the celestial palaces, they often dance to the music produced by Gandharvas to entertain the gods. In Indian mythological narratives, the apsaras, in spite being much significant and powerful, appear only in sub-stories or plays cameo roles as they never get a chance to be the protagonist of a main narrative. Apsaras never got a chance to narrate their stories. But the Indian-English novelist Kavita Kané disrupts this tradition by making Menaka, the most beautiful and intelligent apsara of Indralok, as the protagonist of her novel *Menaka's Choice.* Kané lifts the veil patriarchy puts on Menaka as a seductress and recreates her as a woman of individuality by presenting a panoramic view of her life, highlighting the desires, motives and, aspirations of the character.

Menaka in the Mythologies

In Indian mythology, Menaka is famous in two aspects; the first one is her notorious seduction of sage Vishwamitra and the second is her status as mother to Shakuntala, the wife of king Dushyanta. As the first story goes, once the rishi Vishwamitra was once undergoing a very difficult tapas. As time passed the intensity of his tapasya increased and it threatened Indra as it would make Vishwamitra all powerful and he would easily conquer heaven. So, the cunning Indra sent Menaka, the bewitchingly beautiful apsara, to earth. Her assigned duty was to seduce the sage and destroy his tapasya.

Menaka went to the forest where Vishwamitra was performing the rituals and engaging in meditation. She began to sing and dance in front of him, made garland of aromatic flowers and put it around his neck. Being disturbed by all these, Vishwamitra opened his eyes and his meditation was ruined. But the angry sage was immediately got enthralled in the seductive beauty of Menaka and, at once proposed to marry her. As Menaka's purpose was to destroy the sage-hood of Vishwamitra, she agreed to his proposal and they got married. Shakuntala is the daughter born to Menaka and Vishwamitra. After the birth of Shakuntala, Menaka abandoned the sage with responsibilities of the daughter and returned back to the heaven as her mission was accomplished.

Revising the tale of Menaka

In the traditional narratives, Menaka is portrayed as a *femme fatale* who used her beauty to bewitch the sage Vishwamitra and mercilessly abandoned him once her mission was accomplished. But a feminist revision of the story of Menaka unfolds in Kavita Kané's novel *Menaka's Choice* that narrates how Menaka emerges as an assertive woman who controls her own life as well the lives of others, with her demarcated choices and its well defined execution. Menaka, born out of Brahma's mind, is the cleverest, most feisty as well as exquisitely beautiful among the ten apsaras who amuse devas and gods in the capital of devalok, Amaravati. *Menaka's Choice* portrays two stages of Menaka's life, one is her unknown life in heaven where she falls in love with the Gandharva king Vishwavasu and the next phase is her most talked and scandalous seduction of the sage Vishwamitra, which happens on earth.

Kané exposes the inhuman life forced upon apsaras in heaven where they are prohibited to have eternal love or familial life. "Everything was shared in Heaven; you could not possess anything in this land of plenty. You could have everything but own nothing" (*Kané 2015*) says Kané. Indra considers them only as objects that are created to seduce, give pleasure and desert. Apsaras do not possess any rights on their life. But, shattering Indra's expectations Menaka falls in love with the Gandharva king Vishwavasu and making Indra more jealous and furious, gets pregnant from him. The infuriated Indra decides to punish Vasu alone as he cannot

take risk with Menaka. But Menaka is intelligent enough to understand that Devendra couldn't punish her or exile her. In the face of necessity, she breaks the rules of submissiveness, takes the complete responsibility of the marriage, and rescues Vasu by arguing with Indra and defeating him with her verbal skills. In the combat of words it is out of the question for anyone, even Indra, to defeat Menaka. She recognizes where her power lies; charm and wit turn to be her weapons that disarm the opponents

Kané brilliantly reflects a heaven where contrasting to the earthly principle of woman's chastity, heavenly rules are defined to control women's sexuality. The impression of shame emerges with a woman's open manifestation of desire is revealed when Menaka announces that "My desires should not shame me – and I desired Vasu enough to marry him, to have him for myself" (Kané *2015*). Apsaras are treated and defined in heaven in terms of their utilitarian object status. Menaka realizes this objectification and feels the hegemonic suppression particularly from Indra. When Indra threatens the future of her and the child, she fiercely argues for her fundamental right to be a mother. But Indra does not allow to keep the child in the heaven since apsaras do not enjoy the freedom to raise a baby. The child will be given to some barren kings or sages to be looked after. After long arguments with Indra, Menaka is forced to choose between the two blessings of her life; either she can abandon the child and live with her gandharva in the heaven or she can have the child and leave Vasu and Indralok at once. Menaka is caught in a circumstance where picking either will result in dropping a part of herself. Finally she is forced to leave the child behind.

Kané portrays a ravished Menaka who shows courage to question the injustices patriarchy imposed up on women. She compares herself and other apsaras, whom Indra consider as his prestigious possessions to earthly whores. When Indra feels it as an insult and decrees that it is the obligation of apsaras in heaven to "please and entertain" to which Menaka reacts,

> And flirt and woo, and seduce! To allure and exploit men, that's it! You made me a woman that glorify beauteous creation, yet so rudimentary. I am that beautiful, eternally young woman who believes she lives with the blessed in Heaven. You gave me all the weapons of love, sex and desire but disarmed me of my capability of conscious choice and decision. Why? I can be a woman, but never a wife or a mother. Just a sexual slave.A whore. (*Kané 2015*)

Menaka's comparison of a heavenly apsara with an earthly harlot is very much relevant since mythological tales often initiated and put on a normal footing on devadasi tradition and later prostitution in Indian society. The Indian government redefines prostitution in "Prevention of Immoral Traffic Act-1987, as "Sexual exploitation or abuse of persons for commercial purposes" (Khan & Singh 1987). This is what exactly Indra is undertaking in his heaven, taking advantage of the sexuality and sensuality of apsaras for his personal gain.

Indra, being the champion of patriarchal power on heaven, takes his ultimate revenge on the assertive woman Menaka by plotting with the apsara Rambha. She alleges Vasu as a molester who tried to rape her. They executed the plan in Menaka's absence since she might have defended Vasu at any cost. Discarding all his requests, Indra turns Vasu into a "headless torso monster Kambandh" and banishes him to earth (*Kané 2015*). This completely breaks Menaka as she lost both her child and her husband. But Menaka prevents herself from an emotional breakdown since she knows that she has to take revenge when the right situation comes. And when the right time came, Menaka plays the same plot Indra used against Vasu. She frames Tuburu, Rambha's lover, as a rapist who tried to abuse her several times in the earlier but she couldn't reveal this as he is her teacher. Tilotama, her dearest friend, supports Menaka . When the puzzled Tumburu discards the accusations and calls the two apsaras fabricators of lies, Menaka agrees with him and requests pardon. Menaka was trying to prove the point that Vasu was also deceitfully blamed and deceived by Rambha just like they did to Tumburu. Indra couldn't find any words to justify what he has done.

Using her wittiness and intelligence, Menaka wins the trial once again.

The next phase of Menaka's life begins when she is given the duty to distract the meditation of the great rishi Vishwamitra who is undertaking intense tapasya to be a Brahmarishi. Indra was aware that only Menaka will be able to handle the volatile Vishwamitra as she is a matchless mixture of beauty and brain. Menaka was ordered to seduce Vishwamitra, give him a child and return to devalok, trapping the sage in a domestic life. Indra had no hope that Menaka will obey him after what he has done to her. But to Indra's surprise, she accepts the work as she considered this as a chance to escape from the clutches of heaven. She articulates her own action plan. Menaka goes to Vishwamitra in the forest and presents herself as a victim of Indra's treachery. Later she seduces him with the help of Kama and starts to live with Vishwamitra in his ashram. When time passes she comes to know that the sage loves her enormously to that extend which he not once loved anybody in his life.

In the beginning Menaka was strong willed not to be confined by her relationship with Vishwamitra. Her task was to destroy him, but slowly she falls in love with him. Menaka forgets all about her task and on the contrary inspires him to endure his tapasya. She does not want to be the reason for his disgrace. Menaka's decision to have a true family with Vishwamitra can be seen as her dissent against the patriarchal rule of heaven which rejects the right of apsaras to have familial life. She decides to act upon her own needs and choices which will not be sanctioned by the patriarchal heaven. When Indra tries to persuade Menaka to come back to heaven, she provides him with two choices- he can either take her to the heaven, face the rage of Vishwamitra or he can permit Menaka to carry on her life with the sage so that she will prevent him from becoming a Brahmarishi. Indra had no choice other than letting her to continue the life with Vishwamitra.

Menaka gives birth to Vishwamitra's daughter, Shakuntala as she takes it as her victory over Indra who snatched the first child away from her. But after achieving a blissful family, Vishwamitra forgets his sagely duties and becomes a complete family man. The goal to be a Brahmarishi seems nothing to him in front of a happy family. Even Menaka's efforts couldn't change his mind. Menaka realizes that she is becoming the utmost obstacle in his journey to be a Brahmarishi, that she is finally destroying the man, the real love of her life. Kané elevates Menaka's character to the next level as she is not a self-centered woman who considers only of her own happiness. After attaining everything she ever wished in life, a blissful family, Menaka chooses to leave everything behind. She decides to disclose the truth. The moral uprightness of Menaka seems greater than the devas who directed her to destroy the man. She listens to her conscience.

Menaka discloses the truth to Vishwamitra hoping that he will hate her for all the lies and will return to the quest to become a Brahmarishi. Vishwamitra is devastated in shock and infuriated when he comes to know that Menaka acted a part in Indra's plan to put an end to his penance. Menaka is determined face his wrath and to leave him for his own good, "She had to leave him to set him free. She was the shackle fettering him from his path of high honour, but no longer" (*Kané 2015*). Menaka wisely redirects the situation so that his anger will force him to take shelter in his ambition and Vishwamitra will finally become the Brahmarishi. When Vishwamitra resolves to curse Indra, Menaka stops him from wasting his spiritual powers since that's exactly what Indra needs. Menaka dreads that Vishwamitra may curse her, and he curses her not to come before him again. Menaka agrees with Vishwamitra's decision to give Shakuntala to the childless Kanva who can give her a bright future. Keeping the immense love within themselves, Menaka and Vishwamitra decides to part their way. Kavita Kané's Menaka is not the voluptuous seducer in mythology who destroys men with beauty, but a woman of moral strength who sacrifices her happiness for her man's better future. She may have distracted him and lured him but it is the same woman who persuades him to achieve his lifetime goal

In *Menaka's Choice* Kavita Kané reframes the wrong perception of patriarchy on women, especially on apsaras as the destroyers of men. Kané's protagonist is that woman who encourages her man to take the right path that leads him to the higher goals. Kané portrays Menaka as a responsible individual completely aware of the cost of her decisions. As the reviewer Cris suggests, "The title of the book Menaka's Choice is a paradox. Did Menaka have a choice, or was it her struggle against the choice-less life she was to lead? She makes her life a series of options where she wins some, loses rest. But she has no regrets" (Cris 2016).

Conclusion

Kané's glance into Indra's heaven surprises the readers in a different level. Kané effectively frames the celestial rules and guidelines that bind the heavenly beings as the mirror image of human laws. Women of earth and heaven are deprived identically from their individual freedom of the expressing desires. The apsaras are mere toys to be enjoyed by the gods and do not own any rights of themselves. Menaka's words magnifies the situation when she says, "We are but...apsara, destined to give pleasure to all but ourselves. And it is in such a heaven we live"(*Kané 2015*). The rejection of fundamental rights to one's own needs indicates the hierarchical patriarchal structure in which the women are forced to live, both on earth and heaven. The alternate divine world that Kané portrays exposes the imperfections of a man-encoded mythology that is fundamentally patriarchal and misogynistic.

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Enhancing Naturalist Intelligence Through Experiential Learning for Effective Environmental Resource Management

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ABSTRACT

Teachers may assist their students in developing or enhancing their naturalist intelligence by offering learning opportunities that promote observation, classification, working and learning in or with the natural world that is allow the learner free or experience nature. So experiential learning means learning through reflection on doing. Through experiential learning students are able to receive a deeper understanding of the contents being taught. The present study is an attempt to find out whether there is any correlation between experiential learning and naturalist intelligence. Many research studies reveals that a person with naturalist intelligence possess a strong high environmental consciousness. So this study throws light on Effective Environmental Resource Management by Enhancing Naturalist Intelligence Through Experiential Learning.

Keywords: *Naturalist Intelligence; Experiential Learning; Environmental Resource Management; Scientific Naturalist; Higher secondary school students.*

INTRODUCTION

For the effective management of environment and natural resources it is important to understand that there is far more to consider than just the climate and the natural resources. The interdependence of natural environment and human involvement and behaviour is also a central factor. The field of environmental resource management is concerned with the relationship of the natural world's diverse ecological and sociological process. Changing current resource-use practices to a more sustainable egalitarian economy is a difficulty and intractable problem.

Students must gain knowledge of environmental concerns and natural hazards in this era of rapid environmental problems and issues. We are part of this world, and we will not be able to live in it unless we learn about it. Many of the concerns are pollution, natural resources depletion, loss of biodiversity, lack of conservation etc. Man existed in harmony with nature in the beginning, but scientific advances and technological innovations eventually contributed to exploitation and degradation. As a result it is imperative that people develop positive environmental awareness and consciousness in order to recognize the implications of all of these problems. Here comes the importance of developing Naturalist intelligence, the eighth intelligence in Howard Gardner's list, has to do with observing, understanding and organizing patterns in the natural environment. According to Gardner, Naturalist intelligence is the ability to identify, classify and manipulate elements of the environment, objects, animals or plants. They care about the environment and like to be in touch with nature. They are good at identifying flora and fauna.This particular intelligence that involves how sensitive an individual is to nature and the world. People who excel in this intelligence typically are interested in growing plants, taking care of animals or studying animals or plants. Zookeepers, biologists, gardeners, and veterinarians are among those that Gardner sees as having high naturalist intelligence"(Kelly, M 2019)[15].According to Gardner (2006)[11]Naturalistic intelligence refers to a person's interest in the "natural" world of animals, plants, and the natural work around them. It is the ability to identify and classify patterns in natural environment. Individuals with naturalist intelligence have a sensitivity to and appreciation for nature. Naturalists are inspired and rejuvenated by nature. Persons with a high degree of naturalist intelligence are keenly aware of how to distinguish the diverse plants, animals, mountains, or cloud configurations in their ecological niche. Armstrong [1] defines naturalist intelligence as the ability to recognize and Categorize species, both flora and fauna, in the surrounding environment and the ability to process and Utilize, and preserve it .

Characteristics of Naturalist Intelligence

A person with high naturalistic intelligence possess the following characteristics

- They demonstrate a desire to learn how things function.
- They are concerned about the environment and enjoy being in contact with nature; they enjoy learning about new species and behaviours.
- They're interested in employing instruments like microscopes, binoculars, and telescopes to aid observation.
- They specialise in or take courses in natural sciences (such as botany, ecology, zoology, etc.)
- Gardeners, farmers, biologists, and ecologists are among their specialties.
- They are aware of and grateful for nature.
- They enjoy gardening and feel more alive when they are in the presence of nature.
- They have a hobby that involves being outside in nature.
- They care about the environment and are concerned about pollution.•
- They appreciate having pets and caring for animals and/or plants.
- They are interested in nature and read books or publications about it.

Naturalist intelligence can be created early in life or later in life. It can be cultivated through the use of effective instructional approaches. Direct observation and investigation of the natural world should be the centre of any activities used by a teacher to reach children. Assist them in considering how their learning affects the rest of the world. Because naturalistic intelligence is very much a hands-on experience, stepping outside is the greatest way to acquire it. Take a walk outside and admire the trees, grass, and flowers, among other things. Teachers should take their children for a field trip.

Teachers must give students the chance to develop their intellect. Our learners must be able to contribute to the quality of life on Mother Earth. To improve naturalistic intelligence, we must provide the best educational opportunities possible.

Naturalistic intelligence can be developed in a number of ways. By integrating naturalistic themes and topics in the curriculum will help us to achieve our target. Topics that would help to enrich the curriculum could revolve around the environment in which the students live, where the students were able to get hands on training. The local community / resources can be best utilized in learning and comprehending nature. Beetlestone [5] states that Gardening has very real benefits for physical development, which in turn affects creative development. When gardening children will have plenty of space to move and train their bodies with large-scale Movements such as digging, scratching, running and bending. The benefits of gardening activities in Addition to influencing the physical motor of children, can also increase children's naturalistic Intelligence, train patience, foster responsibility, and build emotions and empathy. This situation proves that gardening activities through games can improve children's naturalist Intelligence Hashanah, Harmawati, Riyana and Usman 2019[13].

So taking students outside the classroom to explore the world is another easy way to stimulate the naturalistic intelligence, has to do with observing, understanding and organizing patterns in the natural environment. We should give opportunities to improve intelligence. A single trip outside will raise enough research questions in the minds of the learner. One way to promote true understanding of nature is to improve naturalist intelligence. This is where the value of outdoor education and experiential learning comes into play. Teachers can help students to develop naturalist intelligence by taking class outside, and ask them to Keep a nature diary to keep track of any changes or discoveries they notice, Demonstrate natural findings, Read books and articles on the environment and nature, help them to write articles on the environment (poems, short stories, news articles), educating people about the weather and wildlife, Putting up skits on the natural world and cycles, Investigate the foliage in their area.

Experiential learning is known as "learning by reflection by doing" and is more broadly defined as "learning by experience". Hands on learning is a form of experiential learning that does not often require students to focus on their work. Experiential learning differs from role or didactic learning, in which the learner is more passive participant. Other types of learning, such as action learning, adventure learning, free choice learning, cooperative learning, service learning and situated learning, are related but not synonymous with it. Experiential learning is a hands on approach to learning that shifts away from the teacher imparting and passing information to students from the front of the class. It aims to offer a more engaged way of learning by making learning an opportunity that extends beyond classroom. The term experiential learning is not a new catch phrase in the education field. Research suggests that experiential learning can help students develop positive attitudes toward life, encourage acceptance of responsibility, promote community involvement, and help students better understand their strengths and weakness (Bouslog, 2000)[7].Rogers (1969), [19] defines experiential learning as the use of pupils' knowledge and experience in the educational process, where they develop life skills and form a positive attitude towards life. Thus experiential learning is related to learning by doing. Experiential learning is an active learning approach that enables trainees to use and process critically their experiences and learn. At the core of the learning process in experiential learning are pupils themselves, and the effectiveness of learning depends on "how to learn" and "how to think."During the experiential teaching, students participate actively, mentally, emotionally and socially during the educational process. The teacher is a member of the team and works with learners to create learning situations for learning experiences that help them interact with learning material.(Voukelatou, 2019)[22]. Experiential learning task involves Concrete experience ,Reflective observation ,Abstract conceptualization and Active experimentation.

How can we develop naturalist intelligence among students? It can only be cultivated if students are given enough opportunities. Experiential learning tactics are extremely beneficial since they involve the process of deriving meaning from first hand experiences. Experiential learning concentrates on the process of learning. It is learning through reflection on doing, hence Experiential learning strategies can be highly effective in fostering nature awareness. Experiential learning practises can help people become more aware of nature. It engages the learner at a more personal level by addressing the needs and wants of the individual. It is about creating an experience where by learning can be facilitated. Moreover, learning from experience by yourself, might be called 'nature's way of Learning'. Help students to make connections between what they've learned and what they've seen in the natural world. Assist students in recalling knowledge by using categories, types, segments, qualities, and rules of thumb, among other things.Show them how to utilise various scientific tools. Teach them about the flora and fauna in various countries , about farming techniques in various climates, explain how various scientific concepts relate to nature like wise through experiential learning strategies, we can foster naturalistic Intelligence among secondary school students, thus making learning more reflective and meaningful.

Experiential learning strategies to develop Naturalist intelligence

- Sensory observation: feeling, smelling, listening.
- Data collection from observation.
- Observation of animal behaviour.
- Growing things plants, gardens.
- Recycling projects and worm boxes.
- Nature walk.
- Field trip.
- Identifying shapes in natural setup.
- Observation through microscope, hand-lens.
- Identifying sounds in nature.
- Modelling, measurement or scale drawing of animals, plants or outdoor settings.

- Explore local environment.

Outdoor education can be considered experiential, especially when learning occurs via experiences" (Ford, 1986)[9]. The Association for Experiential Education, which was created in the 1970s, characterised experiential education as "a theory that informs numerous techniques in which people learn via doing. "Educators intentionally engage students in direct experience and focused reflection in the classroom. In order to improve people's capacity, raise their knowledge, develop skills, clarify values, and expand their knowledge to make a difference in their communities". Environmental resource management attempts to safeguard and maintain ecosystem benefits for future human generations also also maintaining ecosystem integrity by taking into account ethical, economic, and scientific (ecological) factors. So environmental resource management is linked with environmental protection and sustainability.

To reverse ecosystem degradation, it is very essential to understand different ecological systems and science. To achieve this teachers should enable students with a thorough understanding of how ecological principles can be applied to the management and conservation of natural resources and ecosystems, as well as practical skills and techniques.

Objectives of Environmental resource management

1.To locate environmental problems and it's solutions
2. To reduce the over exploitation of natural resources
3. To control environmental pollution
4.To restore natural resources
5. Promote optimum utilization of natural resources
6. To assess the impact of disasters and how to overcome it
7. Promote reforestation

In this regard our duty as teachers is to inculcate environmental resourse management skills among the students and ignite their minds to be environmentally responsible. From different research works it is very evident that Environmental management skills is related to naturalist intelligence of an individual. So through experiential strategies we could develop naturalist intelligence among students for effective environmental resource management.

LITERATURE REVIEW

Meyer&Maggie(1998)[17] suggest ways to teach naturalist intelligence through observation and field studies in an ordinary setting such as the schoolyard. They give emphasis to learning by doing- includes knowledge and skills acquired outside of book / lecture learning situations through work, play and other life experiences.

Voukelatou (2019) [22] showed the significant impact of experiential learning on acquiring knowledge and developing social skills and students' attitudes ,while contributing to the promotion of cultural heritage and the values of tradition this study clearly the pics experiential learning in teaching as well as analysing the teaching method of the project in combination with other different experience/ educational techniques.

Bouhazzama&Mssassi(2020) [6] conducted study on the impact of experiential learning environment on secondary students. Experiential learning activities include simulations, field trips, discussions, role plays were employed in the investigation and results clearly envisages the positive impact of an experiential learning curriculum for secondary school students.

Banchi & Bell (2008) [2] developed a set of interactive and experiential learning strategies to promote learning. Environmental awareness can be developed among secondary school students by giving adequate experiential activities and secondary level is the best for inculcating positive attitude and awareness towards nature(Sreekala, 2012) [15]

"Discovering the Naturalist intelligence-Science in the school yard" a book written by Glock(1999) [12]clearly illustrates the naturalistic traits in children and explains in number of outdoor lessons with which we can strengthen the naturalist intelligence of learners.

Barton(2019)[4] pointed out that experience learning approach is a cycle starting with active exploration of surroundings by students, makes note of what is happening, then reflection followed by drawing generalizations and preparing to experiment for the next experience and explored the importance of utilising resources like fields and garden in making science subject more real and interesting to pupil of all grades.

According to Hayes 2009 [14] states that undergraduate Biology students can develop naturalist intelligence by emphasising the need for well-sounded scientific naturalist developing curriculum that engage students in outdoor enquiry based projects, and assisting students in learning how to observe both the natural world and their own learning ,all of which are necessary skills for developing expert naturalistic knowledge and he suggests that professors, graduate students and administrators can help undergraduate Biology students to develop naturalistic intelligence by allowing them to participate in outdoor research.

Takur, G(2014) [21] developed a model to nurture naturalistic intelligence through integrated and constructivist based approach to curriculum and pointed out that school Gardens are a wonderful way to use the schoolyard as a classroom, reconnect student with the natural world and teach them valuable gardening and agricultural concepts and skills that integrate with several subjects such as maths, science,art,health and physical Education ,Social Studies as well as several educational goals including personal and social responsibility.

Natural settings are extremely important because they allow children to understand themselves, their surroundings, and their own emotions (Marynard&Waters, 2007)[15].This interaction promotes the children's sense of sharing and self-estee, Feelings expressing and decision-making autonomy. As a result, they will be more prepared to succeed in life. Nature In addition to providing a learning environment for experimentation, Discoveries and research Children enjoy themselves when they are not restricted themselves in a safe setting that might bring them together. Self-directed learning with nature and stimulation for all senses. Using learning resources without the help of teachers may aid in the development of creativity and empathy in elementary children.(Ceylan 2018) [8]

The affective bonds (connection to Nature) and the Attentional benefits (perceived restorativeness) at the basis of the relationship between human beings and Nature can be a solid starting point to foster naturalist intelligence. The ability to "care for" and "interact quietly" are indications of the realization of an affective and emotional link with nature. (Barbiero&Berto, 2018) [3]

According to research in the field of experiential learning and multiple intelligence, new and effective learning strategies are needed to improve the teaching learning process in our institution. This must be accomplished by incorporating the key elements of experiential learning, Environmental education or environment based topics in Biology .It is very essential to create environmental concern in young minds. As teachers we should inculcate ecological values among learners by enhancing their naturalistic intelligence by exploring their immediate environment . Naturalist intelligence, like other types of intelligence, requires the right "environment" , So this study throws light towards the enhancement of naturalist Intelligence for effective environmental resource management through experiential learning.

STATEMENT OF THE PROBLEM

Naturalist intelligence can be fostered in higher secondary students by emphasizing the need for well rounded scientific naturalists, designing curricula that engages students in outdoor inquiry-based projects, and assisting

students in learning how to study both the natural environment and their own learning both of which are necessary skills for developing expert naturalistic knowledge. The main objective of the present study is to find out the effectiveness of experiential learning strategy in enhancing Naturalist intelligence among higher secondary school students for effective Environmental Resource Management. So the study is titled as "Enhancing Naturalist intelligence through experiential learning for effective environmental resource management".

OBJECTIVES OF THE STUDY

1) To find out the level of Naturalist intelligence among higher secondary school students.
2) To develop a learning strategy based on experiential learning.
3) To find out the level of awareness regarding environmental resource management among higher secondary school students.
4) To find out the effectiveness of experiential learning strategy in enhancing Naturalist intelligence among higher secondary school students.
5) To find out whether there in any positive correlation between Naturalist intelligence and environmental resource management among higher secondary school students.

HYPOTHESIS OF THE STUDY

1) Experiential learning strategy is effective in enhancing Naturalist intelligence among higher secondary school students.
2) There exist a positive correlation between Naturalist intelligence and environmental resource management among higher secondary school students.

METHOD ADOPTED FORT THE STUDY

The main objective of the present study was to find out the effectiveness of experiential learning strategy in enhancing Naturalist intelligence among higher secondary school students for Effective environmental resource management. Survey cum experiment method was adopted for the study. The investigator select pre test - post test non equivalent group design. Survey method was adopted to identify the level of Naturalist intelligence among higher secondary school students before and after the experimentation. A questionnaire was prepared and used to find out whether there exist any correlation between naturalistic intelligence and environmental resource management among higher secondary school students before and after the intervention. The investigator developed a strategy based on experiential learning on selected environmental topics present in the SCERT Biology text, Standard XI. The study was conducted on a sample of 100 students of standard XI of Kerala State syllabus where 50 each for experimental group and control group. Experimental group was taught with experiential learning strategy and control group through the prevailing method. Before and after intervention of Experiential learning strategy Naturalist intelligence inventory and questionnaire on environmental resource management were administered as pre and posttests. The experimental group was tested for the effectiveness of experiential learning strategy by administering naturalistic intelligence inventory as pretest and after intervention post test I and post test II.

The collected data were analysed using suitable statistical techniques such as paired t test and independent 't' test.

TOOLS AND TECHNIQUES USED FOR THE STUDY

- Naturalist intelligence inventory.
- Strategy based on experiential learning.
- Questionnaire to measure extent of correlation between naturalist intelligence and environmental resource management.

ANALYSIS AND INTERPRETATION

This section focuses on the testing of effectiveness of experiential learning strategy in enhancing naturalist intelligence among higher secondary school students by comparing scores collected before and after administering experiential teaching (pre test post test scores) from the two groups through following modes.

1) Comparison of pre and post test scores of naturalist intelligences of both control and experimental group for the total sample using paired t test. In order to find out whether there exist significant difference between pre test and post test scores of students in control and experimental groups on naturalistic intelligence paired t test was adopted. Table I reveals that critical ratios obtained for results of paired t test are greater than table value at 0.01levels. Hence accept the hypothesis "experiential learning strategy is effective in enhancing Naturalist intelligence among higher secondary school students". That means there is significant difference in the pre test and post test scores in each teaching method and also difference in the post test I score and post II scores.
   Mean pre test score for control group was 13.20 (SD =4.036) which was increased to 28.97 (SD = 6.872) with a percentage increase of 141.66. For experiential group, Mean pre test score was 14.47 (SD = 4.777) increased to 36.26 (SD = 8.31) with percentage increase 150.58. percentage increase from pre test to post test scores for control group was 141.66 and experimental group was 150.58.

Table I : Results of paired t test for comparing pre test and post test scores of naturalistic intelligence of control group and experimental group.

Group	N	Mean	SD	CR	Percentage increase
Pre test	50	13.20	4.036	14.00	141.66
Post I	50	28.97	6.872		
Control Pre test	50	13.20	4.036	5.17	150.58
Post II	50	19.14	7.10		
Post I	50	28.97	6.872	5.04	-34.81
Post II	50	19.14	7.10		
Pre test	50	14.47	4.777	16.15	148.27
Post I	50	36.26	8.31		
Experimental Pre Test	50	14.47	4.777	9.17	92.79
Post II	50	27.20	8.662		
Post I	50	36.26	8.31	5.32	-19.92
Post II	50	27.20	8.662		

Analysis of the data confirms that there is significant increase in post test scores after administering the experiential learning strategy and prevailing activity-oriented method of instruction. However comparing the percentage increase, control group has the lesser increase compared to experiment group. Reduction from post test I and post test II was noted in the case of experimental group compared to control group. This pointed out that the students who were exposed experiential learning strategy showed significant development in naturalist intelligence over control groups.

2) Comparison of pre test, post test I and post test II of naturalist intelligence scores between control and experimental group evaluated using independent t test in order to asses the extent to which experiential learning strategy could enhance naturalist intelligence of students at higher secondary level, the details regarding the test of significance of difference in the mean pre test, post test I and post test II

scores of Naturalist intelligence among experimental and control group are given in table II

Measurement	Group	Number of students	Mean	SD	CR
Pre test	Control	50	13.20	4.06	1.65*
	Experimental	50	14.47	4.17	
Post test I	Control	50	28.97	6.872	3.14**
	Experimental	50	36.26	8.31	
Post test II	Control	50	19.14	7.10	5.3**
	Experimental	50	27.22	8.66	

* indicates significant at 0.01level.

** indicates significant at 0.05level.

Table 2 reveals that critical ratio calculated (3.142) for comparing the effectiveness of experiential learning strategy using post test I and post test II (5.315) were found to be greater than the table value 2.58 at 0.05 level. Mean scores was higher in the case of experimental group indicates that experiential learning strategy is effective for improving naturalistic intelligence of students.

3) Analysis of correlation between the naturalistic intelligence and effective environment resource management.

Table III

Variable	Naturalistic intelligence	Environment resource management
Naturalistic intelligence	1	0.25**
Environment resource management		1

Significant at 0.01 level

From the above table, it is evident that the select variables of the present study, namely Naturalist Intelligence and Environmental resource Management are positively correlated with each other and significant at 0.01 level. Environmental resource Management seeks to conserve and preserve ecosystem services for future human generations and also maintaining ecosystem integrity by taking into account ethical, economic and scientific variables.

Conclusion

The data used to determine the association between experiential learning and Naturalist intelligence clearly demonstrates that there is a strong positive relationship between two. As a result it can be argued that experiential learning experiences in the class room are beneficial. Learners were found to be successful in improving their Naturalist intelligence. The findings of the study also revealed that different aspects of Environmental Resources Management, among the learners is also improved by the enhancement of Naturalist intelligence. The multiple correlation between Naturalist intelligence, Experiential Learning and Ethical, economic and Scientific variables of Environment Resource Management was calculated and the obtained value R=0.253nenvisages that there exists positive correlation between the variables.

Educational Implications and limitations of the study

The present study pointed out that by incorporating well-defined experiential learning strategies in the form of field trips, nature walk, outdoor activities in curriculum will enhance environmental consciousness and environmental ethics of secondary school

students. It also highlights the importance of incorporating outdoor activities into the classroom by adopting experiential approach in the teaching learning process, a teacher can make her student more environment-friendly. Keeping the results of the study in mind the Agencies responsible to improve the quality of education should take up the task of developing experiential learning strategies by utilising natural resources of the learner. The study is limited to secondary level students of Kerala state. The researcher have not included other aspects of Intelligence and cognitive development of the learner such as influence of experiential learning approach and academic excellence, different experiential learning strategies other than nature related activities like prodigy, Cross Age peer tutoring , mnemonics etc.

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RELATIONSHIP BETWEEN CRITICAL THINKING SKILL OF ANALYSIS AND GUIDED DISCOVERY METHOD IN PHYSICS AT HIGHER SECONDARY SCHOOL STUDENTS OF KERALA

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ABSTRACT

The study focuses on Relationship between Critical thinking skill of Analysis and Guided discovery method in physics at higher secondary school students of Kerala It finds out the effectiveness of Guided discovery method is effective for developing Analysis the sub skill of Critical thinking skills in physics at secondary school students of Kerala . Samples of 62 students were selected for the study. Findings from this study revealed that there is significant difference between the control and experimental groups with respect to the post test scores for Analysis the sub skill of Critical thinking skills in physics at secondary school students of Kerala . It finds that Guided discovery method is effective for developing Analysis the sub skill of Critical thinking skills in physics at secondary level students of Kerala.

Key words: *Critical thinking skills, Guided discovery method, Analysis*

Introduction

Critical thinking is an important skill in your real and professional life. Employers value workers who solving the problems logically and observe new situations from different perspectives in order to come up with the suitable solution. Strong critical thinking abilities are especially important in both secondary and higher education environments; critical reading and thinking skills allow high school and college students to engage in learning at the highest level.

The nature of Guided discovery Method is best understood through the steps of critical thinking formulated by Dewey (1933) which is often called the 'scientific method'. It includes all the processes by which the observing and amassing of data are regulated with a view to facilitating the formation of explanatory conceptions and theories. Hayes and Devitt (2008) explained that critical thinking strategies are not widely developed or excised during primary and secondary education‖ (p. 65). School systems need to reform curriculum to confirm that high school graduates have developed a strong foundation of critical thinking skills, enabling young aspirants to be more successful in their pursuits after secondary school.

According to Ennis(2015), "Critical thinking is that the intellectually disciplined method of actively and assuredly conceptualizing, applying, analyzing, synthesizing, and/or evaluating data gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action." it's extremely counseled by man of science Siegel(2013),Peter Facione(1993) and Deanna Kuhn(2015).

Analysis is the ability to understand the information you are being presented with and being able to communicate the meaning of that information to others. Analysis skills will enable to better decode the information and add clarity to what discovered

American Philosophical Association's Delphi project on the definition of critical thinking, is that the characteristics of a critical thinker include traits such as being inquisitive, fair-minded, flexible, diligent, and focused on enquiry (Facione 1990). In Facione's taxonomy (1990, p.12), critical thinking is composed of six main skills, each containing sub-skills, as -

- Interpretation – Categorisation, Decoding significance, Clarifying meaning
- Analysis- Examining ideas, Identifying arguments, Analysing arguments
- Evaluation- Assessing claims, Assessing arguments
- Inference- Querying evidence, Conjecturing alternatives, Drawing conclusions
- Explanation- Stating results, Justifying procedures, Presenting arguments
- Self-regulation-Self-examination, Self-correction

Facione (1990) asserts that critical thinking is focused self-judgement that results in analysis, analysis, evaluation,

and inference, as well as an explanation of the evidential, conceptual, methodological, or contextual thoughts upon which such judgement is based.

Guided discovery Method is a process which begins with the initial contact with the problem and ends when the answer is received in the light of the given information. Mayer (1983) defined problem solving as a multiple step process where the problem solver must find the relationship between past experience and the problem at hand and then act upon a solution. Galadima (2002) and Suleiman (2010) stated that problem solving is a complex process to learn; it consists of a series of tasks and processes that are closely linked together to form a set of heuristic pattern - a set of suggestions and questions that a person follow and ask himself in order to resolve a dilemma. The defining of the problem depends on individual's experience, therefore strategies and problem solving approach is different for problem solvers.

The social movements now shaping the world were not imagined by the best minds of a generation ago.Critical thinking is logical thinking sequences that requires pupils to be reflective, and pay attention to decision-making which lead their values and actions. Critical thinking allows pupils to deduct with more logic, to process intricate information and look at diverse sides of an issue so they can produce more concrete conclusions. Critical thinking is challenging approach to knowledge and gathers wisdom. It incorporates ideas and facts from an empirical position and then questioning new ideas in view of values, attitudes and experiential philosophy.

According to Stupple, E. J. N et.al (2017) The Critical Thinking Toolkit is a substitute measure that examines student beliefs and attitudes about critical thinking. According to Reynolds (2011), The list of core Critical thinking skills includes observation, interpretation, analysis, Interpretation, evaluation, explanation, and meta cognition an individual or group engaged in a strong way of critical thinking gives due consideration to establish for instance. Ennis(2015), Critical thinking is that the intellectually disciplined method of actively and assuredly conceptualizing, applying, analyzing, synthesizing, and/or evaluating data gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.

Objective of the study

To find out the effectiveness of guided discovery method in Physics *'Analysis',* the sub skill of critical thinking skills among students at secondary school students of Kerala .

Hypothesis

Guided discovery method in Physics is effective for developing *'Analysis',* the sub skill of critical thinking skills among students at secondary school students of Kerala .

Methodology

The present study"Guided discovery method is effective for developing*'Analysis',* the sub skill of critical thinking skills in physics at secondary school students of Kerala *"* was intended as a quasi-experimental study and normative survey was adopted. Pretest-posttest Non Equivalent Group Design was selected for the experimental part of the study. Stratified random sampling was selected for the study. The experimental study was conducted on a sample of 62 students studying in the secondary schools of Kerala. *Analysis',* the sub skill of critical thinking skills Test in Physics at secondary students of Kerala. *'Analysis',* the sub skill of critical thinking skills Test in Physics at Secondary level was executed for the experimental and control group as pre test and post test. Delayed post test was conducted for the experimental group and control group after an interval of two weeks to examine the retention of 'Analysis', the sub skill of critical thinking skills in physics at secondary school students of Kerala .

Appropriate statistical techniques viz., computation of mean, percentages, critical ratio, and analysis of covariance (ANCOVA) were employed for data analysis.

Effectiveness of guided discovery method for developing 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala

Hypothesis mentioned that *"Guided discovery method in Physics is effective for developing 'Analysis', the sub skill of critical thinking skills among students at secondary school students of Kerala ".* To examine the statistical significance of Hypothesis, the experimental group and control group were compared with respect to their pretest scores, posttest scores and delayed post test scores of 'Analysis', the sub skill of critical thinking skills in Physics at the Secondary school students of Kerala through critical ratio tests of significance and analysis of gain scores, retention test and analysis of covariance. The details of the statistical analysis are given in Tables.

Comparison of the experimental group and control group with respect to the pretest scores, post test scores and delayed post test scores of 'Analysis', the sub skill of critical thinking skills in Physics at the secondary school students of Kerala was done using critical ratio test of significance. The data and results of the two-tailed test of significance for difference between means (Garrett, 1981, pp 213) are given in Table 1.

Table:1. Critical ratio test of significance for difference between the control and experimental groups with respect to Pretest, Posttest and Delayed Posttest scores of 'Analysis', the sub skill of critical thinking skills in Physics at the Secondary school students of Kerala

'Analysis', the sub skill of critical thinking skills in Physics at the secondary school students of Kerala	**Control Group**			**Experimental Group**			**Critical Ratio**	
	N_1	**M_1**	**σ_1**	**N_2**	**M_2**	**σ_2**	**t**	**P**
Pretest	62	11.60	0.83	62	11.77	0.75	1.20	.01
Post test	62	14.47	0.69	62	17.10	0.64	22.02**	.01
Delayed Posttest	62	13.61	1.50	62	15.98	1.48	8.88**	.01

** Significant at .01 level of significance

The null hypotheses formulated in connection with the comparison of experimental group and control group with respect to the pretest scores, post test scores and delayed post test scores of 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala are *"there is no significant difference between the control and experimental groups with respect to the pretest scores for 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala "*; *"there is no significant difference between the control and experimental groups with respect to the posttest scores for 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala "* as well as *"there is no significant difference between the control and experimental groups with respect to the delayed post test scores for 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala ".*

Table 1 shows that there is no significant difference between the experimental group and control group with respect to the pretest scores of 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala (CR=1.20; *df*= 122; P<0.01).Whereas significant difference was observed between the experimental group and control group with respect to the posttest scores on 'Analysis', the sub skill of Critical thinking skills in physics at the secondary school students of Kerala (CR = 22.02; *df* = 122; P<0.01). Further, comparison of the experimental and control groups with respect to the delayed post test scores on 'Analysis', the sub skill of Critical thinking skills in physics at the secondary school students of Kerala revealed significant difference (CR = 8.88; *df*= 122; P<0.01).

Comparison of the experimental and control groups with respect to the gain scores of 'Analysis', the sub skill of Critical thinking skills in physics at the secondary school students of Kerala

Gain Score Analysis was performed to examine the difference between the experimental group and control group with respect to the achievement of 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala . The null hypothesis formulated in this context was *"there is no significant difference between the experimental group and control group with respect to the gain score of 'Analysis', the sub skill of critical thinking skills in Physics at the secondary school students of Kerala ".* Table 2 represents the details of statistical analysis performed with respect to analysis of gain score.

Table 2. Critical ratio test of significance for difference between the experimental and control groups with respect to the gain scores of 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala

Groups	N	M	σ	CR	*df*	P
Control	62	2.87	1.11	12.22**	122	0.01
Experimental	62	5.32	1.12			

** Significant at .01 level of significance

The critical ratio test of significance shows that there is significant difference between the control group and experimental group with respect to gain scores of 'Analysis', the sub skill of critical thinking skills in physics at the secondary level (C.R = 12.22; *df* = 122; P<0.01). From Table 2 it is evident gain in achievement of 'Analysis', the sub skill of critical thinking skills in physics at the secondary level is greater for the experimental group (M_1 = 5.32) than that of the control group (M_2 = 2.87).

Comparison of the experimental and control groups with respect to the Adjusted Post test scores of 'Analysis', the sub skill of Critical thinking skills in Physics at the secondary school students of Kerala

Analysis of covariance was conducted on the adjusted post test scores of 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala to examine the effectiveness of guided discovery method for developing 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala . The null hypothesis formulated in this context was *"There is no significant difference between the experimental group and control group with respect to the adjusted post test scores of 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala ".* The data and results of the analysis of covariance are presented in Tables 3.

Table 3. Analysis of covariance of the Adjusted Post test scores of 'Analysis', the sub skill of critical thinking skills in Physics at the secondary school students of Kerala for the experimental and control groups.

Test	Mean Exp	Mean Con	Source	Sum of squares	*df*	Mean Square	F	P
Pretest (X)	11.77	11.60	Between groups	0.98	1	0.98	**1.53**	.05
			Within groups	77.76	122	9.27		
			Total	78.73	123			
Post test (Y)	17.10	14.47	Between groups	214.27	1	214.27	**476.54**	.01
			Within groups	54.85	122	0.45		
			Total	269.12	123			
Sum of Co deviates SS_{xy}			Between groups	14.46				
			Within groups	10.95				
			Total	3.51				

Adjusted test(Y.X)	Post	17.66	15.00	Between groups	215.65	1	215.65	**490.11**	.01
				Within groups	53.31	121	0.44		
				Total	268.96	122			

Table 3 shows that the F_x ratio calculated for the pre test scores for 'Analysis', the sub skill of critical thinking skills in physics at the secondary level (F_x = 1.53) is less than table values (F = 6.84 ; P<0.01 and F = 3.92; P <0.05). From the calculated value for F_x it is evident that there is no significant difference between the experimental group and control group with respect to the pre test scores for 'Analysis', the sub skill of critical thinking skills in physics at the secondary level. F_y ratio computed for the post test scores of 'Analysis', the sub skill of critical thinking skills in physics at the secondary level (F_y=476.54), is greater than the statistical table value (F=6.84; P<0.01), which makes it evident that the experimental group and control group differ significantly with respect to the post test scores of 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala . The analysis of covariance computed from the adjusted post test scores of 'Analysis', the sub skill of critical thinking skills in physics at the secondary level shows that the calculated F ratio ($F_{Y.X}$= 490.11) is significantly greater than the table value (F=6.84; P<0.01). Further, from the adjusted post test means it is evident that the experimental group ($M_{Y.X}$=17.66) differ significantly from control group ($M_{Y.X}$= 15.00) with respect to the 'Analysis', the sub skill of critical thinking skills in physics at the secondary level. The results of ANCOVA presented in Table 3 converges to the finding that the Guided discovery method for developing the 'Analysis', the sub skill of critical thinking skills in physics at the secondary level is effective than the traditional method currently being practiced in the secondary schools of Kerala. Hence, the Hypothesis *"Guided discovery method is effective in developing 'Analysis', the sub skill of critical thinking skills in Physics at the secondary school students of Kerala "* stands valid.

Comparison of the experimental and control group with respect to the retention of 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala .

Delayed posttest analysis was done to compare the experimental and control groups with respect to the retention of 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala . The null hypothesis *"there is no significant difference between the experimental group and control group with respect to the retention of 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala "* was examined through critical ratio test of significance. The details of statistical analysis are presented in Table 4.

Table 4. Critical ratio test of significance for difference between the experimental and control group with respect to the retention of 'Analysis', the sub skill of Critical thinking skills in physics at the secondary school students of Kerala .

Groups	**N**	**M**	**Σ**	**CR**	***df***	**P**
Control	62	1.44	0.64	0.20**	122	0.01
Experimental	62	1.47	0.96			

** Significant at .01 level of significance

The critical ratio test of significance reveals that there is significant difference between the control and experimental groups with respect to the retention of 'Analysis', the sub skill of Critical thinking skills in physics at the secondary level (C.R = 0.20; *df* = 122; P<0.01). The mean scores of delayed post test for the experimental and control groups presented in Table 4 makes it evident that the experimental group (M_1 = 1.47) has better retention of 'Analysis', the sub skill of Critical thinking skills in physics at the secondary level than the control group (M_2 = 1.44).

Findings emerged from section

1. There is no significant difference between the control and experimental groups with respect to the pretest scores (CR = 1.20; *df* = 122; P<0.01) for 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala .
2. There is significant difference between the control and experimental groups with respect to the posttest scores (CR = 22.02; *df* = 122; P<0.01) for 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala .
3. There is significant difference between the control group and experimental group with respect to gain scores (C.R = 12.22; *df* = 122; P<0.01) of 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala . The gain in achievement of 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala is greater for the experimental group (M_1 = 5.32) than that of the control group (M_2 = 2.87).
4. There is significant difference between the experimental group and control group with respect to the adjusted post test scores of 'Analysis', the sub skill of Critical thinking skills in physics at the secondary school students of Kerala (($F_{Y.X}$ =490.11; *df* = 122; P<0.01). The experimental group ($M_{Y.X}$ = 17.10) is significantly better than the control group ($M_{Y.X}$ = 14.47) with respect to the adjusted post test scores of 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala .
5. There is significant difference between the control and experimental groups with respect to the delayed post test scores (CR = 8.88; *df*=122; P<0.01) for 'Analysis', the sub skill of critical thinking skills in physics at the secondary school students of Kerala .
6. There is significant difference between the control and experimental groups with respect to the retention of 'Analysis', the sub skill of critical thinking Skills in physics at the secondary school students of Kerala (C.R = 0.20; *df* = 122; P<0.01). The experimental group (M_1=1.47) has better retention of 'Analysis', the sub skill of critical thinking Skills in physics at the secondary school students of Kerala than the control group (M_2 = 1.44).

Conclusion

Guided discovery method for developing Critical thinking skills in physics at secondary school students of Kerala is effective than the existing method currently being practiced in the secondary schools of Kerala. Teaching for guided discovery in a context- free situation has proved to be futile. Teaching Guided discovery method to students in every field facilitates organization of ideas, development of different thought skills, and building consistent thought models. As literature recommend, students who attain the ability to think critically and perceptively will perform more effective in academically in their current secondary school level, and will also be better prepared for the rigors and enhanced academic prediction in college.

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PAPPA KNOWS EVERYTHING: THE PAINFUL PLEASURE OF GABRIEL TALLENT'S *MY ABSOLUTE DARLING*

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ABSTRACT

The present paper focuses on the relationship between an individual and the collective memory and brings out the concept of personalizing the traumatic historical events. It is difficult, if not impossible, to blot away atrocities from the consciousness of an individual and traumatized childhood experience denial, repression and dissociations both at the social and individual levels, and a probe into the past becomes imperative to understand the present and the future. The victims of childhood abuses, rapes and long-time traumatic experience suffer from dissociation which is a psychological process where the mind of the victim is disconnected from the bodily experience. The paper explores Gabriel Tallent's My Absolute Darling and the phenomenon of childhood trauma that results due to the abuses that the child encounters and how these repressions results in a life long struggle with the self. The novel is a heartbreakingly insightful study of the conflicted inner life of an abused victim.

Key words: *Childhood Trauma, psyche, abuse, incest.*

Trauma, the Greek word for wound has departed from its real meaning and has acquired a place within the area of psychology, anthropology, medicine, and literary as well as cultural studies. Traumatic experience can have a devastating impact on a child, altering his physical, cognitive and social development. In turn, the impact on the child gets profound reflection on its family as well as on the society and provides room to explore the Freudian phase of loss, repetition and shared witnessing that constitute the traumatic experience. In trauma-theoretical approaches to literature, a distinction is often made between "acting out" and "working through", terms based on Freudian Psychoanalysis, and further developed by critics like Dominick La Capra. When a traumatised person is "acting out" after a traumatic event, he or she has not yet reached the point of coming to terms with the experience and the emotions involved in it. The person who is acting out often re-experiences the event, e.g. in flashbacks, hallucinations or dreams, which could be seen as an (unconscious) attempt to cope with the experience. In order to move on with their lives, it is generally believed that the traumatised should "work through" the trauma. The notions of "acting out" and "working through" are connected to the Freudian terms of "melancholia" and "mourning", two possible psychological reactions related to loss (La Capra 65). The condition of acting out can manifest itself in different ways. One of them consists of re-experiencing the traumatic event: in that case the traumatised person is likely to have dreams, nightmares and/or illusions that take him or her back to this event.

World Health Organization views child abuse as an emotional or physical ill treatment which results in potential harm to the child's health and development. Child abuse includes physical, emotional, sexual abuse and neglect. The world of a child revolves around its parents as they provide him with safety, security, love, and sustenance. Child abuse violates his/her relationship with the world and alters the thoughts and feelings. Children are viewed as weak and are easily oppressed psychologically and physically making them easy victims. A child's brain development takes place through the experiences it receives from the family and environment that envelops him but stressful incidents affect the brain, making it more reactive and less adaptive. The repetition of traumatic experiences causes emotional and behavioural problems leading to difficulties in regulating the emotions.

According to Judith Herman, trauma is a state of, "feeling of intense fear, helplessness, loss of control and threat of annihilation . . . traumatic events overwhelm the human ordinary adaptations to life, then adds, involve threats of life or bodily integrity or close encounter with violence and death" (*Trauma* 24). She classifies post-traumatic

stress disorder into three layers – the first is the physical transformation and the sensitive state of the trauma victim, the second is the terrific experiences remains within victim's memory and the final is the method of surrender when the attempt of self-defence is paralyzed. The victim is weak to defend and suffers from enduring vigilance and sensitivity to environmental threat. PTSD is seen in the survivors of repeated and prolonged traumatic experiences and involves symptoms like personality change, anger, self-destructiveness and sexual behaviours. The victims of childhood abuses, rapes and long-time traumatic experience suffer from dissociation which is a psychological process where the mind of the victim is disconnected from the bodily experience. The paper studies the phenomenon of childhood trauma that results due to the abuses that the child encounters and how these repressions results in a life long struggle with their self.

Trauma studies acclaimed great importance in literary criticism after the publication of Cathy Caruth's *Unclaimed experience: Trauma, Narrative and History* and Kali Tal's *Worlds of Hurt: Reading the literature of Trauma*. Numerous literary works especially novels has dealt with the problems and conditions of children. The violence against children in the manner of physical, sexual or emotional abuse is rising in the society and became a dark or depressed reality in many corners of the world. Christa Schonfelder is of the opinion that, "the literary imagination, with its ability to fictionalize and symbolize, can create a space in which experiences that appear to defy understanding and verbalization, that concern existential dimensions of the trauma condition especially threatening experiences of vulnerability or morality can be explored from multiple perspectives" (7).

Victorian literature had a more sceptical approach and has marked the beginning of literature concerned with emotions of children. Many authors like Dickens, W.H.G. Kingston, Lewis Carroll, Charles Kingsley, Bronte sisters portrayed the psyche of the children in their works. Genres like adventure literature, domestic fiction, fantasies, fairy tale and themes of child abuse bring out the multiple perspectives of the struggles faced by children. In African American literature, mostly the feminist writers took up the subject of childhood subjugations and trauma as they had a first-hand experience. The traumatized protagonist in these works brings into forefront the importance of individual trauma which is often connected to larger social factors and cultural ideologies. A novel dealing with child abuse represents the children in the world who suffers similar violence, slavery, war, torture, rape, natural disaster etc.

The American writer, Gabriel Tallent was born in New Mexico. He graduated from Willamette University in 2010, and spent time leading youth trail crews through the backcountry of the Pacific Northwest. He published stories in Narrative and in the St Petersburg Review. *My Absolute Darling* (2017) his debut novel, focuses on a fourteen year old protagonist Julia, who is a victim of sexual and physical abuse from her father Martin. He tortures the girl claiming it as his affection and care, but ultimately what exists between them is an incestuous relation. The victims of abuse suffer tremendously both physically and mentally. The effect of abuse may be short or long, but it destroys the child's sense and ability to lead a healthy relationship. Judith Herman in her book *Father Daughter Incest* points that,

> Many abused children cling to the hope, that growing up will bring escape and freedom. But the personality formed in an environment of coercive control is not well adapted to adult life. The survivor is left with fundamental problems in basic trust, autonomy, and initiative. She approaches the task of early adulthood - establishing independence and intimacy - burdened by major impairments in self-care, in cognition and memory, in identity and in the capacity to form stable relationship. She is still a prisoner of her childhood; attempting to create a new life she encounters the trauma. (80)

My Absolute Darling is a heart wrenching novel which revolves around a fourteen year old Julia Alveston, who is abused by her father. The girl is known by the nick name Turtle and her father affectionately

calls her 'Kibble' or 'My absolute darling', is a victim of physical, sexual, and emotional violence. The abuse that she faces is from Martin, her father. She expects the abuse at any time and even waits for it, because her psyche has reached a tune with the daily abuse, harassment and torture by her father, a human monster:

> He comes into the room. He raises her chin up with his knuckle and she puts her arms around him and breathes in his scent, wool and cigarettes and gun grease. The sig Sauer is still in her hand. He carries her back to his room, and she feel for him a terrible neediness. He is so massive that to be in his arms is skin-crawlingly good, like returning home, like going back to being a child. Martin cradles her in one arm to work the cut glass knob with the other and kicks open the door and carries her into the bedroom with his clothes strewn on the floor and a new bed with new sheets and a new bedside table. (*AD* 327)

Martin used to crouches over her by calling in his usual tone 'Goddamn, Kibble' and used to put his hands on her hip bones, on her stomach, on her face and runs his scarred fingertips through her hair. She bears it facedown thinking, whether she want it or not, but his touch gave life to her skin and it hold him close to her. She keeps all these within her. His approach made her lose faith in each and everyone around her. The father who is supposed to be a child's protector becomes a tyrant who destroys both her mind and dreams. This was not what she deserved from a father, who seduced her sexually making her believe that he is the only one who loved her.

Judith Herman in her work *Father Daughter Incest* said that, "When a parent compels a child to work to support the family, that is the exploitation of child labour. When a parent compels a child to fulfil his sexual needs, that is incest" (4). Turtle is an object in the hands of Martin who used her daughter to gratify his sexual needs. At the age of six Turtle is proficient with firearms and he rigorously trained her in survival skills. Turtle is affectionate to her father, but at the same time develops a self-hatred, but also believes that her father is perfect as she blindly loves him. "I don't want to get away from my daddy, she says. And I don't think he would let it happen, either . . . He is my daddy" (*AD* 253-54). As a victim of abuses Turtle's mind is fragmented and is not ready to accept the real nature of her father. She suffers from derealisation and her distressed mind creates an image of goodness about Martin and views him through her mind's eye. But Martin is a wild creature who creeps into his daughter's room to rape her and compels her to do pull ups by holding a knife under her. She is afraid and stands on her heels and his cruel entertainment brings blood stains in her body parts which she never reveals to anyone. She develops into an unusual character unlike other children of her age as he had injected her with fear, anger and anxiety.

Turtle fails to concentrate in her class and her teacher suspects the abuse. Martin used to punish Turtle brutally for every single reason. When she fails in the vocabulary test conducted by Martin, he asks her to work with the Sig Sauer and repeatedly warns her. Turtle watches each and every movement of her father and is not able to bear his pains because she loves him, but simultaneously the care that Martin gives his daughter is dangerous as she is unable to identify the right and wrong. It is his sexual and physical abuse that makes her to collapse into self-hatred.

Turtle is a victim of Stockholm syndrome which leads to an incestuous relationship being considered as a sexual abuse, where there is an aggressor and a victim similar to any other abusive relationship. Judith Herman's voices that, "female children are regularly subjected to sexual assaults by adult males who are part of their intimate social world. The aggressors are not outcaste and strangers; they are neighbours, family friends, uncles, cousins, stepfathers and fathers" (*Incest* 7). Martin has a control over the child as she is dependent on him for the unconditional protection and nurturance. Turtle is imprisoned in an abusive cage and is in a dilemma that she cannot prevent her fate. Her grandfather Daniel, is aware of the fact that Martin approach towards Turtle was wrong but not aware of

the sexual abuses that she faces. Daniel use to advice his son but he explained it as his protectiveness towards his daughter, but after his death, Turtle is devoid of all hopes. Martin continued with his tortures:

> You are mine, he says, and swings the fire poker around and strikes her on the arm and she pitches onto her stomach in the mud, her left arm numb, her shoulder broken feeling and she tries to rise, get one hand under herself and heaves up and he plants his boot on the small of her back and drives her to the ground. He raises the poker into the air and she thinks; get away, get away. Turtle, for your life get away, but she is pinned in place by his boot and she thinks, you have to- you have to, but she cannot move, and he brings the fire poker down into the back of her thighs, and she bucks, spasms. (*AD* 140)

Turtle never spoke about her pains and sufferings to others and hid the truth about her bruise from everyone. Martin used to cook up stories to create an impression in order to make Turtle believe that he is a saviour who will take any risks to protect her. He told her about the risk he had taken to save her from the attack of mountain lions and other beasts. Martin argues with the school authorities when they complain about Turtle's poor learning skills by stating the fact that the poor academic performance was a result of her poor mental sanity. Turtle hated her teacher Anna, but it is Anna who doubts about the abuse, by observing her inactive attitude in studies. She gives her a helping hand, but Turtle not only hates Anna but women in general. Anna finds her as a Misogynist, who has isolated herself from peers and displayed signs of misbehaving. The absence of her mother has created a void in her. Judith Herman says that "the Cinderella story warns little girls that it is dangerous to be left alone with a widowed father, for a widowed father must remarry . . ." (*Incest* 1). Turtle's mothers' friend Caroline was of the opinion that he was the kind of guy who always needs a woman in his life. She was well aware about his treatment of women. After his wife's death he turns Turtle as the woman in his life and most of his friends tell him that Turtle resembled her mother.

Turtle saved the life of Brett and Jacob from the flood risking her own life. The boys were her seniors in school and were exactly opposite to Turtle as their lives had the colours that she lacked. Despite the odds, a friendship develops among them. Turtle's traumatised mind finds relief in their company and she without openly showcasing starts to maintain a distance from Martin. In between, Martin disappears for several months, leaving her to provide for her and when he returns, he brings a nine year old girl, Cayenne. Turtle's dislike towards Cayenne is changed when she realizes that Martin is trying to seduce the little girl and realises the fact that she has to save the girl from Martin. Cayenne becomes sympathetic towards Turtle when she realises about the sexual abuse that Turtle was enduring and questions why she has not reacted. She later learns that it was Turtle's fear that prevented her from taking any actions against Martin.

Martin's torture, the pains and the abuses made her ready to take up and face any dangerous physical and mental situations. She has the mental courage to overcome the hidden dangers in her life but what made her down is her father's treatment and her courage was a pseudo cover to protect herself. Judith Herman says that "traumatic events overwhelm the human ordinary adaptation to life, then adds, involve threats to life or bodily integrity, or close encounter with violence and death" (*Trauma* 24). In the novel, Turtle decides to fight her father's abuses. She bravely fights him and stops the rape of Cayenne and escapes with her to her friend Jacob's house. It was an act of self-defence to protect the lives of her loved ones that she drives the blade to his skin. The murder was the result of her love, her trauma and her sufferings. It was the abuse of her father that turned her into a dangerous neurotic:

> His hand, enormous, calloused, covered in sand, clenches at her and his strength is just like she remembers it. She hauls him into her lap and sits stooped over him, hot and alive in the cold water, his labored breathing twinned with a suckering

> squelch. Turtle puts a hand on his face and holds his jaw. His mouth opens spasmodically, and she thinks he will talk, he will say something now, but he just gasps, sucking air through a pit in his chest, and she covers it with her hand and feels the wound draw flush against her palm, and he drags in a breath. She thinks that he will speak, but he does not speak. She says, I love you. (*AD* 389)

Anna helps Turtle to overcome the haunted memories and Turtle finds relief in gardening. She was also shot by Martin and one of the bullets made a severe injury, but finally feels a peace as her terror has left her. The pains, abuses, neglect, attacks and tortures trigger her thoughts in between and anything could move her to tears. A spider, a loud noise and so on and she would lean back against the wall and cried. Anna tried to calm her by providing unflinching support but Turtle could not explain the reason of her tears. She suffered from severe Post Traumatic Stress Disorder.

Abused children struggle to cope with what they are experiencing and usually cry out their anger, feel stress, pain etc. Society and NGOs work hard to provide support, love and care to the victims by providing them with good rehabilitation. Psychological studies show that the rate of atrocities against children is on a rise and these burning experiences traumatize them for the rest of their life hindering the development of their psyche. The alarming fact is that most of these children face abuse from their relatives or dear ones that creates a permanent fear in their minds and estranges them from the world.

The scars of the atrocities in the minds of the characters are clearly delineated in the work and the recollections of the past are stressful to the survivors as they are in constant flight to evade their memories. Childhood trauma is related to psychosis and schizophrenia where the distressing events cause a permanent damage to the psyche of the individual. The victims, the perpetrators as well as the witnesses suffer from deep-rooted fear about the repetition of the traumatic events. They constantly flee from scenes of violence and lose the confidence to face the challenges of life experiencing emptiness in worldly relations and redemptions through faith.

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INFLUENCE OF PERFORMANCE APPROACH ORIENTATION ON ACADEMIC ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS

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ABSTRACT

The present study aimed at investigating whether performance approach orientation influences the academic achievement of secondary school students. Normative survey method was used for the study, which included a representative sample of 384 secondary school students. A multi-stage cluster sampling technique was used for the study. Performance approach orientation test (prepared and standardized by the investigator) was administered for data collection, and Pearson correlation coefficient was used for the analysis. Findings of the study revealed that the calculated value of r = 0.74 and is significant at 0.05 level. (r = 0.74; p<0.05). Hence, it can be concluded that there is a significant positive relationship between Performance approach orientation and academic achievement. The value of shared variance is obtained as 54.93. This means that 54.93% of the variance in one variable can be explained by the other variable. The study's findings have significant implications in the field of education. It would be critical to educators, academicians, and curriculum developers to prepare syllabus and activities for the students that would enhance performance approach orientation, which will improve their academic performance.

Keywords: *Performance approach orientation, Goal orientation, Adaptive behavior, Competitiveness, Attention seeking, Action orientation.*

INTRODUCTION

From a very young age, children learn from their parents and teachers that they should get good grades in the examination, and this has been quite a high motivation for the learners from schools to later at the universities (Gafoor & Kurukkan, 2015). Indeed, many educational institutions emphasize more on relative comparison and acquiring higher grades among students, which pushes them to master the content and outperform others (Abd-el-fatta, 2018). The goals which aim at performing well relative to others can be defined as the performing goals (Basit & ur Rahman, 2017). Students with high-performance goals concentrate more on demonstrating their abilities than the desire to acquire knowledge (Cellar et al., 2016). Human behavior is motivated by desire and needs and the process of achieving them (O'Keefe et al., 2013). The goal orientation theory explains this concept which became an essential theoretical framework to understand achievement motivation (Linnenbrink, 2005). It was broadly divided into Mastery goal orientation and Performance goal orientation (Senko & Tropiano, 2016). These theories examine how the students engage in their academic pursuits (Izadikhah et al., 2012). Later, it was further bifurcated, leading to four divisions, namely, Mastery approach, Mastery avoidance, Performance approach, and performance avoidance (Senko & Tropiano, 2016). The present study focus on the influence of Performance approach orientation on the academic achievement of secondary school students.

Performance approach orientation can be explained into five prominent traits.

Adaptive behavior:

It is a kind of behavior in which the individual can adapt to the surroundings and quickly adjust to it and make it favorable for the achievement of his/her goals (Senko & Tropiano, 2016).

Attention seeking

It is a conscious or unconscious effort made by an individual to get others' attention and thereby try to gain an appreciation for his/her work (Linnenbrink, 2005). Students with this behavior always prefer to be the center of attraction and be highly motivated to express their strength to others (Darnon et al., 2007).

Action orientation

It is the ability of an individual to detach oneself from any negative situation and convert any situation positively into their favor by indulging in constructive actions (Guarino et al., 2017). People with the action-

orientated trait are highly action-oriented and always tends to action disposition (Martin et al., 2008). They tend to have more self-regulated than their counterparts.

Competitiveness

It can be defined as the intense need or desire to win in an interpersonal situation (Self-brown & Mathews, 2003). People with a competitive mind are motivated by achievement, and they always strive for success and focus on winning (Lemberger et al., 2012).

Result orientation

It is a trait in which one learns from its mistakes and takes a conscious effort for improvement (Martin et al., 2008). People of this trait will get easily bored and restless if not provided with challenging tasks.

REVIEW OF RELATED LITERATURE

Abd-el-fatta, (2018) conducted a study to investigate the relationship between different goal profiles and academic achievement and the role of learning approaches as a mediator between goal profiles and academic achievement. The sample chosen for the study was 350 high school students in Oman. Learning Process Questionnaire was used for data collection. The study revealed that students with mastery approach goal profiles showed deep interest in learning, and those with performance-avoidance goals showed the lowest.

Basit, & Rahman (2017) carried out a study to identify the influence of achievement goal orientations and their effects on their academic performance in English on secondary school students. A survey method was used for the study, and the PALS scale was used to assess the student's perception, and a multiple-choice test measured achievement. The study revealed that students have multiple goal orientations, and the prominent one among them was mastery orientation followed by performance-approach and performance-avoidance.

Guarino, et al., (2017) have tried to explore the indirect effects of mastery goal orientation and cognitive ability on post-training performance in a learner-directed training context in the present study. A representative sample of 114 students was chosen for the study, ranging from 18 to 38 years. The study's findings are off-task thoughts mediate the positive effect of mastery goal orientation on post-training performance; on the other hand, declarative knowledge mediates the positive impact of cognitive ability on post-training performance.

Creed, & Hennessy (2016) carried out a study to bring out a model that considers goal orientation, including mastery approach, performance-approach, and performance-avoidance approach as an antecedent to vocational identity. The study sample was 281 young adult participants with a mean age of 26, and 77 % were women. The study results revealed that mastery and performance approaches were more consistent with career exploration and more excellent career-related strategies. On the other hand, performance avoidance was related to more career commitment leading to more great distress.

Damian, et al., (2014) researched how self-oriented and socially prescribed perfectionism predicted students' goal orientation. A representative sample of 584 adolescent school students was chosen for the study. The investigator used a cross-sectional correlational design for the study. Multiple regression was used as an essential statistical technique, and it was found that self-oriented perfectionism positively predicted mastery approach and mastery avoidance gaol orientation. The study concluded with the findings that perfectionism predicts the individual difference in adolescent school students' achievement goal orientations; however, different forms of perfectionism are associated with different goal orientations.

O'Keefe, et al., (2013) carried out a study ranging to nine months to examine the changes in mastery goal orientation, performance approach, performance-avoidance approach, and self-worth contingencies. The sample chosen for the

study was 126 high-ability adolescents. Mastery structure academic program was introduced. It was observed that mastery goal orientation improved even after returning to their home learning environment. In contrast, performance-approach and avoidance decreased during the training program; however, they returned to the previous level when assessed after six months of returning to the familiar learning environment. The study throws light on the temporally proximal and distal influence of goal structures on related contingencies of self-worth and as a potential source for psychological mind frames that would help shape goal orientation.

Izadikhah, et al., (2012) proposed and tested a theoretical model that argues that different work contexts influence the relationship between performance-approach orientation and work performance. The three studies with different work performance types consistently supported a theorized interaction between performance-approach orientation and rewarding climate. Two self-rating studies showed generally similar interactions, with some critical differences in the simple slopes' significance. More significant differences emerged between the self-rating and a supervisor rating study. The present research supports a model in which type of work (part-time vs full time), rewarding climate, performance criterion (supervisor vs self-rating), and type of work performance are important contextual components of a model relating approach orientation to work performance.

Rashidi, & Javanmardi (2012), in the present study, tried to investigate the type of goal orientations held by Iranian EFL students and to examine if achievement goals are dependent on gender. The sample chosen for the study were 182 BA students majoring in English Literature at Shiraz University. Goal orientation questionnaires were administered. The result indicated that mastery was the dominant type of goal orientation held by Iranian EFL students, followed by performance approach, work avoidant, and performance avoidant goal orientation. An independent sample t-test was done to determine if there is any significant difference in achievement motivation concerning gender; however, the result shows no significant difference, which means the goal orientations held by students are independent of gender.

Cellar, et al., (2011) carried out a thematic study to meta-analytically examine trait goal orientation constructs and their relationship between self-regulation variables like self-monitoring, self-evaluation, self-regulation, and self-efficacy and task performance. The researcher examined nearly 102 research reports which involved over 16000 participants. The study findings showed a positive relationship between mastery goal orientation constructs and self-regulation variables. On the contrary, a negative relationship was found between performance-avoidance constructs and self-regulation variables. It was also evident that the relationship between mastery goal orientation and self-regulation variables was higher than those found for goal orientation and performance. Finally, the study revealed a discriminant validity of the three factors of goal orientation (mastery approach, performance-approach, and performance-avoidance).

Ergene (2011) studied "The relationship between academic achievement with test anxiety, study habits, and achievement motivation." The sample of the study was 510 high school students. The Self-Evaluation Inventory was the tool used to measure achievement motivation. The study revealed a relationship between achievement motivation and academic achievement for the Turkish sample, and there was a significant relationship between achievement motivation and study habits. The finding of the study revealed that the study habits had a positive relation to academic achievement.

HYPOTHESES OF THE STUDY

1. There is a significant relationship between Adaptive behavior and academic achievement.

2. There is a significant relationship between Attention seeking and academic achievement.

3. There is a significant relationship between Action orientation and academic achievement.

4. There is a significant relationship between Competitiveness and academic achievement.

5. There is a significant relationship between Result orientation and academic achievement.

6. There is a significant relationship between performance approach orientation and academic achievement.

MATERIALS AND METHODS

Method: Correlational survey method was used for the study.

Sample: A representative sample of 384 secondary school students from the Thiruvananthapuram District of Kerala was chosen for the study.

Sampling technique: Multi-stage cluster sampling technique was used in the study for the data collection. The following clusters were made to select the sample.

Educational Districts: One (out of 3)
Educational Sub-Districts: Four (out of 12)
Schools: Two Schools from each Sub-district.
Class: IX std students of selected schools.
Divisions: Two from each school.
Variables: Performance approach orientation is the independent variable, and Academic achievement is the dependent variable.

Tools: Performance approach orientation scale (Designed and standardized by the investigator). The tool comprises five components: Adaptive behavior, Attention seeking, Action orientation, Competitiveness, and Result orientation.

The academic achievement of students is assessed based on the first term examination conducted at the school. The marks were converted to 100 for statistical calculations.

Hypothesis in the null form

1. There is no significant relationship between Adaptive behavior and academic achievement.
2. There is no significant relationship between Attention seeking and academic achievement.
3. There is no significant relationship between Action orientation and academic achievement.
4. There is no significant relationship between Competitiveness and Academic Achievement.
5. There is no significant relationship between Result orientation and academic achievement.
6. There is no significant relationship between performance approach orientation and academic achievement.

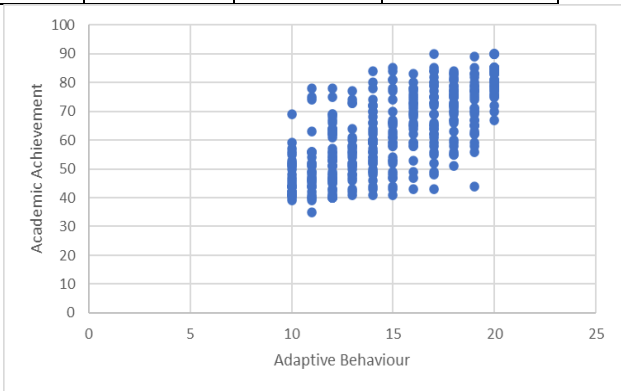
RESULTS AND DISCUSSION

Table 1 Correlation between Adaptive behavior and academic achievement

N	Coefficient of correlation (r)	t	Level of significance	SEr	95% CI Lower	95% CI Upper	Shared variance
384	0.71	19.87	0.05	0.03	0.66	0.76	50.82

The calculated value of r = 0.71 and is significant at 0.05 level. (r = 0.71; p<0.05). Hence it can be concluded that there is a significant positive relationship between Adaptive behavior and academic achievement. The value of shared variance is obtained as 50.82. This means that 50.82% of the variance in one variable can be explained by the other variable.

Figure 1



Scatter plot of Adaptive behavior and academic achievement

Tenability of hypothesis

The test of significance of the relationship between Adaptive behavior and academic achievement revealed a significant relationship between Adaptive behavior and academic achievement. Hence the null hypothesis formulated in this context is rejected.

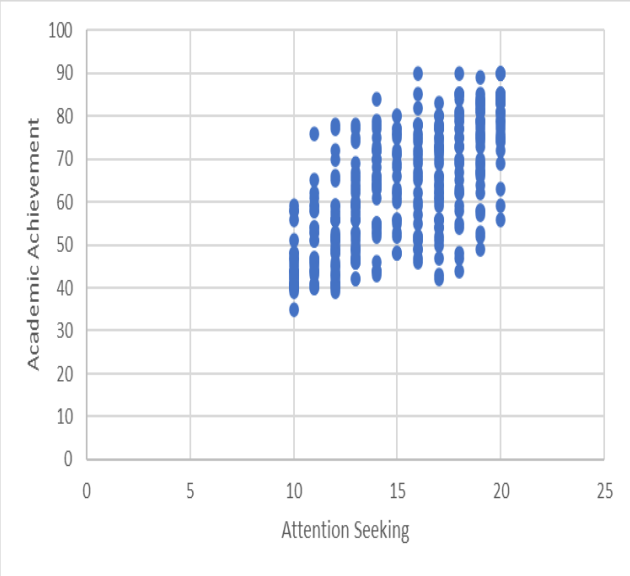
Table 2 Correlation between Attention seeking and academic achievement

N	Coefficient of correlation (r)	t	Level of significance	SEr	95% CI Lower	95% CI Upper	Shared variance
384	0.68	18.27	0.05	0.03	0.63	0.74	46.62

The calculated value of r = 0.68 and is significant at 0.05 level. (r = 0.68; p<0.05). Hence it can be concluded that there is a significant positive relationship between Attention seeking and academic achievement. The value of shared variance is obtained as 46.62. This means that 46.62% of the variance in one variable can be explained by the other variable.

Scatter plot of Attention seeking and academic achievement

Figure 2



Tenability of hypothesis

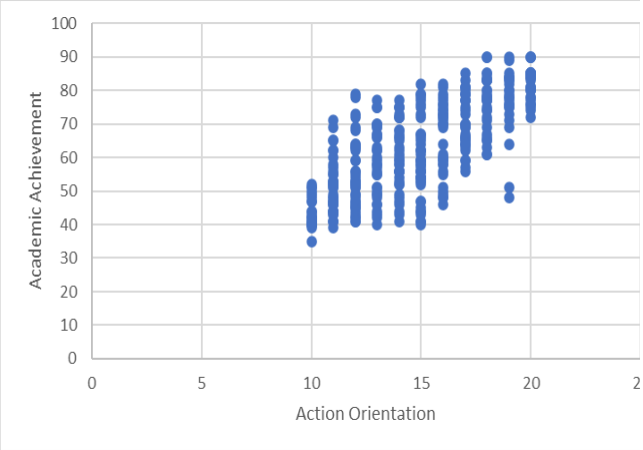
The test of significance of the relationship between Attention seeking and academic achievement revealed a significant relationship between Attention seeking and academic achievement. Hence the null hypothesis formulated in this context is rejected.

Table 3 Correlation between Action orientation and academic achievement

N	Coefficient of correlation (r)	t	Level of significance	SEr	95% CI Lower	95% CI Upper	Shared variance
384	0.74	21.79	0.05	0.02	0.7	0.79	55.42

The calculated value of r = 0.74 and is significant at 0.05 level. (r = 0.74; p<0.05). Hence it can be concluded that there is a significant positive relationship between Action orientation and academic achievement. The value of shared variance is obtained as 55.42. This means that 55.42% of the variance in one variable can be explained by the other variable.

Figure 3



Scatter plot of Action orientation and academic achievement

Tenability of hypothesis

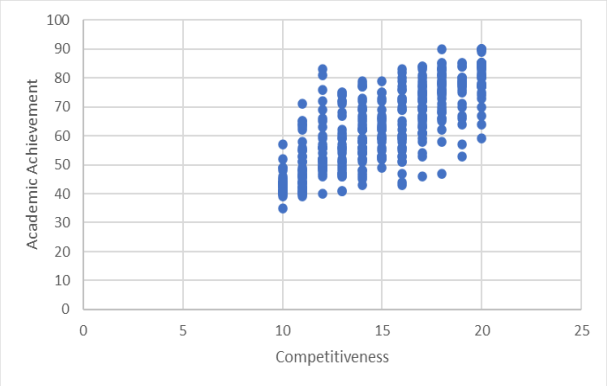
The test of significance of the relationship between Action orientation and academic achievement revealed a significant relationship between Action orientation and academic achievement. Hence the null hypothesis formulated in this context is rejected.

Table 4 Correlation between Competitiveness and Academic Achievement

N	Coefficient of correlation (r)	t	Level of significance	SEr	95% CI Lower	95% CI Upper	Shared variance
384	0.77	23.64	0.05	0.02	0.73	0.81	59.39

The calculated value of r = 0.77 and is significant at 0.05 level. (r = 0.77; p<0.05). Hence it can be concluded that there is a significant positive relationship between Competitiveness and academic achievement. The value of shared variance is obtained as 59.39. This means that 59.39% of the variance in one variable can be explained by the other variable.

Figure 4



Scatter plot of Competitiveness and Academic Achievement

Tenability of hypothesis

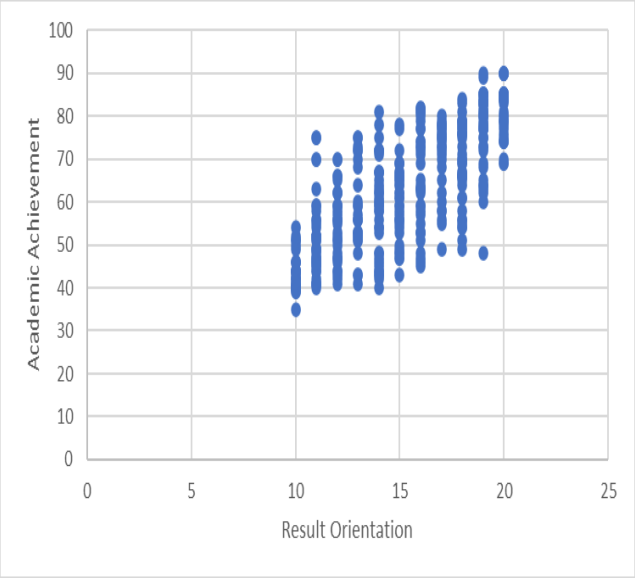
The test of significance of the relationship between Competitiveness and academic achievement revealed a significant relationship between Competitiveness and academic achievement. Hence the null hypothesis formulated in this context is rejected.

Table 5 Correlation between Result Orientation and Academic Achievement

N	Coefficient of correlation (r)	t	Level of significance	SEr	95% CI Lower	95% CI Upper	Shared variance
384	0.76	22.64	0.05	0.02	0.71	0.8	57.3

The calculated value of r = 0.76 and is significant at 0.05 level. (r = 0.76; p<0.05). Hence it can be concluded that there is a significant positive relationship between Result orientation and academic achievement. The value of shared variance is obtained as 57.3. This means that 57.3% of the variance in one variable can be explained by the other variable.

Figure 5



Scatter plot of Result orientation and academic achievement

Tenability of hypothesis

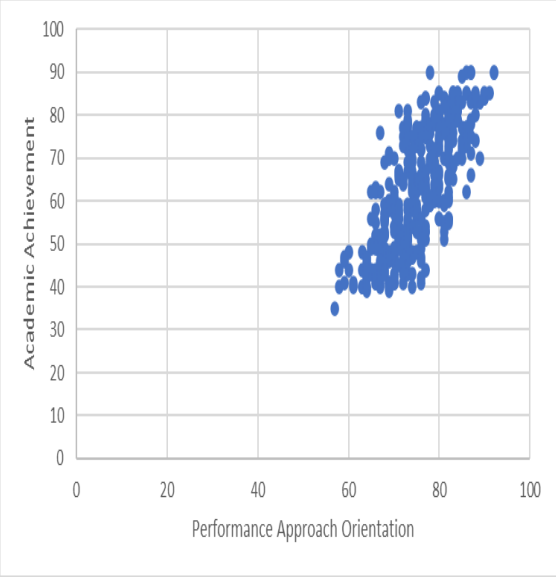
The test of significance of the relationship between Result orientation and academic achievement revealed a significant relationship between Result Orientation and Academic Achievement. Hence the null hypothesis formulated in this context is rejected.

Table 6 Correlation between performance approach orientation and academic achievement

N	Coefficient of correlation (r)	t	Level of significance	SEr	95% CI Lower	95% CI Upper	Shared variance
384	0.74	21.58	0.05	0.02	0.7	0.79	54.93

The calculated value of r = 0.74 and is significant at 0.05 level. (r = 0.74; p<0.05). Hence it can be concluded that there is a significant positive relationship between performance approach orientation and academic achievement. The value of shared variance is obtained as 54.93. This means that 54.93% of the variance in one variable can be explained by the other variable.

Figure 6



Scatter plot of Performance Approach Orientation and Academic Achievement

Tenability of hypothesis

The test of significance of the relationship between performance approach orientation and academic achievement revealed a significant relationship between performance approach orientation and academic achievement. Hence the null hypothesis formulated in this context is rejected.

CONCLUSION

The study revealed a positive relationship between performance approach orientation and academic achievement in secondary school students. It further revealed that the components of performance approach orientation such as Adaptive behavior, Attention seeking, Action orientation, Competitiveness, and Result orientation also has positively related to academic achievement. The study's findings would be much of interest to the Educationist and Academicians to focus on curriculum development which would enhance the performance approach orientation. The teachers can use a wide variety of activities and programs to develop and increase the level of performance approach orientation to result in the high academic achievement of the child. The classroom teacher should promote and assist the children in developing the performance approach orientation and help them set challenging but realistic goals. The students should be motivated throughout, and positive feedback should be given

promptly to keep the children's enthusiasm high.

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CHARACTERIZATIONS OF INFLATED PARAMETER DISTRIBUTIONS BASED ON ρ-TYPE LACK OF MEMORY PROPERTY

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ABSTRACT

Characterization of the inflated-parameter geometric distribution in terms of $\rho-$type lack of memory property is established and this is extended to the characterization of inflated parameter extended geometric distribution.

Key words: *zero-inflated distributions, inflated-parameter geometric distribution, measure of memory, $\rho-$type lack of memory property.*

Introduction

For the purpose of modeling different kinds of count or frequency data structures in various fields like reliability, insurance, finance, biometrics, econometrics etc. a great deal of research has been done in generalizing the classical discrete distributions and is still continuing. Modeling of count processes based on Poisson distribution has been the common approach. However, if the number of observed zeros out do the expected number of zeros, then one of the key features of the Poisson structure is violated. For example, in transportation research, one notable characteristic of crash frequency data is that the variance exceeds the mean of the crash counts (Lord and Mannering (2010)). Often count data exhibits more variability than the variance under the Poisson model, a condition called over-dispersion. Such over-dispersion in count data can occur because of excess zeros, unexplained heterogeneity or temporal dependency.

The negative binomial model has a built-in dispersion parameter that can account for situations where the variance is greater than the mean (Chin and Quddus (2003)). Consequently, when count data are over-dispersed, a number of studies have argued for the negative binomial model as an alternative to the Poisson model (Bliss and Fisher (2003)).

Admitting that Poisson and negative binomial models have been the most common choices, in some situations they could still fail to fit to a set of data with a lot of zeros due to zero-inflation, over-dispersion or both (Deng and Paul (2005)). Zero inflated count models have gained considerable recognition as a substitute for handling count data with a bulk of zeros (Lambert (1992), Gupta et. al. (1996), Lord et. al. (2004)). For these types of count data, more zeros are noticed than anticipated by a normal Poisson or negative binomial process (Park and Lord (2009), Lord et. al. (2007)).

In this paper, we discuss some characteristics of the inflated parameter distributions in connection with the ρ-type lack of memory property and the measure of memory of discrete distributions. In Section 1 an overview of the zero-inflated distributions and measure of memory is given. Inflated parameter geometric distribution is discussed in Section 2. Section 3 discusses a new characterization of the inflated parameter geometric distribution in the light of ρ-type lack of memory property. Extended distributions inflated at the point 'a' and the measure of memory of a-inflated distributions is discussed in Section 4. Section 5 introduces the inflated parameter extended geometric distribution. Section 6 discusses the ρ-type lack of memory of this distribution.

Zero-inflated distributions and measure of memory

Inflated parameter (zero modified) discrete distributions are used to model counts that encounter disproportionably large frequencies of zeros, see Johnson et. al. (1992). In certain applications involving discrete data, it is sometimes found that $X = 0$ is observed with a frequency significantly higher than predicted by the assumed model. See Neyman (1939) and Feller (1943).

Zero-inflated models address the problem that the data display a higher fraction of zeros or non occurrences, than can be possibly explained through any fitted standard count model. Kolev et. al. (2000) suggest an extension of the classical univariate geometric, negative binomial, Poisson, Bernoulli, binomial and logarithmic series distributions by including an additional parameter ρ. It has a natural interpretation in terms of zero inflation and because of this they named the corresponding generalized versions adding 'inflated parameter'.

Let X be an arbitrary non-negative integer valued random variable (*r.v.*) such that

$$P(X = t) = p(t), \qquad t = 0,1,2,\ldots, \quad \sum_{t=0}^{\infty} p(t) = 1 \tag{1.1}$$

and let

$$G_X(s) = E(s^X) \tag{1.2}$$

be the corresponding probability generating function (*p.g.f.*). An extra proportion of zeros is added to the proportion of zeros from the distribution of the *r.v. X*, while decreasing the remaining proportions in an appropriate way. The zero inflated modification, *Y*, of *X* is defined by

$$P(Y=0) = \rho + (1-\rho)\,p(0)$$

$$P(Y=t) = (1-\rho)p(t),\ t = 1,2,\ldots \tag{1.3}$$

The *p.g.f.* of Y is

$$G_Y(s) = \rho + (1-\rho)G_X(s) \tag{1.4}$$

$$E(Y) = (1-\rho)E(X). \tag{1.5}$$

$$E(Y^2) = (1-\rho)E(X^2). \tag{1.6}$$

$$V(Y) = (1-\rho)E(X^2) - (1-\rho)^2\left[E(X)\right]^2. \tag{1.7}$$

If $\rho = 1$, then the corresponding zero inflated distribution is degenerated at zero. If $\rho = 0$, 'nothing is changed' *i.e.*, $G_Y(t) = G_X(t)$.

In general, the inflation parameter ρ may take negative values provided that $P(Y=0) \geq 0$, *i.e.*, $\rho \geq -\dfrac{p(0)}{1-p(0)}$ and therefore $max\left\{-1, -\dfrac{p(0)}{1-p(0)}\right\} \leq \rho \leq 0$. This corresponds to the opposite phenomenon, excluding a proportion of zeros from the basic discrete distribution, if necessary.

Muth (1977) introduced the concept of measure of memory of statistical distributions in terms of the mean residual life function employed in the reliability theory. Nair (1983) suitably modified the above measure of memory of evolve an expression that enables the evaluation of memory for the family of discrete distributions in which the random variable assumes non-negative integral values. It is shown that, when the distribution lacks memory, the definition proposed coincides with the conventional counterpart. The measure of memory proposed by Nair (1983) for a discrete random variable is

$$M = \frac{2r^2(0) + r(0) - E(X^2)}{E(X^2) + r(0)}. \tag{1.8}$$

where $r(t) = E(X - t \mid X \geq t),\ t \geq 0$.

Now, let M_Y be the measure of memory of the zero-inflated discrete non-negative random variable *Y*. Then, it can be shown that

$$M_Y = \frac{2\left[(1-\rho)E(X)\right]^2 + (1-\rho)E(X) - (1-\rho)E(X^2)}{(1-\rho)E(X^2) + (1-\rho)E(X)}$$

$$= \frac{2(1-\rho)E^2(X) + E(X) - E(X^2)}{E(X^2) + E(X)}$$

Inflated parameter geometric distribution

Kolev et. al. (2000) suggest a generalization to the geometric distribution by including an additional parameter $\rho \in (0,1)$. Let $\{w_1, w_2, w_3, \ldots\}$ be a sequence of independent binary variables

$$w_k = \begin{cases} 0, \text{ with probability } (1-\pi) \\ 1, \text{ with probability } \pi \end{cases} \tag{2.1}$$

Consider the zero inflated sequence $\{\overline{w}_1, \overline{w}_2, \overline{w}_3, ...\}$

$$\overline{w}_k = \begin{cases} 0, \text{ with probability } (1-\pi)(1-\rho)+\rho \\ 1, \text{ with probability } \pi(1-\rho) \end{cases}$$

with, $max\left\{-1, -\frac{1-\pi}{\pi}\right\} \le \rho \le 1.$

Kolev et. al. (2000) has defined the *r.v.* V to be equal to the number of trials that we need to achieve the first observed "success" in the new constructed sequence $\{\overline{w}_1, \overline{w}_2, \overline{w}_3, ...\}$ of independent binary variables given by

$$P(V=t) = pq^{t-1},$$

$$= (1-\rho)\pi[(1-\pi)(1-\rho)+\rho]^{t-1}, t = 1,2,... \quad (2.3)$$

The *r.v.* V has the usual geometric distribution on the positive integers, $V \sim Geo_1(\pi^*)$, where

$$\pi^* = (1-\pi)(1-\rho)+\rho \quad (2.4)$$

$$= 1-(1-\rho)\pi.$$

The *r.v.* X is defined by the following relations

$$P(X=0) = \pi$$

$$P(X=t) = (1-\pi)(1-\rho)\pi[(1-\pi)(1-\rho)+\rho \quad (2.5)$$

The mean and variance are given by

$$E(X) = \frac{(1-\pi)}{\pi(1-\rho)} \quad (2.6)$$

$$V(X) = \frac{(1-\pi)(1+\pi\rho)}{\pi^2(1-\rho)^2}. \quad (2.7)$$

Definition 2.1 The *r.v.* X defined by inflated-parameter geometric distribution with parameters $\pi \in (0,1)$ and $\rho \in \left(\max\left\{-1, -\frac{1-\pi}{\pi}\right\}, 1\right)$ is denoted by $X \sim IGe_0(\pi, \rho)$.

If $\rho = 0$, the defined inflated parameter geometric distribution coincides with the usual geometric distribution on the non-negative integer values, with parameter π. Measure of memory of X is given by

$$M_X = \frac{2(1-\pi)+(1-\rho)\pi-(2-\pi+\pi\rho)}{(2-\pi+\pi\rho)+(1-\rho)\pi} \quad (2.2)$$

$$= -\pi\rho.$$

This result implies that the measure of memory is always negative irrespective of the value of ρ.

ρ – type lack of memory property

In this section we obtain a characterization of the inflated parameter geometric distribution in the light of ρ – type lack of memory property. Kolev et. al. (2000) defines the ρ – type lack of memory property as follows.

Definition 3.1 The *r.v.* U is said to have ρ – type lack of memory property if

$$P(U \ge b+x \mid U \ge b) = (1-\rho)P(U \ge X) + \rho P(U \ge x \mid U > 0)$$

for any $x \ge 0$ and $b > 0$.

Main Result

Theorem 3.1 Let X be a discrete *r.v.* taking non-negative integral values. Then X has an inflated parameter geometric distribution with parameter π and ρ $(ie., X \sim IGe_0(\pi, \rho))$ if and only if the following equivalent conditions are true.

1. $$r(t) - r(0) = \frac{\rho}{1-\rho} \text{ and } r(t) = r(s) = r \forall t, s \ge 1.$$

2. X has ρ – type lack of memory property i.e.,

$$P(X \ge t+s \mid X \ge s) = \left[1 + \frac{\pi}{(1-\pi)}\rho\right] S(t).$$

***Proof*:** First assume that $X \sim IGe_0(\pi, \rho)$

Then,

$$r(t) = \sum_{j=t}^{\infty} \frac{(j-t)P(X=j)}{P(X \ge t)}$$

$$= \frac{1-(1-\rho)\pi}{(1-\rho)\pi}; t = 1,2,... \quad (3.1)$$

$$r(0) = E(X) = \frac{(1-\pi)}{\pi(1-\rho)}.$$

$$r(t) - r(0) = \frac{1-(1-\rho)\pi}{(1-\rho)\pi} - \frac{(1-\pi)}{\pi(1-\rho)} = \frac{\rho}{(1-\rho)}.$$

Conversely, let $r(t) - r(0) = \frac{\rho}{1-\rho}$ and $r(t) = r(s) = r, \forall t,\ s \geq 1.$

We have, $\frac{S(t+1)}{S(t)} = \frac{r(t)}{1+r(t+1)}$ and $S(0) = 1,$ where $S(t) = P(X \geq t).$

On substitution, we get

$S(1) = \frac{r(0)}{1+r}$ and

$$S(t) = \frac{r(0)}{1+r}\left(\frac{r}{1+r}\right)^{t-1}; t = 2,3,...$$

Hence,

$$p(0) = S(0) - S(1) = \frac{1}{(1-\rho)(1-r)}.$$

$$p(t) = S(t) - S(t+1) = \left(1 - \frac{1}{(1-\rho)(1+r)}\right)(1-\rho)\frac{1}{(1-\rho)(1+r)}$$

$$\left(\left(1 - \frac{1}{(1-\rho)(1+r)}\right)(1-\rho) + \rho\right)^{t-1}.$$

which is of the form $(1-\pi)(1-\rho)\pi((1-\pi)(1-\rho)+\rho)^{t-1},$ where $\pi = \frac{1}{(1-\rho)(1+r)}.$

Hence, $X \sim IGe_0\left(\frac{1}{(1-\rho)(1+r)}, \rho\right)$

i.e., if $r(t) - r(0) = \frac{\rho}{1-\rho}$ and $r(t) = r(s) = r \forall t,\ s \geq 1,$ then $X \sim IGe_0\left(\frac{1}{(1-\rho)(1+r)}, \rho\right).$

Finally, to prove the equivalence of *a* and *b* (3.2)

Let $r(t) - r(0) = \frac{\rho}{1-\rho}$ and $r(t) = r(s) = r \forall t, s \geq 1$

$$P(X \geq t+s \mid S \geq s) = \frac{S(t+s)}{S(s)} \quad (3.3)$$

$$= \left(1 + \frac{\pi}{(1-\pi)}\rho\right)P(X \geq t)$$

(3.7)

$\Rightarrow X$ has ρ – type lack of memory property.

Conversely, let X has ρ – type lack of memory property.

Then,

$$P(X \geq t+s \mid X \geq s) = \left[1 + \frac{\pi}{(1-\pi)}\rho\right]S(t) \quad (3.4)$$

i.e., $S(t+s) = \left[1 + \frac{\pi}{(1-\pi)}\rho\right]S(t)S(s)$

Now,

$$r(t) = \sum_{s=1}^{\infty} \frac{S(t+s)}{S(t)} \quad (3.5)$$

$$\Rightarrow r(t) - r(0) = \frac{\rho}{1-\rho}. \quad (3.9)$$

This completes the proof.

Extended distributions inflated at the point 'a' and their measure of memory (3.6)

Let X be an arbitrary non-negative integer valued *r.v.* and $Z = a + kX, a \geq 0, k \geq 1$ integers such that $P(Z = a+kt) = p(a+kt), t = 0,1,2,...$ and $\sum_{t=0}^{\infty} p(a+kt) = 1.$ On inflating the *r.v.* Z at 'a' we will have the *r.v.* W defined by

$$P(W = a) = \rho + (1-\rho)p(a)$$

$$P(W = a+kt) = (1-\rho)p(a+kt), t = 1,2,...$$

It can be easily verified that the *r.v. W* obtained by inflating the *r.v. Z* is same as the *r.v.* obtained by extending the inflated *r.v. Y* of *X*. Hence $W = a + kY$. The *p.g.f.* of *W* is given by,

$$G_W(s) = E(s^W)$$

$$= \sum_{t=0}^{\infty} s^{a+kt} p(a+kt)$$

$$= s^a \left[\rho + (1-\rho) G_Z(s)\right].$$

$$E(W) = \sum_{t=0}^{\infty} (a+kt) P(W = a+kt)$$

$$= a + kE(Y)$$

from (1.5) .

$$E(W^2) = \sum_{t=0}^{\infty} (a+kt)^2 P(W = a+kt)$$

$$= a^2 + 2kaE(Y) + k^2 E(Y^2).$$

Hence, $V(W) = k^2 V(Y)$ *from* (1.7) .

Sandhya and Rajasekharan (2012) showed that the measure of memory of the discrete non-negative extended *r.v. Z* is given by

$$M_Z = M_{a+kX} = kM_X = k \frac{2E^2(X) + E(X) - E(X^2)}{E(X^2) + E(X)} \quad (4.5)$$

This result and other related works on discrete distributions with change of origin and scale is referred in Nair et. al. (2018)

Hence, measure of memory of *W* is given by

$$M_W = M_{a+kY} = kM_Y = k \frac{2(1-\rho)E^2(X) + E(X) -}{E(X^2) + E(X)} \quad (4.6)$$

Inflated parameter extended geometric distribution

Let $X \sim IGe_0(\pi, \rho)$. Define the *r.v.* $Z = a + kX$.

$$P(Z = a) = \pi$$

$$P(Z = a+kt) = (1-\pi)(1-\rho)\pi\left[(1-\pi)(1-\rho) + \rho\right]^{t-1}, \quad (5.1)$$

$t = 1, 2, \ldots;\ k = 1, 2, \ldots;\ a \geq 0,$ integers.

$$G_Z(s) = \sum_{t=0}^{\infty} s^{a+kt} P(Z = a+kt)$$

$$= s^a \left[\pi + \frac{s^k (1-\pi)(1-\rho)\pi}{1 - s^k\left[(1-\pi)(1-\rho) + \rho\right]}\right] \quad (4.2)$$

$$= s^a \frac{\pi(1 - s^k \rho)}{1 - s^k (1 - \pi + \pi\rho)}.$$

We say that the *r.v. Z* defined above has an inflated parameter extended geometric distribution on $\{a, a+k, a+2k, \ldots\}$ with parameters $\pi \in (0,1)$ and $\rho \in \left[max\left\{-1, -\frac{1-\pi}{\pi}\right\}, 1\right]$ will be denoted by $IEGeo_a(\pi, \rho)$. (4.4)

$$E(Z) = a + kE(X)$$

$$= a + k\frac{(1-\pi)}{\pi(1-\rho)}.$$

$$V(Z) = k^2 V(X)$$

$$= k^2 \frac{(1-\pi)(1+\pi\rho)}{\pi^2 (1-\rho)^2}.$$

The measure of memory of Z is given by $M_Z = -k\pi\rho$.

6. ρ – type lack of memory property for Z

A *r.v.* *Z* on $\{a, a+k, a+2k, \ldots\}, a \geq 0, k \geq 1$ integers is said to have lack of memory property if *Z* satisfies.

$$P(Z \geq a + k(t+s) \mid Z \geq a + ks) = P(Z \geq a + kt), t, s > 0 \quad (6.1)$$

Now,

$$P(Z \geq a + kt) = \sum_{j=t}^{\infty} (1-\pi)(1-\rho)\pi\left[(1-\pi)(1-\rho) + \rho\right]^{j-1},$$

which on simplification

$$= (1-\pi)\left[(1-\pi)(1-\rho) + \rho\right]^{t-1} \quad (6.2)$$

Theorem 6.1 Let $Z \sim IEGeo_a(\pi,\rho)$ then for any $t \geq 0, s \geq 0,$ the conditional probability $P(Z \geq a+k(t+s) | Z \geq a+ks)$ has the following equivalent representations.

a) $[(1-\pi)(1-\rho)+\rho]^t$.

b) $\frac{[(1-\pi)(1-\rho)+\rho]}{(1-\pi)} P(Z \geq a+kt)$.

c) $\left(1+\frac{\pi\rho}{1-\pi}\right) P(Z \geq a+kt)$.

d) $P(Z \geq a+kt)+\pi\rho P(Z \geq a+kt \mid Z > a$

e) $(1-\rho)P(Z \geq a+kt)+\rho P(Z \geq a+kt \mid$

f) $P(V \geq a+k(t-1))$.

Proof:

a)

$P(Z \geq a+k(t+s) | Z \geq a+ks) = \frac{P(Z \geq a+}{P(Z \geq a}$

$= [(1-\pi)(1-\rho)+\rho]^t$.

b)

$P(Z \geq a+k(t+s) | Z \geq a+ks) = [(1-\pi)(1-$

$= \frac{(1-\pi)(1-\rho)+\rho}{(1-\pi)} P(Z \geq a+kt)$.

c)

$P(Z \geq a+k(t+s) | Z \geq a+ks) = \frac{(1-\pi)(1}{(1-}$

$= P(Z \geq a+kt)\left[1+\rho\frac{\pi}{(1-\pi)}\right]$.

d)

$P(Z \geq a+k(t+s) | Z \geq a+ks) = P(Z \geq a+kt)\left[1+\rho\frac{\pi}{P(X>a)}\right]$

$= P(Z \geq a+kt)+\pi\rho P(Z \geq a+kt \mid Z > a)$.

e)

$P(Z \geq a+k(t+s) | Z \geq a+ks) = \left[(1-\rho)+\frac{\rho}{(1-\pi)}\right] P(Z \geq a+kt)$

$= (1-\rho)P(Z \geq a+kt)+\rho P(Z \geq +a+kt \mid Z > a)$.

f)

$P(Z \geq a+k(t+s) | Z \geq a+ks) = [(1-\pi)(1-\rho)+\rho]^t$

$= P(V \geq a+k(t+1))$. □

This leads to the following definition for the $\rho-$type lack of memory for a *r.v.* Z on $\{a, a+k, a+2k, ...\}$.

Definition 6.1. The *r.v.* Z on $\{a, a+k, a+2k, ...\}, a \geq 0, k \geq 1$ integers is said to have $\rho-$type lack of memory property if

$$P(Z \geq a+k(t+s) | Z \geq a+ks) = (1-\rho)P(Z \geq a+kt)+\rho P(Z \geq a+kt \mid Z > a) \quad (6.3)$$

from $t \geq 0, s > 0$.

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"AN IMPACT AND LEVEL OF COLLECTIVE BARGAINING SYSTEM OF TNSTC EMPLOYEES AND ITS TRADE UNION – KMBAKONAM DIVISION"

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ABSTRACT

This Paper addresses the collective bargaining of TNSTC trade union members, the future of collective bargaining, the conditions necessary for successful collective bargaining, some of the advantages of collective bargaining, issues of concern for employers and guidelines for employers on the process of bargaining itself. Collective bargaining is specifically an industrial relations mechanism or tool, applicable to the employment relationship as a process. In collective bargaining the union always has a collective interest since the negotiations are for the benefit of several employees. Where collective bargaining is not for one employer but for several, collective interests become a feature for both parties to the bargaining process. In collective bargaining certain essential conditions need to be satisfied, such as the existence of the freedom of association and a labour law system. collective bargaining took a new turn as trade unions were forced to examine seriously their approach to the preparation of proposals and the presentation of their case to bargain collectively is the performance of the mutual obligation of the employer and the representative of the employees to meet at reasonable times and confer in good faith with respect to wages, hours, and terms and conditions of employment,

Keywords: *TNSTC employees, Collective bargaining, Transport employees.*

CONCEPT OF COLLECTIVE BARGAINING

TNSTC is the second largest government bus transport corporation in India and is well known for its route coverage almost too every remote area within Tamil Nadu. In Tamil Nadu, TNSTC (Kumbakonam) Ltd accounts major stake. Transportation service here is more than 40 years old and is the back bone of the economy of this division. In this study area, majority of the TNSTC workers are getting membership in various trade unions. So that the researcher concentrate the trade union's collective bargaining system. The phrase *"collective bargaining was first coined by Sidney and Beatrice Webb*. This was widely accepted, particularly in the developed countries. Generally by collective bargaining we mean, an essential element of economic democracy, is a 'two party' procedure for arriving at a commonly agreed solution. The term is thus used to describe the procedure, whereby employers must attempt to reach agreement about wage-rates and basic conditions of labour with trade unions, instead of with individual workers. In other words, it is the process of discussion and negotiation between an employer and a union culminating in a written agreement or contract and the adjustment of problems arising under the agreement. The existence of trade unions of various sorts: craft, industrial, company, general and federations or congresses, has been accompanied by the formation of employers' unions. The interaction between these institutions comprises the collective relations of industrial relations.

The growth of collective bargaining is closely associated with growth of trade unionism. The trade union movement revolves around collective bargaining. The important trend in collective bargaining, however, is the expansion in the number and the type of subjects which it covers. Collective bargaining as a technique for the fulfillment of the needs and objectives of workers and employers is an integral part of industrial society

The Trade Unions Act, 1926 ("TU Act") provides for formation and registration of trade unions and in certain respects to define the law relating to registered Trade Unions. The TU Act defines a trade union as "any combinations, whether temporary or permanent, formed primarily for the purpose of regulating the relations between workmen and employers or between workmen and workmen, or between employers and

employers, or for imposing restrictive condition on the conduct of any trade or business, and includes any federation or two or more trade unions."

Why employees join trade unions

Employees join unions for numerous reasons: economic (to give leverage in pay bargaining), social justice (inequality), to gain a voice in decision-making and for protection against authoritarian or abusive treatment by LMs.

Collective Bargaining in India

In India, the function of the trade unions was limited largely to collective bargaining for economic considerations. Collective bargaining has been defined by the Supreme Court ("**SC**") as "the technique by which dispute as to conditions of employment is resolved amicably by agreement rather than coercion". It is a process of discussion and negotiation between employer and workers regarding terms of employment and working conditions. Workers are generally represented by trade unions with respect to expressing their grievance concerning service conditions and wages before the employer and the management. Refusing to bargain collectively in good faith with the employer is considered to be an unfair labour practice as per the provisions of the Industrial Disputes Act, 1947 ("**IDA**") . This is generally an effective system as it usually results in employers undertaking actions to resolve the issues of the workers. However, the legal procedure for pursuing collective bargaining in India is complicated .

Meaning and definition of Collective Bargaining

> "a mutual obligation on the employer and employee to bargain in good faith towards the settlement of colllective bargaining"

Louis E. Howard, collective bargaining means "……. To get together (right of meeting), to enter a common organization (right of association), to determine that whatever conditions of work are allotted shall be the same for all workers and to make a bargain with employers to that effect (rights of combinations and bargaining) and eventually in case the employers should refuse to enter on such a bargain or fail to honour it when entered upon, to confront them with a united refusal to go to work or to continue at work (right of strike).

According to Flanders "Collective Bargaining as a means of joint regulation"

The **ILO** Right to Organize and Collective Bargaining Convention (No. 98), 1949 describes
collective bargaining as: "Voluntary negotiation between employers or employers' organizations and workers' organizations, with a view to the regulation of terms and conditions of employment by collective agreements."

"Collective bargaining" writes **Harbison** "is a process of accommodation between two institutions which have both common and conflicting interests".

Levels of Collective Bargaining in India

i ***National-level industry bargaining*** is common in core industries such as banks, coal, steel, ports and docks, and oil where the central government plays a major role as the employer.

ii. ***Industry-cum regional bargaining*** is peculiar to industries where the private sector dominates, such as cotton, jute, textiles, engineering, tea plantation, ports and docks. Bargaining generally occurs in two stages: company-wide agreements are formed, which are then supplemented with regional (i.e. plant-level) agreements.

iii. ***Enterprise or plant-level bargaining*** practices differ from case to case because there is no uniform collective bargaining procedure. Typically, the bargaining council (or negotiating committee) is constituted by a proportional representation of many unions in an establishment

Advantages of Collective Bargaining

- ✓ Collective bargaining has the advantage of settlement through dialogue and

consensus rather than through conflict and confrontation.

- ✓ Collective bargaining agreements often institutionalize settlement through dialogue.
- ✓ Collective bargaining is a form of participation. Both parties participate in deciding what proportion of the 'cake' is to be shared by the parties entitled to a share
- ✓ Collective bargaining agreements sometimes renounce or limit the settlement of disputes through trade union action.
- ✓ Collective bargaining is an essential feature in the concept of social partnership towards which labour relations should strive.
- ✓ Collective bargaining has valuable by-products relevant to the relationship between the two parties
- ✓ Collective bargaining and consequent agreements tend to stabilize union membership.
- ✓ Collective bargaining usually has the effect of improving industrial relations.

SCOPE OF THE STUDY

This study is mainly confined to the study of collective bargaining of trade union and its members of TNSTC (Kumbakonam) Ltd towards their occupation

OBJECTIVES OF THE STUDY

The following specific objectives of the study are as follows.

1. To study the mean score of good faith and confidence on each management and employees towards collective bargaining of TNSTC Ltd, Kumbakonam division.
2. To analyses the various level of collective bargaining towards TNSTC Ltd, Kumbakonam division.

Area of the study: The researcher has taken TNSTC (Kumbakonam) Ltd for this study.

The collective bargaining of the employees of TNSTC (Kumbakonam) Ltd is studied.

Research Design

The present study is based on both primary and secondary data were used. For collecting the primary data using well framed questionnaire was designed to elicit necessary data and details collected through a sample survey from the drivers, conductors, technical, Administrative and others employees of TNSTC Kumbakonam division. The secondary data were collected from the books, journals, web portal, and records from Tamil Nadu State Transport Corporation Limited, Kumbakonam division, and publication of the department of TNSTC, Indian Journal of Transport Management Pune.

SAMPLING DESIGN

The sampling designs were formulated to collect data from the employees. In TNSTC (Kumbakonam) Ltd, the numbers of respondents are in variably high employees have been selected for the study. The researcher collected for pilot study of 100 TNSTC employees were used and its implied that reliability is not high-quality

Statistical Design : Various statistical tools are used in analyzing the primary and secondary data. This involves a lot of calculation and computations. Tables, mean score of collective bargaining were used to judge the significance through chi-square test . From each category of employees namely Drivers, Conductors, Technical staff members Administration staff members and others staff members were selected for the study.

Statement of problem

Unions exist to deal with problems faced by laborers, these problems may be of any nature such as those concerning the pay, unfair work rules, timings and so on. All the workers working under one particular employer is represented by the worker's union. All the communication that happens in between the employer and the workforce generally takes place through the union. Collective bargaining has addressed equity issues from the point of view of employees - issues such as a job security, Fair wage, working conditions and the equal distribution of wage increases to all. As a result, collective bargaining process gets weakening from industries to industries due to non-cooperation among the trade unions.. In that event, in collective bargaining the areas of dispute would be narrowed, and both parties would be likely to share a common view

about the issues and even arrive at a basic agreement on them.

CHI-SQUARE TEST – COLLECTIVE BARGAINING

Null Hypothesis (H_0): There is no significant difference in the mean score of collective bargaining is a powerful device.

Alternative Hypothesis (H_0): There is a significant difference in the mean score of collective bargaining is a powerful device.

TABLE – 1 COLLECTIVE BARGAINING POWERFUL DEVICE

Statements	Observed N	Expected N	Residual
Highly Satisfied	63	185.2	-122.2
Satisfied	240	185.2	54.8
Neutral	513	185.2	327.8
Dissatisfied	82	185.2	-103.2
Highly Dissatisfied	28	185.2	-157.2
Total	**926**		

Source: Primary Data

TABLE – 1.1 RESULT

	CB POWERFUL DEVICE	REMARKS
Chi-Square	867.985[a**]	Significant
df	4	
Asymp. Sig.	.000	

****1% level of significant**

(*P*<0.01 i.e. Rejected)

The above table observes that the collective bargaining powerful device from expected and expected frequencies TU employees in Kumbakonam Division. Since, the *P*-value 0.000 is less than 0.05 (*P*<0.01), the indifference between observed and expected variables is 'significant'. It is concluded that the there is a significant difference in the mean score of collective bargaining is a powerful device in the study area.

CHI-SQUARE TEST – COLLECTIVE BARGAINING

Null Hypothesis (H_0): There is no significant difference in the mean score of industrial peace and labour harmony between employees and employer.

Alternative Hypothesis (H_0): There is a significant difference in the mean score of industrial peace and labour harmony between employees and employer.

TABLE –2 COLLECTIVE BARGAINING

Statements	Observed N	Expected N	Residual
Highly Satisfied	112	185.2	-73.2
Satisfied	257	185.2	71.8
Neutral	444	185.2	258.8
Dissatisfied	77	185.2	-108.2
Highly Dissatisfied	36	185.2	-149.2
Total	**926**		

Source: Primary Data

TABLE –2.1 RESULT

	CB POWERFUL DEVICE	REMARKS
Chi-Square	601.829[a**]	Significant
df	4	
Asymp. Sig.	.000	

****1% level of significant**

(*P*<0.01 i.e. Rejected)

The above table observes that the collective bargaining powerful device from expected and expected frequencies TU employees in Kumbakonam Division. Since, the *P*-value 0.000 is less than 0.05 (*P*<0.01), the indifference between observed and expected variables is 'significant'. It is concluded that the there is a significant difference in the mean score of industrial peace and labour harmony between employees and employer in the study area.

CHI-SQUARE TEST – COLLECTIVE BARGAINING

Null Hypothesis (H_0): There is no significant difference in the mean score of the different opinion from employees about employer.

Alternative Hypothesis (H_0): There is a significant difference in the mean score of difference opinion from employees about employer.

TABLE – 3 COLLECTIVE BARGAINING-3

Statements	Observed N	Expected N	Residual
Highly Satisfied	111	185.2	-74.2
Satisfied	220	185.2	34.8
Neutral	501	185.2	315.8
Dissatisfied	56	185.2	-129.2
Highly Dissatisfied	38	185.2	-147.2
Total	**926**		

Source: Primary Data

TABLE – 3.1 RESULT

	CB POWERFUL DEVICE	REMARKS
Chi-Square	781.894[a**]	Significant
df	4	
Asymp. Sig.	.000	

****1% level of significant**

(*P*<0.01 i.e. Rejected)

The above table observes that the collective bargaining powerful device from expected and expected frequencies TU employees in Kumbakonam Division. Since, the *P*-value 0.000 is less than 0.05 (*P*<0.01), the indifference between observed and expected variables is 'significant'. It is concluded that the there is a significant difference in the mean score of difference opinion from employees about employer in the study area.

CHI-SQUARE TEST – COLLECTIVE BARGAINING

Null Hypothesis (H_0): There is no significant difference in the mean score of good faith and confidence on each management and employees.

Alternative Hypothesis (H_0): There is a significant difference in the mean score of good faith and confidence on each management and employees.

TABLE – 4 COLLECTIVE BARGAINING

Statements	Observed N	Expected N	Residual
Highly Satisfied	57	185.2	-128.2
Satisfied	358	185.2	172.8
Neutral	445	185.2	259.8
Dissatisfied	19	185.2	-166.2
Highly Dissatisfied	47	185.2	-138.2

Total	**926**		

Source: Primary Data

TABLE – 4.1 RESULT

	CB POWERFUL DEVICE	REMARKS
Chi-Square	866.700[a**]	Significant
df	4	
Asymp. Sig.	.000	

****1% level of significant**

(*P*<0.01 i.e. Rejected)

The above table observes that the collective bargaining powerful device from expected and expected frequencies TU employees in Kumbakonam Division. Since, the *P*-value 0.000 is less than 0.05 (*P*<0.01), the indifference between observed and expected variables is 'significant'. It is concluded that the there is a significant difference in the mean score of good faith and confidence on each management and employees.in the study area.

CHI-SQUARE TEST – COLLECTIVE BARGAINING

Null Hypothesis (H_0): There is no significant difference in the mean score of strength and weakness of management in the study area.

Alternative Hypothesis (H_0): There is a significant difference in the mean score of strength and weakness of management in the study area.

TABLE – 5 COLLECTIVE BARGAINING POWERFUL DEVICE

Statements	Observed N	Expected N	Residual
Highly Satisfied	73	185.2	-112.2
Satisfied	278	185.2	92.8
Neutral	489	185.2	303.8
Dissatisfied	66	185.2	-119.2
Highly Dissatisfied	20	185.2	-165.2
Total	**926**		

Source: Primary Data

TABLE – 5.1 RESULT

	CB POWERFUL DEVICE	REMARKS
Chi-Square	836.905[a**]	Significant
df	4	
Asymp. Sig.	.000	

****1% level of significant**

(*P*<0.01 i.e. Rejected)

The above table observes that the collective bargaining powerful device from expected and expected frequencies TU employees in Kumbakonam Division. Since, the *P*-value 0.000 is less than 0.05 (*P*<0.01), the indifference between observed and expected variables is 'significant'. It is concluded that there is a significant difference in the mean score of strength and weakness of management in the study area.

Conclusion

In numerable number of important conclusions can be drawn from the findings of this study which have collective bargaining of TNSTC employees towards occupation. The researcher should take the respondents gradually from various depots under Kumbakonam division. The union's demands should be carefully studied. Generally, the trade unions and the employers' associations are registered and it is mandatory to be registered to conclude the collective agreements. The disputes from the application at workplace shall be handled between the employer and employee. It is concludes that

the more reliable information given by TU members and modified study were applied and the result was 'good' in this study area.

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"MEMBER'S SATISFACTION ON SALARY AND WAGE BENEFITS WITH TRADE UNIONS - AT TNSTC KUMBAKONAM DIVISION "

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ABSTRACT

The existence of a strong and recognized trade union is a prerequisite to industrial peace. Decisions taken through the process of collective bargaining and negotiations between employer and unions are more influential. Trade unions play an important role and are helpful in effective communication between the workers and the management. A union acts as an intermediary between employees and Corporation and provides a necessary complement to legislated benefit and protection. Unions bargain with management for the successful increase workers salary and wages benefits through collective bargaining. The impact of unions on worker's wage and salary benefits therefore, the aim of the study is to analyze member's satisfaction salary and wage benefitswith the activities of trade unions in the TNSTC kumbakonam divisionTamil Nadu. The result of the study reveals that among the skilled, semi-skilled and unskilled workers, the majority of the skilled workers perceive moderate satisfaction, whereas the majority of the semi-skilled and unskilled workers perceive a high level of satisfaction with the activities of the trade unions in the study unit.

INTRODUCTION

A trade union is an organized association of workers formed to protect their rights and interest. In the rapid programme of industrial development of India and with the implementation of new economic policy, trade unions have come to occupy a critical position in the success of industrial relations in the country. The Trade Unionism in India has been undergoing rapid changes due to socioeconomic transformation also. It is an important instrument to promote class collaboration and harmony. They are found as an instrument of solving social economic, political and psychological problems of large scale industry, machine, technology and mass production. Trade unions can reshape the relationship between the employers and employees in order to maintain an atmosphere of industrial peace and harmony. Trade unions play a significant role in securing the nature of the job and enforcing the rights on the job. Unions act as an intermediary between employees and Corporation and provide a necessary complement to legislated benefit and protection. Unions bargain with management for the successful increase of worker wages, other benefits through collective bargaining. The impact of unions on worker's wage and salary benefits is presented in Table 4.11

REVIEW OF LITERATURE

Review of literature paves way for a clear understanding of the areas of research already undertaken and throws a light on the potential areas which are yet to be covered. The reviews of some of the important studies are presented in the succeeding pages.

ParagShil and Santa Kar (2013) measured the satisfaction of the railway employees about the role performed by the trade unions and other activities of the trade unions related to the up gradation of the railway employees in the Badarpur sub-division of N. F. Railway, They concluded that the trade unions at Indian Railway, which are operating in Badarpur Subdivision, in particular, are not only playing an active role in improving the quality of work life of employees, but also in maintaining good industrial relation in the organization. In fact, the welfare of workers seems to be an inseparable component of the functions of these unions.

Manoranjan Dhal and Kailash B.L. Srivastava (2002) their study, based on a questionnaire survey in South Eastern Railway, Kharagpur, examined the perceptions and attitudes of actors of the industrial relations system. Workers were found to be satisfied with the approach of the management but not with union leaders. Managers were also trying to adopt people building strategies and gain the confidence of workers through establishing direct channels of communication with them and bypassing the union. They considered union leaders as obstacles, not willing to maintain good relationships. Union leaders succumbed to

pressure due to the loss of membership and lack of participation of workers in union activities. They were satisfied with the prevailing union-management relationships, but considered management as an opposing force, as they were working towards decreasing the membership and creating multiplicity for their own interests. Thus, union leaders had to bear the responsibility to increase membership, work for the success of the union as well as maintain a favourable union-management relationship.

STATEMENT OF THE PROBLEM

The trade unions have a crucial role to play in maintaining smooth industrial relations. It is true that the unions have to protect and safeguard the interests of the workers through collective bargaining. But at the same time they have equal responsibility to see that the organizations do not suffer on account of their direct actions such as strikes, even for trivial reasons. They must be able to understand and appreciate the problems of managements and must adopt a policy of „give and take" while bargaining with the managements. Trade unions must understand that both management and workers depend on each other and any sort of problem on either side will do harm to both sides.Trade unions are juristic entities and volitional associations that have, historically and ideologically, represented the aggregate strength of labour to maximise their effectiveness in their endeavour to fulfil their core responsibilities and principal functions. The mandate of trade unions is to, inter alia, protect, maintain, and improve the working conditions of their members. They fulfil this mandate by ensuring that they offer services that meet, if not exceed, members' satisfaction levels. Trade unions ultimately exist to protect the work- and non-work-related interest of their members, whether these be economic, social, political, or environmental (Venter, 2003). Neletal. (2005) asseverate that trade unions are membership organizations: They exist because of their members, they are made up of members, they serve their members' interest, and they are governed by their members. That is, they derive their authority and mandate from the members. Therefore, trade union is service providers. They must give employees enough reason to become attracted to them as members and to remain members. Simply put, trade unions, as the embodiment of workers' aspirations, owe a duty of care to their members, and thus should at all times, act in their best interests. Thus, the kind and quality of services offered by trade unions should be perceived by members as sufficient and satisfactory. Highly satisfied and committed union members are more likely to support and participate in trade union activities. Trade unions, like any other organization that provides services, are faced with challenges of membership decline due to perceived poor services or the lack thereof, and are therefore required to devise remedial measures to mitigate the membership decline (Kgapola, Leslie Seth 2017). Against the backdrop of the foregoing, the aim of the study is to analyze the member'ssatisfaction on salary and wage benefits with activities of trade unions in the TNSTC kumbakonam Tamil Nadu with the following research questions.

RESEARCH QUESTIONS

The following research questions were addressed in the study.

1. Whether there is any significant difference between satisfaction among drivers, conductors and Technical workers with the activities of the trade unions?

2. Whether there is any significant relationship between demographic variables of the members and their satisfaction of salary and wage benefits with activities of trade unions?

RESEARCH METHODOLOGY

The present study has been conceptualized in order to analyze the member'ssatisfaction on salary and wage benefits with activities of trade unions in the TNSTC kumbakonam division of Tamil Nadu. The study has made use of survey method of research to achieve the set objectives.Among them, 100 members of trade union were selected. Thus, the total sample size is 100 works selected on the basis of convenience sampling method.For the purpose of analysis the workers were

classified asdrivers, conductors and Technical workers

RESULT AND DISCUSSION

The member satisfaction with trade unions in the selected study unit is discussed in the subsequent pages.

DRIVER'S SATISFACTION ON SALARY AND WAGE BENEFIT WITH TRADE UNIONS

The mean score obtained by the drivers for their satisfaction on salary and wage benefits with the activities of the trade unions is shown in table 1.

Table 1 Impact of trade union on salary and wage benefits

S. No.	Variables	SA	A	N	DA	SDA	Total
1.	Union have succeeded in securing better salary or wages through their efforts	173	209	49	84	85	600
		(28.83)	(34.83)	(8.17)	(14.00)	(14.17)	(100.00)
2.	Union bargains overcome unfair wages	154	295	40	57	54	600
		(25.67)	(49.17)	(6.67)	(9.50)	(9.00)	(100.00)
3.	Union bargain fringe benefits for the workers	319	128	63	55	35	600
		(53.17)	(21.33)	(10.50)	(9.17)	(5.83)	(100.00)
4.	Union reduce wages inequality	109	186	37	175	93	600
		(18.17)	(31.00)	(6.17)	(29.17)	(15.50)	(100.00)
5.	Union maintains and improves workers' terms and conditions through collective bargaining with employers.	146	191	67	121	75	600
		(24.33)	(31.83)	(11.17)	(20.17)	(12.50)	(100.00)
6.	Union negotiate improved terms and conditions for employees, including wages and more fringe benefits	149	210	50	86	105	600
		(24.83)	(35.00)	(8.33)	(14.33)	(17.50)	(100.00)

Source: Data from Primary Source

Table 1 indicates that nearly three fourth (74.50) of the employees agree with union bargain fringe benefits for the workers (74.50 percent), union bargain to overcome unfair wages in the corporation (74.83 percent) and more than three-fifth (63.67 percent) of the employees agree with union secure better salary or wages through their efforts. Nearly three-fifths (59.83 percent) of the employees agree with union negotiate improved terms and conditions for employees and (56.17 percent) unions maintain and improve terms and conditions through collective bargaining in the corporation. However, nearly fifty (49.17 percent) percent of the employee agree with union reduce wages inequality in the TNSTC Kumbakonam Division – 1. It is concluded that the union role in reducing the wages inequality has a low level in the corporation and the union has to focus more on is aspect in the corporation

Significance of demographic status in the involvement of unionon job security, salary and wage benefits, welfare facility and working condition.

The demographic variables such as employees' age, marital status, education, income, and residence, number of dependants, experience and cadre of the employees show significant difference in the involvement of trade union on job security, salary & wage benefits, welfare facility and working condition.

The other demographic variables like employees' gender and nature of family do not show any significant in the involvement of union on job security, salary & wage benefits, welfare facility and working condition.

CONCLUSION

The study reveals that out of 100 sample respondents, nearly 51 per cent of the respondents expressed a high level of satisfaction followed by 35 per cent and 13 per cent of the respondents reported moderate and high level of satisfaction with the activities of trade unions in the study unit.

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EVALUATION OF BUDGET ANALYSIS OF KUMBAKONAM MUNICIPALITY

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ABSTRACT

The financial structure of Urban Local Bodies in India is mainly comprises of tax and non-tax revenues as major source of revenues and these local bodies also receive grants-in aid and other concessions from the Government. The expenditure of the municipalities are classified as establishment expenditures, administration expenditures, operating, repairs & maintenance expenditures finance expenses and depreciation. Therefore this study is focussed on the evaluation of budget analysis of Kumbakonam Municipality using trend analysis using actual and estimated values. For further study Chi-square test is used.

Key words: *Urban Local Bodies, Source of revenues, Grants-in aid.*

Introduction

Financial Management is used in each and every organisation, whether it is trading or non-trading organisation. Finance is needed to promote or establish business, acquire fixed assets, make investigations such as market survey, develop product, keep men and machine at work It is necessary as it guides in

- Financial planning and successful promotion of an enterprise,
- In acquisition of funds at a minimum cost,
- In efficient usage and allocation of funds,
- In taking sound financial decisions and
- In promoting and mobilising individual and corporate savings.

Urban Local Government (ULG)

It refers to the governance of an urban area by the people through their elected representatives. The jurisdiction is limited to a specific area which is demarcated by the State Government.

During the period of British rule, the institutions of local government is originated in India. The first municipal corporation in India was set up in 1687 at Madras. In 1726, the municipal corporations were ste up in Bombay and Calcutta. Under the provincial autonomy sceme introduced by the Government of India Act of 1935, local self-government was declared a provincial subject.

74th Amendment Act has added in Part IX –A to the constitution of India. It is named as "Municipalities" and consists of provisions from articles 243-P to 243 G. This act aims at revitalising and strengthening the urban governments for the purpose of adopting the municipalities

Municipal Finance

Every municipality has to levy, collect taxes, duties, tolls and fees. They can get the grants-in aid out of the funds of the State. Finance commission for every five years review the financial position of the municipalities. Municipality is established for the administration of the towns and smaller cities. It has three authorities namely Council, the Standing committees, and the Chief executive officer. The State Finance Commission will make recommendations on the following:

- Amount of taxes levied by both the Central and State Governments,
- To fix the taxes, fees and rates to be used by the local bodies, and
- To recommend the steps for improving the financial condition of the Local Government

Sources of Revenues

The sources of revenues of the municipalities are tax revenues, assigned

revenues, grants and contributions, service charges and loans.

Expenditure

Total expenditure includes establishment expenditure, operating, repairs & maintenance expenditure, Administration expenditure, programme expenses, finance expenses and depreciation.

Audit of Accounts

Accounts are maintained in the way of funds separately as Revenue & capital Fund, Water Supply & Drainage Fund, and Elementary Education Fund. Accounts are to be audited properly.

Review of Literature

Om Prie Srivastava's in her research 'Municipal Government and Administration in India" explains the various kinds of state control and suggests remedial measures that need to be taken. She has felt that government should reorient its attitude in regard to municipal corporations, providing constructive guidance and adequate assistance to them, as an active partner in the common cause of city administration.

Sujatha Srinivasan in her article titled "Financial Disclosure in Local Government‖- A Comparative study" attempted on the financial reporting and disclosure practices in the public sector across the world. She analysed the accounting and financial reporting reforms that have taken place in the public sector of certain of European and Asian countries. This article also examines the significant reforms being introduced in the public accounting system in India. The findings of the study shows that countries like United States, United Kingdom, Canada, Australia and New zealand have comparatively better and more transparent disclosure practices. Further the study reveals that Indian government has taken number of steps to introduce transparency into local operations as e-goverence, accrual accounting model financial statements etc.

Research Gap

Studies about the evaluation of financial condition of Municipalities are rare particularly Kumbakonam Municipality. And most of the studies were dealt with either working of Urban Local Government, Administration of Urban Local Bodies or General performance of the Municipalities and no studies are related to Kumbakonam Municipality. Therefore the present study deals with Kumbakonam Municipality and its budget analysis.

Need of the study

In the present economic conditions, it is not possible for the central and State Governments to solve the problems of the general public. It is only the local government that guides the state government to give importance to the welfare of the society and helps to solve their problems. In the case of major cities, Municipal corporations have to look after the welfare of the society. Hence, the present study is made to attempt on the evaluation of budget analysis of Kumbakonam Municipality.

Objectives of the study

- To evaluate the budget analysis of the Kumbakonam Municipality.
- To assess the findings and give suggestions.

Hypotheses

$H_0$1: There is no significant variation in the tax revenue of the municipality during the study period.

$H_0$2: There is no significant variation in the total revenue of the municipality during the study period.

$H_0$3: There is no significant variation in the total expenditure of the municipality during the study period.

Tools used

For easy analysis linear trend and Chi-square is used. Chi-square is used to find out the significant variation in tax revenues, total revenue and total expenditure during the study period.

Methodology

The present study is completely relied upon secondary data.

Results and Discussions

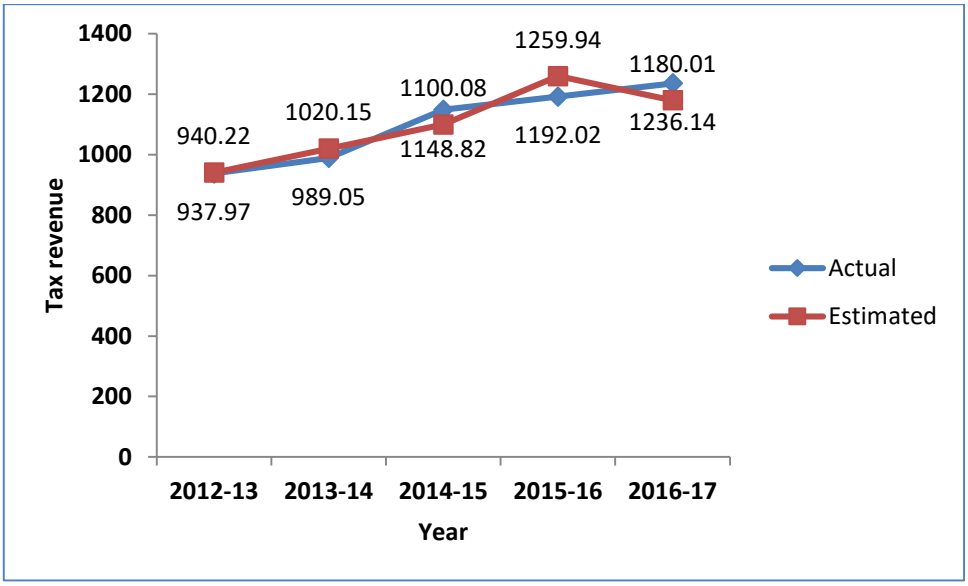
The following table clearly exhibits the Trend in tax revenue of the Kumbakonam Municipality. Chi-square test is used to find out whether there is significant variation in the tax revenue of the Municipality during the study period.

Table. A-1 Trend in tax revenue.

Year	Actual tax revenue (Rs.in lakhs)	Estimated tax revenue (Rs.in lakhs)	Increase/decrease (Rs.in lakhs)
2012-13	937.97	940.22	-2.25
2013-14	989.05	1020.15	-31.10
2014-15	1148.82	1100.08	48.74
2015-16	1192.02	1259.94	-67.92
2016-17	1236.14	1180.01	56.13
Mean	1100.08		
Chi-Square Value	9.44		

Source: Financial report of Kumbakonam Municipality.

Figure.A-1 Trend in tax revenue.



Source: Financial report of Kumbakonam Municipality.

Table.A.1, shows that the actual tax revenue of the Kumbakonam Municipality is increased from Rs.937.97 lakhs in the year 2012-13 to Rs.1,236.14 lakhs in the year 2016-17. But the estimated tax revenue has exhibited an increasing trend from Rs.940.22 lakhs in 2012-13 to Rs.1259.94 lakhs in the year 2015-16, whereas in the last year it has reduced to Rs.1180.01 lakhs . When estimated tax revenues and actual tax revenues are compared, there has been decrease in the tax revenue in the year 2012-

13 at Rs.2.25 lakhs but in the year but in the last year actual tax revenue is increased by Rs.56.13 lakhs as maximum tax revenues collected by the Municipality in this year. The average tax revenue collected by the Municipality is Rs.1100.08 lakhs. Since chi-square analysis shows that the calculated value of 9.44 is less than the critical value(9.49) at 5% level of significance, the null hypothesis is accepted. There is no significant variation in the tax revenue of the Municipality during the study period.

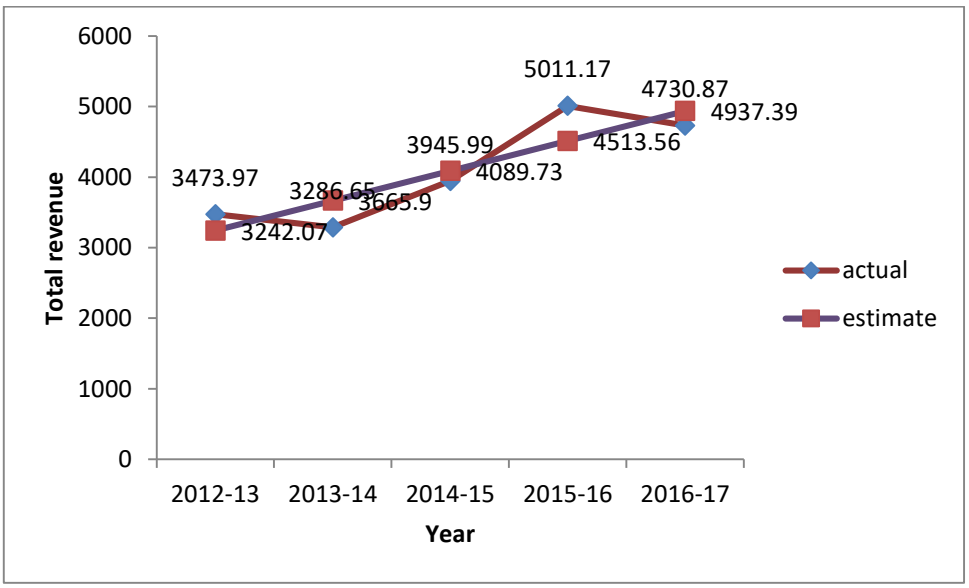
The figure A-1 shows that the trend line of estimated value reached the peak point of Rs1259.94 lakhs in the year 2015-16, higher than the actual tax revenue.

Table. A-2 Trend in total revenue.

Year	Actual total revenue (Rs.in lakhs)	Estimated total revenue (Rs.in lakhs)	Increase/decrease (Rs.in lakhs)
2012-13	3473.97	3242.07	231.90
2013-14	3286.65	3665.90	-379.25
2014-15	3945.99	4089.73	-143.74
2015-16	5011.17	4513.56	497.61
2016-17	4730.87	4937.39	-206.52
Mean	4089.73		
Chi-Square Value	124.37		

Source: Financial report of Kumbakonam Municipality.

Figure.A-2 Trend in total revenue of the Municipality



It is found from table.A-2, the actual total revenue has reduced from Rs.3473.97 lakhs to Rs.4730.87 lakhs in the year 2016-17, the estimated total revenue has shown an increasing trend of Rs.3242.07 lakhs in the year 2012-13 to Rs.4937.39 lakhs in the year 2016-17, but when actual revenue is considered it has shown fluctuations throughout the study period. The total revenue has increased in the year 2016-17 at Rs.5011.17 lakhs and when both actual and estimated total revenue is compared there has been heavy rise in the total revenue in the year 2015-16 by Rs.497.61 lakhs and the average total revenue collected by the Municipality is Rs.4089.73 lakhs. This is due to heavy non-tax revenue received by the Municipality. Since chi-square analysis shows that the calculated value of 124.37 is more than the critical value (9.49) at 5% level of significance, the null hypothesis is rejected and alternate hypothesis is accepted. That is there is significant variation in the total revenue of the Municipality during the study period.

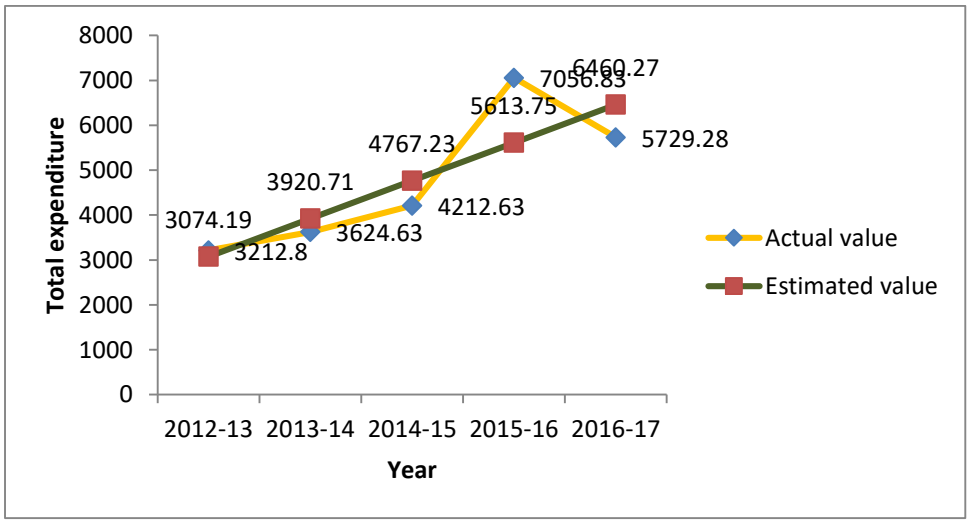
The figure A-2 shows that the trend line of actual value reached the peak point of Rs.5011.17 lakhs in the year 2015-16, higher than the estimated tax revenue.

Table. A-3 rend in total expenditure.

Year	Actual total expenditure (Rs.in lakhs)	Estimated total expenditure (Rs.in lakhs)	Increase/decrease (Rs.in lakhs)
2012-13	3212.80	3074.19	138.61
2013-14	3624.63	3920.71	-296.08
2014-15	4212.63	4767.23	-554.60
2015-16	7056.83	5613.75	1443.08
2016-17	5729.28	6460.27	-730.99
Mean	4767.23		
Chi-Square Value	546.80		

Source: Financial report of Kumbakonam Municipality.

Figure.A-3 Trend in total expenditure.



It is clear from table A.3, the actual total expenditure of the Kumbakonam Municipality is higher than the estimated total expenditure in the year 2015-16 at Rs.7056.83 lalkhs compared to estimated total expenditure of Rs.5613.75 lakhs and when actual total expenditure and estimated total expenditure is compared, the actual expenditure has increased by Rs. 1443.08 lakkhs in the year 2015-16, it is due to heavy operating, repairs and maintenance expenses met by the municipality in that year. The average total expenditure is shown at Rs.4767.23 lakhs.

Since chi-square analysis shows that the calculated value of 546.80 is more than the critical value (9.49) at 5% level of significance, the null hypothesis is rejected and alternate hypothesis is accepted. That is there is significant variation in the total expenditure of the Municipality during the study period.

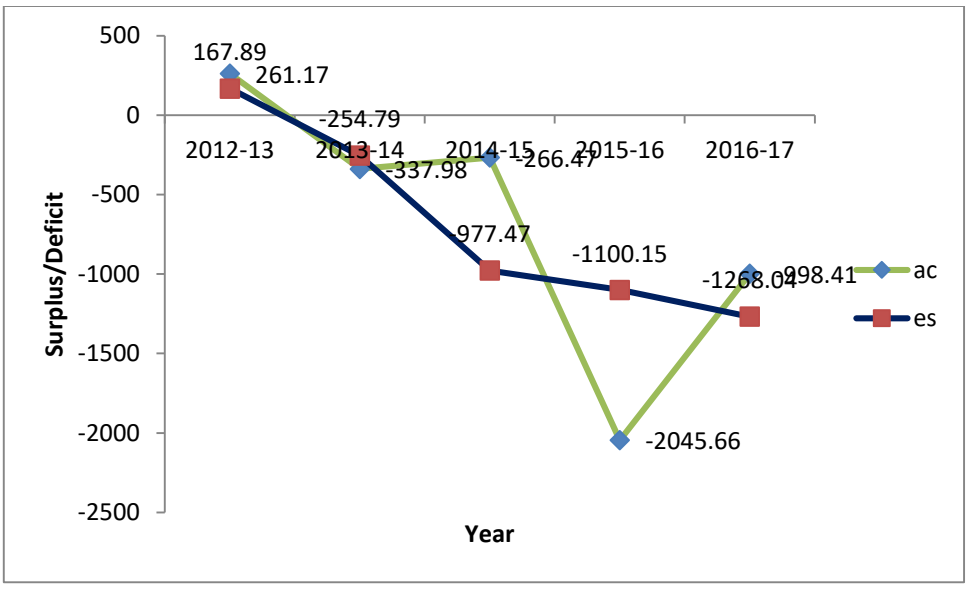
The figure A-3 shows that the trend line of actual value reached the peak point of Rs.5011.17 lakhs in the year 2015-16, higher than the estimated tax revenue

Table. A-4 Trend in surplus/deficit.

Year	Actual surplus/deficit (Rs.in lakhs)	Estimated surplus/deficit (Rs.in lakhs)	Increase/decrease (Rs.in lakhs)
2012-13	261.17	167.89	93.28
2013-14	-337.98	-254.79	83.19
2014-15	-266.47	-677.47	-411.00
2015-16	-2045.66	-1100.15	945.51
2016-17	-998.41	-1268.04	-269.63
Mean	-677.47		

Source: Financial report of Kumbakonam Municipality.

Figure.A-4 Trend in surplus/Deficit



It is clear from table A.4, the actual surplus of the Kumbakonam Municipality is higher than the estimated surplus in the year 2012-13 at Rs.261.17 lakhs compared to estimated surplus of Rs.167.89 lakhs and actual surplus is increased by Rs.93.28 lakhs in the same year. But in the remaining years the Kumbakonam Municipality has faced the problem of deficit especially in the year 2015-16, where the actual deficit is shown at Rs.2045.66 lakhs and it has increased by Rs.945.51 lakhs compared to the estimated deficit of Rs.1100.15 lakhs. This is due to the total expenses met by the Municipality in the same year. The average deficit is shown at Rs.677.47 lakhs.

The figure A-4 shows that the trend line of actual deficit is reached the peak point of Rs.2045.66 lakhs in the year 2015-16, higher than the estimated deficit.

Findings, Suggestions and Conclusion

When Budget analysis of Kumbakonam Municipality is evaluated ,

- It is found that on comparing both actual and estimated total revenue there has been heavy rise in the total revenue in the year 2015-16 by Rs.497.61 lakhs and the average total revenue collected by the Municipality is Rs.4089.73 lakhs. This is due to heavy non-tax revenue received by the Municipality and chi-square test shows that there is significant variation in the actual and estimated total revenue throughout the study period.
- In the case of total expenditure when actual total expenditure and estimated total expenditure is compared, the actual expenditure has increased by Rs. 1443.08 lakkhs in the year 2015-16, it is due to heavy operating, repairs and maintenance expenses met by the municipality in that year and in the case of chi-square test there is significant variation in the actual and estimated total expenditures throughout the study period.
- When surplus or deficit is considered, except in the year 2012-13, there has been only deficit condition for the municipality, especially in the year 2015-16, it has exhibited a maximum deficit of Rs.2045.66 lakhs compared to estimated deficit of Rs.1100.15 lakhs.

Hence, it is suggested that proper policies and procedures should be followed by the Municipality to collect the revenues especially tax revenues in addition to getting grants and concessions from the Government.Further to compensate the deficit condition it should increase both tax and non-tax revenues.

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FINANCIAL ANALYSIS OF TIRUNELVELI CITY MUNICIPAL CORPORATION

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ABSTRACT

The main function of municipal corporations is to provide various services to the public such as Water & sewerage facilities, Drainage facilities, Education facilities, and Hospital facilities . To provide these services Municipal corporations should pool the resources in the form of revenues to meet out necessary Expenditures. Therefore this article throws light on the Snapshot of Tirunelveli City Municipal Corporation's financial analysis. Important revenue and expenditure ratios are used for thorough analysis. Simple regression has been used as statistical tool.

Key words: *Revenues, Expenditure.*

Introduction

Local Government is an autonomous local body which is free from interferences by the Governement in certain matters but for survival and success it has to depend upon the government.

Local Government is defined as "authority to determine and execute measures within a restricted area inside and smaller than the Whole state"- Encyclopaedia Britannica.

In the words of B.K.Gokhale, Local Governemnt is "the Government of a specified locality by the local people through the representatives elected by them"

Above definitions exhibit the fact that the Local Government is partly autonomous and deals with matters of particular locality.

Features of Local Government

Both Urban and Rural local government has similar features such as:

- It is a territorial, non-sovereign community.
- It has a right to regulate its own affairs.
- It can act independently on its own and
- It allows the local community to participate in its own affairs.

Role of Local Government

As local government has to act for the welfare of the public and for development of the nation, it has certain roles:

- Democratic role: As democracy is possible only when there is public participation, Local Government provides the number of opportunities to the public to take part in its functions.
- Educative role: Local Government is a best educator and also an effective method of public education in public affairs.
- Civic role: Local Government provides civic amenities to the mass.
- Managerial role: As procedures and methods of Local Government are simple, it can easily manage its matters.
- Administrative role: According to the changing conditions and environment Local Government can easily alter its rules and regulations.
- Subordinate role: As Local Governemnt is the agent of both State and Central Governments, it carries out the developmental programmes and projects provided to it.

Municipal corporation: It is created in order to provide conveniences for the community. It has to fulfil the necessities of the public. Municipal corporation is assigned with two types of functions that is legislative and administrative functions delegated by the State Goevernment. The main functions are :

Obligatory Functions: These include supply of water supply, construction and maintenance of water works, Electricity, Road transport service, construction and maintenance of public streets, Removal & disposal of filth& rubbish, Lighting, watering and cleaning of public streets and public

places, construction, maintenance and cleaning of drains & drainage work of public latrines & urinals, Registration of Births and Deaths, Maintenance of fire brigades, provision of primary and Nursery Education.

Discretionary Functions: These include Construction of public parks, gardens, libraries, theatres, Public housing, conducting census and surveys, Undertaking community development programmes, Conducting Industrial and commercial activities.

Municipal Finance

Finance is the most important for any government. Without finance no administration can be carried on. Municipal corporations are provided with some sources of revenues which include:

- Own revenues including both tax revenues and Non-tax revenues.
- Grants,assigned fees, Devolution fund by the State and Central Governments.
- Loans and other receipts including lapsed deposits, fines, fees, rent on tools& plants etc.

Expenditures

Municpal expenditures are classified as Revenue and Capital Expenditures.

- Revenue expenses includes Establishment, Administrative, operating & maintenance and Interest on on Loans
- Capital expenditures include Expenses for Capital formation and Expenses on principal repayment.

Statement of the problem:

As Municipal Corporation has to render services to the society, there has been inequlity in Tax revenue and Non-tax revenues. Sources of revenues are inadequate to meet out the expenditures of municipal corporations. There has been strict provisions in the tax implications by the Government. Therefore this study is undertaken to study the financial analysis of the Tirunelveli City Municipal Corporation using ratios. For this purpose the ratios are classified as Revenue ratios, Expenditure ratio, and Budget solvency ratios.

Objectives of the Study

- To evaluate the financial analysis of of the Tirunelveli City Municpal Corporation using ratios.
- To analyse the influence of revenue ratio and expenditure ratio on operating ratio using simple regression.

Hypotheses

H_0 : Tax revenue ratio does not significantly influences the operating ratio of Tirunelveli City Municipal corporation.

1. H_0 : Total Expenditure ratio does not significantly influences the operating ratio of Tirunelveli City Municipal corporation

Methodology

For the purpose of evaluating the financial analysis of the corporation the collection of the data is based on secondary sources. The researcher referred mainly the Audited financial statements of the corporation. Reviews are based on articles, magazines and the annual report of the corporation. Financial tool in the form of ratios and statistical tool, simple regression are used as yardsticks for analysis.

Profile of Tirunelveli City Municipal Corporation (TCMC)

Tirunelveli is also called as 'Nellai' is situated in the outskirts of the city of Adichanallur. It is an ancient city having some archaeological excavations. It is the second capital of Pandya kings. In the year(900-1200)it had been important city of Vijayanagar empire. According to 2001 census it has a population of 4,11,831.

General Administration of TCMC

It was constituted as Municipality in the year 1864 and on 1.6.94 it was reconstituted as Tirunelveli City Municipal Corporation.Area limit are Tirunelveli, Palayam kottai, Melapalayam, and 15 village panchayats.

Committees: Accounts standing committee, Taxation Finance committee, Education, Public health,Town planning, Works committee, and Ward committees,

Accounts Department activities: Preparation and submission of annual accounts are their main activities. Usually Municipal corporations maintain their accounts on accrual basis and three funds are divided in order to prepare the accounts. They are General Revenue Fund(GRF). Water suplly &Drainage Fund(WS&DF) and Elementary Education Fund(EEF).

Review of Literature

It helps to understand the past trend that has been made in the research work. This study helps the researcher to know the area in which the research is to be concentrated. Therefore the following reviews are taken from articles and thesis.

Kusum Lata Kedia in his research work" A Study of Municipal Finance of Varanasi Division" had stated that only in the year 1978-79, the contribution of property tax was 10.40%. For this purpose the researcher had taken 1951-52 to 1978-79 as his study period.

Dr. N.M Makandar in his article titled"Financial performance of selected city municipal corporations in Karnataka" examined the changes in revenues and Expenditures of three municipalities and analysed the growth rate of total income and total expenses. He had used growth rate as his measure for analysis.

" Modelling Local Government Financial conditions in Indonesia" by Irwan Taufiq Ritonga-2014 stressed that financial condition of Local Government has also been affected by demand and supply framework framed by municipalities.

Results and Discussions

For the purpose of evaluating the financial analysis of Tirunelveli City Municipal Corporation the ratios have been classified as Tax revenue to total Income Ratio, Non-Tax revenue to Total Income Ratio, Operating Ratio and Surplus/Deficit Ratios.

$$\text{Tax Revenue to Total Revenue Ratio} = \frac{\text{Revenue}}{\text{Total Revenue}} \times 100$$

Source: Audited Annual Accounts of Thirunelveli City Muni.Corpn.

Table: 1-A Tax Revenue ratio

Year	Tax revenue (Rs.in crores)	Total revenue (Rs.in crores)	Ratio (%)
2012-13	25.63	94.05	27.25
2013-14	29.77	131.83	22.58
2014-15	30.36	124.68	24.35
2015-16	32.29	145.03	22.26
2016-17	33.34	157.23	21.20

Table.1-A clearly shows that the tax revenue ratio of this Municipal Corporation is fluctuated throughout the study period. It is at 27.25% in the year 2012-13 and finally reduced in the year 2016-17 at 21.20%.

Non-Tax revenue to Total Income Ratio: This ratio denotes the proportion of Non –tax revenue in total revenue. Non-Tax revenue includes Service charges collected by this fund, Devolution fund, Grants and contributions received from the Government, Interest on Investments etc. A high ratio is considered as good.

$$\text{Non-Tax Revenue}$$

$$\text{Non-Tax Revenue to Total Revenue Ratio} = \frac{\text{Non-Tax Revenue}}{\text{Total Revenue}} \times 100$$

Table:1-B Non-Tax Revenue to Total Revenue Ratio

Year	Non-tax revenue (Rs.in crores)	Total Revenue (Rs.in crores)	Ratio (%)
2012-13	68.42	94.05	72.75
2013-14	102.06	131.83	77.42
2014-15	94.32	124.68	75.65
2015-16	112.74	145.03	77.74
2016-17	123.89	157.23	78.80

Source: Audited Annual Accounts of Thirunelveli City Muni.Corpn.

It is understood from table.1-B, the Non-tax revenue ratio is at 72.75% in the year 2012-13 and reduced to 75.65% in 2014-15 and from 2015-16 it has exhibited an increasing trend due to increase in the non-tax revenue.

Operating Ratio:

This ratio refers to the operating efficiency of the concern. Ratio more than 1 is considered as satisfactory as total income is sufficient to meet out the expenditures

$$\text{Operating Ratio} = \frac{\text{Total Revenue}}{\text{Total Expenditures.}}$$

Table: 1-C Operating Ratio

Year	Total Revenue (Rs.in crores)	Total Expenditure (Rs.in crores)	Operating ratio(in times)
2012-13	94.05	104.20	0.90
2013-14	131.83	132.60	0.99
2014-15	124.68	162.53	0.77
2015-16	145.03	174.66	0.83
2016-17	157.23	159.98	0.98

Source: Audited Annual Accounts of Thirunelveli City Muni.Corpn.

Table 1-C discloses the fact that the operating ratio of TCMC is not good as the ratio is less than 1 throughout the study period. But from the year 20014-15 it has been in upward trend. This is because of the increase in both tax and non-tax revenues in the year 2016-17 and reduction in the expenditure in the last year.

Table.1-D Total Expenditure Ratio.

Year	Total Expenditure (Rs.in crores)	Total Revenue (Rs.in crores)	Ratio (%)
2012-13	104.20	94.05	110.79
2013-14	132.60	131.83	100.58
2014-15	162.53	124.68	130.36
2015-16	174.66	145.03	120.43
2016-17	159.98	157.23	101.75

Source: Audited Annual Accounts of Thirunelveli City Muni.Corpn.

From table.1-D, it is understood that the total expenditure ratio has also shown fluctuations throughout the study period. It is exhibited at 110.79% in the year 2012-13 and raised to 130.36% in the year 2014-15, and finally reduced to 101.75% in the year 2016-17 due to increase in both tax revenue and non-tax revenues.

Simple Regression Analysis

To find out whether tax revenue ratio influences the operating ratio of the TCMC simple regression is applied. For this Operating ratio is taken as dependent variable and tax revenue ratio as independent variable as operating ratio helps the corporation to find out whether there is surplus or deficit and also it shows the performance of the corporation.

Hypothesis

H_0 : Tax revenue ratio does not significantly influences the operating ratio of Tirunelveli City Municipal corporation.

H_1 : Tax revenue ratio significantly influences the operating ratio of Tirunelveli CitMunicipal corporation.

Table.1-E Regression of Tax revenue ratio on Operating ratio

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	0.322	0.103	-0.195	0.10390	

ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig
Regression	0.004	1	0.004	0.346	0.598
Residual	0.032	3	0.011		
Total	0.036	4			

Source: SPSS Package

Table 1-E shows that as p- value is greater at 5% level of significance the hypothesis is accepted. That is tax revenue ratio does not significantly influences the operating ratio of TCMC.

Hypothesis:

H_0 : Non-Tax revenue ratio does not significantly influences the operating ratio of Tirunelveli City Municipal corporation.

H_1 : Non-Tax revenue ratio significantly influences the operating ratio of Tirunelveli City Municipal corporation.

Table.1-F Regression of Non-tax revenue ratio on Operating ratio

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	0.244	0.060	-0.254	0.10640	

ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig
Regression	0.002	1	0.002	0.190	0.692
Residual	0.034	3	0.011		
Total	0.036	4			

Source: SPSS Package

Table 1-F shows that as p- value is greater at 5% level of significance the hypothesis is accepted. That is non-tax revenue ratio does not significantly influences the operating ratio of TCMC.

Findings, Suggestions and Conclusion

When financial analysis of TCMC is evaluated, it is found that throughout the study period there has been deficit situation in the Corporation as the operating ratio is less than 1. This is due to heavy expenses met out in the first three years. But in the last two years of the study period the ratio has shown an increasing trend. This indirectly points out that in the fourth coming years the Corporation will show surplus. When simple regression is calculated both tax revenue ratio and non-tax revenue ratio do not significantly influences the operating ratio of TCMC..

Suggestion

It is therefore suggested that TCMC must follow certain policies to collect the taxes from various sources. More Grants and concessions can be provided by the Government so as to increase the rate of operating ratio..

Conclusion

To conclude the financial analysis of TCMC is not bad. To meet out the expenditures the resources available are very slender. In order to raise the revenues, sharing of taxes must be in equal proportion to functions assigned. Allocation of funds should also be in tune with National or State plans. If the Government provides certain powers and along with certain grants and concessions this municipal corporation will render efficient services and there will be development in the corporation.

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ON RESPONSES OF IGF-I TO ENDOGENOUS RAISING IN GROWTH HORMONE AFTER HEAVY RESISTANCE EXERCISE USING NEW GENERALIZED EXPONENTIAL DISTRIBUTION

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ABSTRACT

The Generalized Exponential Distribution (GED) is one of popular stochastic mathematical model through its wide applicability. In this study, we have selected the real time data for the responses of spontaneous increase in growth Hormone after heavy-resistance exercise (HRE). The levels of probability density function, survival function and hazard function of Generalized Exponential Distribution are shown in the results. The obtained statistical results are matches with the life time data. In this manuscript, it has been recorded that the Generalized Exponential Distribution could be an accepted stochastic model to express the life time data.

Keywords: *GH, Exponential, Parameters, Hazard function, survival function.*

INTRODUCTION

The Generalized exponential distribution is known that an extreme value distribution and received an important research area in the last few years mainly, in extreme value analysis of extreme events. In 1895, Karl Pearson has described the family of gamma distributions Balakrishnan and Basu [1]. Exponential distributions are more attractive method in statistical modelling which gives an efficient method of commencing a spared shape parameter for the standard distribution to attain flexibility and robustness. Exponential Distribution is well connected towards the Poisson process. The time in the middle of two consecutive Poisson events obeys the Exponential Distribution and it was invoked by Kondo [2] as Pearson's Type X distribution. Weibull [4], Teissier [3], The Weibull distributions have numerous applications in life-time data analysis and reliability engineering [4].

In the present study, we were implicated to develop a stochastic model using life time data of insulin like growth hormones. Human body is made up of many tissues that are responsible for growth among which a few organs concentrate on IGF. Liver serves as the important factor of circulating IGF-I, while high concentrations are circulated by serum [7]. Shoot up in IGF-I levels circulations is not just by simple instigation of IGF-I release, stored in the liver or more tissues. IGF are composite structures and has high-affinity binding proteins (BIP). Characterization of six definite BIP are given in [9] out of which four of them are found in serum. Over 90% are constrained in 150-kDa complex that presumes IGF-I or -11, BIP 3 along with an acid-labile subunit. BIPs are distinctively balanced and perform independent functions in varied tissues and cells. Main endocrine stimulant for IGF-I generation is growth hormone (GH), that mediates IGF-I synthesis, fusion of segments of 150-kDa complex of IGF-I and BIP. Almost all IGF-I actions are moderated by IGF-I receptor [9].

In this article, we have discussed the lifetime data from [6], using generalized exponential distribution [5] for selected parameters with modifications to acquire the clear interpretations on hazard function and survival functions.

METHODOLOGY

Generalized exponential distribution (GED)

A continuous r.v. X with probability density function

$$f(x) = \begin{cases} \beta e^{-\beta x} & if\ x \geq 0 \\ 0 & if\ \ x < 0 \end{cases} \qquad \beta > 0,$$

is presumed to follow exponential distribution.

GED has probability density function

$$f(x, \alpha, \beta) = \alpha\beta\left(1 - e^{-\beta x}\right)^{\alpha-1} e^{-\beta x}, \qquad x > 0\ for\ \ \alpha, \beta > 0$$

$$f(x, \alpha, \beta) = 0, otherwise$$

MGF is

$$M_X(t) = E(e^{tX}) = \int_0^{\infty} e^{tx}\ \alpha\beta\left(1 - e^{-\beta x}\right)^{\alpha-1} e^{-\beta x}\, dx$$

$$= \alpha B\left(\propto, 1 - \frac{t}{\beta}\right),$$

Where $B(m,n) = \int_0^1 y^{n-1}(1-y)^{m-1}dy$

Replacing β *by* $1/\lambda$ and x by $(x-\mu)$, GED obtained is

$$f(x,\alpha,\lambda,\mu) = \frac{\alpha}{\lambda}\left(1 - e^{-(\alpha-1)/\lambda}\right)^{\alpha-1} e^{-(\alpha-1)/\lambda}$$

$x > \lambda. \alpha > 0, \lambda > 0.$

Extensions of GED

Major reason of the present research work is exposure of appealing extensions of GED in several ways and analyzing the instant generating functions. GED is defined with a latest criterion $k > 0$ and is called k-GED. It has been proven the following result that combines GED as an extraordinary instance.

Theorem: 1.

Let X be a r.v. of continuous type (CT) and let $\alpha, \beta > 0$ and $k > 0$ be the criteria. Then,

$$f(x,\propto,\beta,k) = \propto \beta\left(1 - e^{-\beta x/k}\right)^{\alpha-1} x^{k-1} e^{-\beta x/k}, x > 0$$

$f(x,\propto,\beta,k) = 0,$ elsewhere is the p.d.f of r.v. X of CT.

Remark 1: If $k = 1$, it becomes GED. By above theorem, clearly

$$f(x,\propto,\beta,k) \geq 0\ \forall\ x > 0, \propto > 0, \beta > 0, k > 0.$$

Now $\int_0^{\propto} f(x,\propto,\beta,k)dx$

$$= \int_0^{\propto} \propto \beta\left(1 - e^{-\beta x/k}\right)^{\alpha-1} x^{k-1} e^{-\beta x/k}\, dx$$

$$= \propto \int_0^{\propto} \left(1 - e^{-\beta x/k}\right)^{\alpha-1}\left(x^{k-1} e^{-\beta x/k}\right) d$$

$$\propto \left[\frac{\left(1 - e^{-\beta x/k}\right)^{\alpha}}{\propto}\right]_0^{\propto}$$

$$= \left[\left[\left(1 - e^{e^{-\beta x/k}}\right)^{\alpha}\right]\right]_0^{\infty}$$

Hence $f(x,\alpha,\beta,k)$ is a PDF of r,v. X of CT.

GED is constructed by using new variable developed from Weibull distribution. Some of the theorem and remarks are given here.

Theorem: 2.

Let X be a r.v. of CT, $\alpha, \beta > 0$ and $k > 0$ be the criteria. Then

$$f\ (x,\alpha,\beta,k) = k\alpha\beta\left(1 - e^{-\beta x^k}\right)^{\alpha-1} x^{k-1}\, e^{-\beta x^k}\ 0 < x < \infty$$

$$f\ (x,\alpha,\beta,k) = 0, elsewhere,$$

is p.d.f. of r.v. X of CT.

Remark: 2. If $k = 1$, K- GE is reduced to classical ED.

From previous theorem,

$$f(x,\alpha,\beta,k) \geq 0 \forall x > 0, \propto > 0, \beta > 0, k > 0.$$

$$\int_0^{\propto} f(x,\propto,\beta,k)dx$$

$$= k\alpha\beta \int_0^{\infty}\left(1 - e^{-\beta x^k}\right)^{\alpha-1} x^{k-1}\, e^{-\beta x^k} dx$$

$$= \alpha \int_0^{\propto}\left(1 - e^{-\beta x/k}\right)^{\alpha-1}(k\beta x^{k-1}) e^{-\beta x^k})\, dx$$

$$\propto \left[\frac{\left(1 - e^{-\beta x/k}\right)^{\alpha}}{\propto}\right]_0^{\propto} = \left[\left[\left(1 - e^{e^{-\beta x/k}}\right)^{\alpha}\right]\right]_0^{\infty}$$

=1 - 0 = 1.

Hence $f(x, \propto, \beta, k)$ is a p.d.f. of r.v. X of CT.

Theorem: 3.

Let X be a continuous r.v. Then

$$f(x, \alpha, \beta, \delta) = \frac{\alpha\beta\delta}{1-(1-\delta)^{\alpha}}\left(1 - \delta e^{-\beta x}\right)^{\alpha-1} e^{-\beta x}$$

$$x > 0, \alpha > 0, \beta > 0, 0 < \delta \leq 1,$$

$$f(x, \alpha, \beta, \delta) = 0,$$

otherwise is p.d.f. of r.v. X of CT. [5]

The m.g.f. of the above Theorem as in [5] is,

$$B_{\delta} = \frac{\alpha}{(1-(1-\delta)^{\alpha})} B_{\delta}\left(\alpha, 1 - \frac{t}{\beta}\right)$$

where

$$= B_{\delta}(m, n) = \int_0^1 (1-\delta y)^{m-1} y^{n-1} dy.$$

$$m > 0, n > 0, 0 < \delta \leq 1.$$

Remark: 3. If $\delta = 1$,

$$B_1(m, n) = \int_0^1 (1-y)^{m-1} y^{n-1} dy$$

$$= B(m, n).$$

$$f(x, \alpha, \beta, k) = p(X \leq x)$$

$$= \int_0^x f(x, \propto, \beta, x) dx$$

$$=(1 - e^{-\beta x^{k/K}})^{\propto},$$

$$x > 0, \propto > 0 >, \beta > 0.$$

The survival function

$$S(x, \propto, \beta, k) = 1 - F(x, \propto, \beta, k)$$

$$=1 - (1 - e^{-\beta x^{k/K}})^{\propto}, x > 0$$

The hazard rate $h(x, \alpha, \beta, k)$is

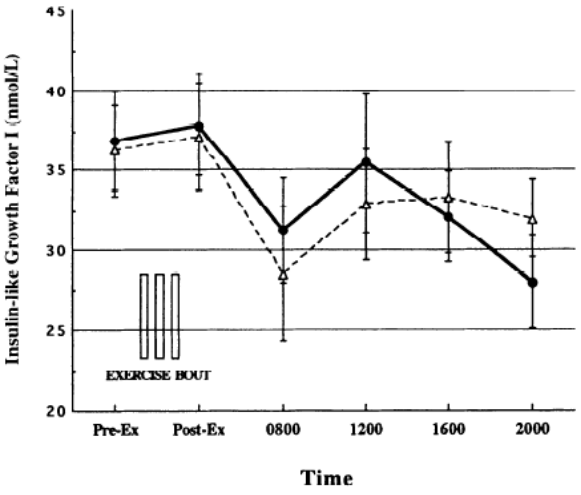
$$S(x, \propto, \beta, k) = \frac{F(x, \propto, \beta, k)}{S(x, \propto, \beta, k)}$$

$$= \frac{(1-e^{-\beta x^{k/K}})^{\propto} x^{k-1} e^{-\beta x^{k/K}}}{1-(1-e^{-\beta x^{k/K}})^{\propto}}, x > 0.$$

APPLICATION

Background

To establish a GED, the life time data was taken from [6]. Seven lively men came forward and gave written willingness to take part in the activities. The characteristics of the participants were: age 23.1 t 2.4 yr, height 170.1 t 4.0 cm, body mass 74.4 2 10.3 kg, and body fat 10.3 t 2.5%. The participated individuals' weight was 23kg to 30kg. A descriptive data collection for each and every participant was completed in day by day. Please refer [6] for detailed description for methodology. In this study, we have considered the following information (indicated in Medical Figure 1) to develop a stochastic model.



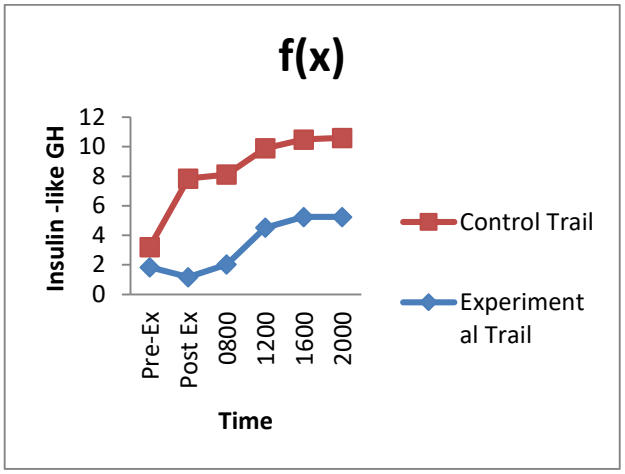
Medical figure 1

MATHEMATICAL RESULTS

The p.d.f of the GED

Probability density functions $f(x)$ of generalized exponential distribution analysis in Response of total IGF -1 hormone concentrations while at rest and for HRE protocol at different intervals of time when in control and for experimental trials is shown in mathematical figure 1. Generalized exponential distribution probability density function plots reveals that the IGF levels are evaluated for the corresponding problem in Pre-Ex, Post-Ex, 0800, 1200, 1600 and 2000 min. Probability density function $f(x)$ plots

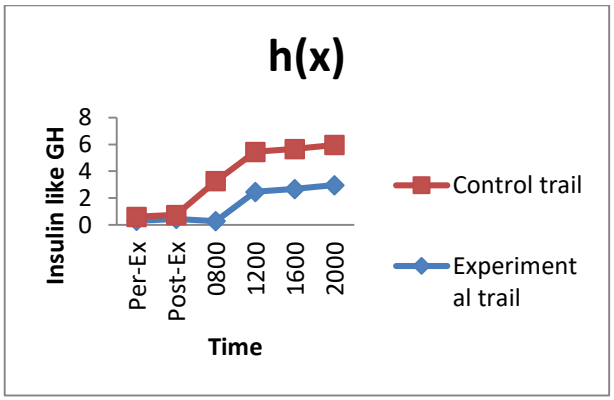
shows that the levels are increased in control and experimental trails.



Mathematical fig 1

The Hazard function of the generalized exponential distribution

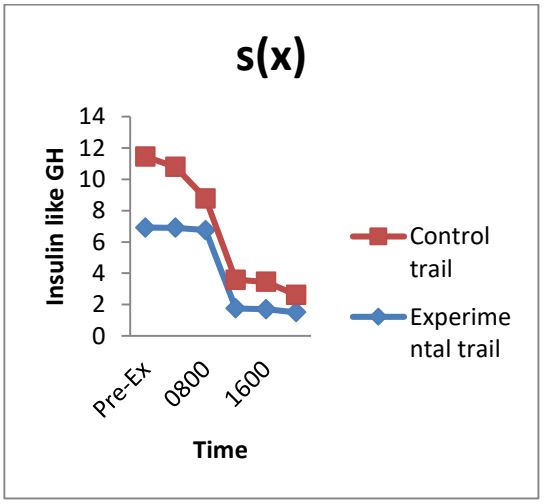
Mathematical Figure.2 represents the mathematical graphical levels of hazard rate function for Response of total IGF -1 hormone concentrations while at rest and for HRE protocol at different intervals of time Pre-Ex, Post-Ex, 0800, 1200, 1600 and 2000 min time intervals. Hazard function $h(x)$ plots show increased IGF levels within control and experimental trials.



Mathematical fig 2

The Survival function of the generalized exponential distribution

Mathematical Figure.3 shows the mathematical graphical levels of survival function for Response of total IGF -1 hormone concentrations while at rest and to HRE protocol as compared with the control and experimental trials Pre-Ex, Post-Ex, 0800, 1200, 1600 and 2000 min time intervals. Survival function $S(x)$ plots shows decreased level of IGF in both control and experimental trials



Mathematical fig 3

DISCUSSION

Statistical distributions are invariably used in perceiving and anticipating the real time general phenomena out of which is extreme value distribution. It is extensively used to model lifetime data and natural circumstances. In this article, evaluation of responses in total IGF -1 hormone concentrations while at rest to HRE protocol as compared with the control and experimental trials Pre-Ex, Post-Ex, 0800, 1200, 1600 and 2000 min time intervals by using mathematical model of generalized exponential distribution is carried out. Here, we use selected value parameters $\alpha, \beta > 0$ and $k > 0$. The probability density function $f(x)$ of control and experimental levels of IGF hormone concentrations while at rest to HRE protocol shown in mathematical figure 1. The evaluated Hazard function $h(x)$ of control and experimental levels of IGF hormone concentrations at rest and to HRE protocol of its graphical results is shown in mathematical figure 2 and survival function plot is shown in mathematical figure 3. The above results are evaluated at various times in minutes Pre-Ex, Post-Ex, 0800, 1200, 1600 and 2000 min. Suggesting that the degree to which the result of a measurement, calculation, or specification are depended on to be accurate and consistently well.

CONCLUSION

In conclusion, we have explicated the mathematical expressions for some of its essential stochastic characteristics like probability density function, hazard function and survival function. The obtained results reveal that in IGF -1 hormone concentrations while at rest to HRE protocol as compared with the control and experimental trials Pre-Ex, Post-Ex, 0800, 1200, 1600 and 2000 min. In this paper, we have given mathematical plots for control and experimental trials levels for the corresponding medical problem in the particular times.

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DEEP LEARNING FOR LUNG NODULE CLASSIFICATION: A TECHNICAL REVIEW

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ABSTRACT

Convolutional networks, in particular, have swiftly risen to popularity as the primary way for analysing medical images. In recent years, however, various deep learning algorithms have been utilised in lung nodule classification, with outstanding results when compared to many other state-of-the-art approaches. Multiple deep learning algorithms for lung nodule classification have been employed in the past, as well as adjustments used to deep learning design to improve the classification program's accuracy, are shown in this study and also discuss the main deep learning ideas related to medical image analysis and contribute to the conclusion that new nodule classification issues must be solved in order to detect cancerous tumours early.

Keywords— *Lung Nodule Classification, Deep Learning, Medical Imaging.*

Introduction

Deep learning (DL) has been commonly used in a range of medical imaging challenges and has gained improved process in a number of medical application areas, ushering us into the artificial intelligence (AI) era. Medical imaging, on the other hand, poses special obstacles to DL strategies. Lung cancer are among the most dangerous and widespread forms of cancer in the world, in terms of both new patients and fatalities. Lung cancer survival has improved significantly over the last decade, from a median overall survival of 11 months to a 17.8% 5-year survival rate. Early identification and treatment of lung cancer improves the sufferer's chances of survival. Lung cancer diagnosis requires classifying tumours as benign or malignant, which is achieved using image mining techniques known as classification. Image classification is the primary domain wherein Deep Neural Networks play the most essential role in medical image processing. [1] Sensibly identifying image by subject is a vital way to collect helpful info from wide image set. The classification module in the mining method is typically called classifier. The object detection problem, which is concerned with classification of images, is one of the most important problems in computer vision. The numerical properties of different image features are evaluated, and data is grouped into categories. Most innovative classification methods, such as fuzzy sets, artificial neural networks, and expert systems, have been commonly used for image classification in recent years, and each of them has its own set of issues and has a lower rate of precision. Cancers are graded clinically as small-cell lung carcinoma (SCLC) or non-small-cell lung carcinoma (NSCLC), with SCLCs accounted for 15% of the overall lung cancer population and NSCLCs accounting for 85%. [4] Adenocarcinoma, Squamous-cell carcinoma, and Large-cell carcinoma are the three subtypes of NSCLC. Adenocarcinoma is by far the most common form of lung cancer, accounting for 40% of all lung cancer cases. For prognostication and treatment planning, it is essential to categorise the

form of malignancy based on histopathology and immunohistochemistry as shown in Figure 1. [3]

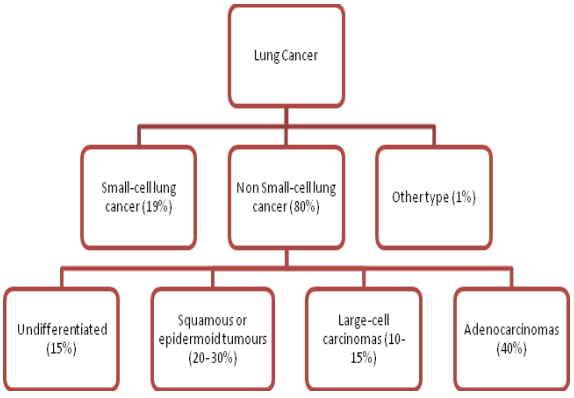

Figure: 1. Classifications of Lung Tumors

USE FOR A DIAGNOSTIC TOOL

Sadly, lung cancer signs occur early in the disease's development, when it is no longer treatable. After all, there are two main concerns to consider: (1) Failure to understand lung cancer's presenting signs and (2) Taking longer to finish diagnostic investigations. [3] About two-thirds of people had advanced lung tumours at the time of surgery, according to a survey published in Southern Norway (stage IIIB and IV). Delays in medical imaging result in a rise in tumor size and level, which has a negative effect on lung cancer diagnosis. [5]

To diagnose and stage lung cancer, a chest X-ray, CE-CT (Contrast-Enhanced Computed Tomography), Computed Tomography (CT) Scan, MRI, Positron Emission Tomography (PET) Scan, and other research methods can be used. While chest X-rays have been used for screening, they have not proven to be successful in detecting tumors early. Low-dose CT scans (LDCTs) have been used in recent years to screen people that are at a higher risk of cancer in the future. The term "screening" refers to a procedure that is used to diagnose illness in individuals that have not yet received treatment. LDCT scans may aid in the detection of unhealthy areas in the lungs that may be cancerous.

DEEP LEARNING

Deep learning has increased in popularity as a branch of machine learning in recent years. Deep neural networks have obtained impressive results in the fields of face recognition, object detection and image classification thanks to a vast amount of available data and the powerful computing strength of GPUs, as well as other images, and it's also been applied to disease diagnosis. The key issues with increasing network depth in the deep learning process are gradient explosion and gradient disappearance. Data normalization and initialization is the traditional solution to the gradient problem, which solves the problem but degrades network output. While the depth has increased, the failure rate has risen. There are several different types of images used in medical imaging, but computer tomography (CT) +scans are usually favored because they all have less noise. Deep learning has been shown to be the most effective tool for classifying diagnostic imaging entities and extracting features. Many researchers have suggested many types of deep learning architectures to classify lung disease.

Today, a number of deep learning networks are in use, including: Recurrent Neural Network (RNN), Deep Boltzmann Machine (DBM), Auto encoder, Convolution Neural Network (CNN) and many more. [3] Below mention different Architectures for Deep Learning shown in Figure 2.

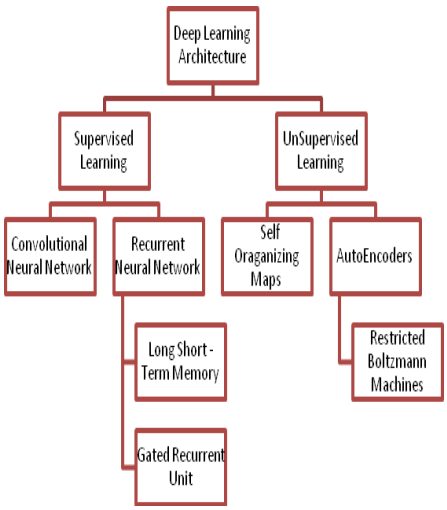

Figure: 2. Architecture for Deep Learning

According to Figure2, Deep learning is not really a single technique, but instead a set of algorithms and optimization techniques that can be used to solve a variety of problems. Learning is focused on training the neural network with example data and rewarding them based on their performance; the more data available, the better. The fundamental architecture of deep learning is the artificial intelligence system (ANN). ANN has led to the development of a number of algorithm variations. To gain a basic understanding of deep learning and artificial neural networks.

The problem space in which the goal to be determined is explicitly labeled inside the training data is referred to as supervised learning. Recurrent neural networks and Convolutional neural networks, as well as

some of their variants, are the most common supervised deep learning architectures. A CNN is a layered neural network which was motivated by the visual cortex of animals. In image processing tasks, the structure is especially useful. The RNN is one of the fundamental access networks that other learning algorithms are designed, The key difference between a traditional a recurrent network and multilayer network is that a recurrent network may have connections that feed back into previous layers rather than being fully feed-forward. By using traditional neuron-based neural networks, the LSTM used the idea of a memory cell. As a feature of its inputs, the processing unit will maintain its value for a short or long time, allows cells to recognize what's essential rather than just its last calculated value. Current CNN and LSTM applications have resulted in video and image captioning systems that caption images and videos in linguistic form. The image and video processing is done by the CNN, and the LSTM is learned to translate the CNN performance into linguistic form. The GRU is easier than the LSTM, can be learned faster, and can execute tasks more efficiently. The LSTM, on the other hand, can become more informative, and with much more details, it can yield different results.

In Unsupervised learning applies to a given problem in which the data being used for training has no goal name, SOM (Self-organized map) is a neural network that reduces the size of the input data set to construct clusters. In many ways, SOMs differ from standard artificial neural networks. In Autoencoders is the type of ANN is consists of three layers: input, secret, and output, As during learning process, an error function is used to calculate the difference between both the input and output layers, and the weights are changed to mitigate the error. Since there is no details to which to evaluate the outputs, autoencoders use backward propagation to learn continuously. Autoencoders are known as self- supervised algorithms as a result of this. A two- layered neural network is referred to as an RBM (Restricted Boltzmann Machines). Input and secret layers are the frameworks. Each node in a noticeable network is connected to a nodes in a hidden units in RBMs. Nodes in the input and hidden layers are often linked in a typical Boltzmann Machine. In a RBM, nodes inside a level are not related due to its computational difficulty. RBMs are defined as generative models because the reproduced input is often different from the current source. In truth, that's the most important distinction between an autoencoder and a deterministic model. A guided graph links the nodes of a recurrent neural network, and the network remembers the previous input to estimate the output. [6] The recursive neural network is composed of RNN in which all inputs have the same set of weights. For natural language processing, both recurrent and recursive neural networks are used.[3] A Deep Convolution Network is a deep network comprised of many connected hidden layers of restricted Boltzmann machines, but the units within each layer are not linked. The DBN and the Deep Boltzmann Machine are both unsupervised learning mechanisms, but the hidden layers are linked in an undirected manner. Speech and image recognition are also possible with DBN. [7] Autoencoders are commonly used for image denoising and feature extraction. To extract features from images, a convolution neural network uses a series of convolution layers, followed by a completely full connection. A convolutional network that skips several layers is known as a Deep Residual Network. Convolution Restricted Boltzmann Machine (CRBM) is an acronym for Convolution Restricted Boltzmann Machine. In terms of image classification, CNN has proven to be the most successful. Over-fitting and processing time are two major problems with deep neural networks. When a network learns a sequence in the training set but is unable to learn patterns outside it, this is known as over fitting. As a result, the training set must be broad and well-balanced in order to cover all potential patterns that could happen in the real time.

DEEP LEARNING FOR LUNG NODULE CLASSIFICATION

A. Initial Considerations

In this figure.3 show that Benign (not Cancer) Tumor cells can only expand internally and cannot grow by metastatic disease or penetration. Malignant (cancer) tissues infiltrate neighboring tissues, join blood vessels, and spread to other parts of the body. Related to its violent nature and late diagnosis at advanced stages, Lung cancer is among the most common cancer-related death rates. Lung cancer is a type of cancer is critical for a person's life, and it is a difficult problem to solve. In most cases, computed tomography (CT) and chest radiographs (X-rays) scans are used to diagnose malignant nodules: The existence of benign nodules, on the other hand, can lead to erroneous judgments. The benign and malignant nodules have a striking similarity in their early stages. For lung nodule identification and classification, we used two deep three-dimensional (3D) customised mixed connection network (CMixNet) architectures, because of deep convolutional neural networks' (CNN) recent achievements in image analysis To detect nodules, a faster R-CNN based on features from CMixNet and U-Net, such as encoder–decoder architecture, was used. [8]

To help the surgeon make correct decisions, computer-assisted lung cancer detection is needed. The CAD success functions as a proper diagnosis for the radiologist, enhancing radiological diagnosis accuracy and reducing the time it takes to read an image. There are two types of CAD systems: 1) CADx (Computer Aided Diagnostic), 2) CADe

(Computer Aided Detection). CADe is used to analytic methods, while CADx is used to assess tumors malignancy and staging.

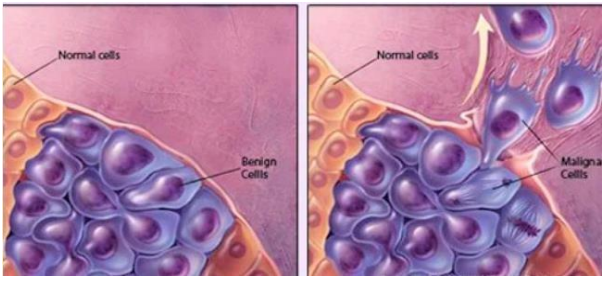

Figure: 3. Benign vs. Malignant Tumors

Machine Learning methods and techniques are commonly used in lung cancer diagnosis and prognosis. They can diagnose lung disease with just

0.11 mSv of radiation. At standard doses, For lung cancer detection, machine learning were found to have a sensitivity of 91.5–95.9%. [9]

The following are the two major concepts to lung nodule classifier: (1) Radiomics, that is based on extracting picture attributes from a lung CT scan.

(2) Neural Network - based with Convolutions (CNN). The model is developed using a radiomics method that extracts either 2D or 3D feature maps of lung nodules. To define the tumour, it also needs an effective Feature Extraction algorithm & Lung Segmentation. Another side, CNN does not always necessitate a feature extraction and segmentation stage. CNN, on the other hand, necessitates a very big dataset.

Picture Collection, Image Segmentation, Image Pre- processing, Lung Nodule Classification and Feature Extraction, and are the 5 steps in the Radiomics method to Lung Nodule Classification exhibited in fig 4. All of these systems has its own set of difficulties. For eg, the best image acquisition and reconstruction protocols must be defined and established. Segments must also be stable and require minimal operator feedback. Features must be produced that faithfully represent the difficulty of the specific quantities, but they must not be excessively complicated or duplicate. In addition, informatics databases allowing the inclusion of feature representation and annotations, as well as biological and personal data, must be developed.

After this, since radiomics is not a mature field of research, the computational methods used to interpret these data must be optimized. [10]

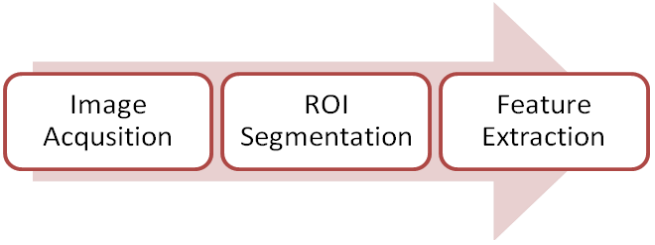

Figure: 4. The fundamentals of radiomic classification

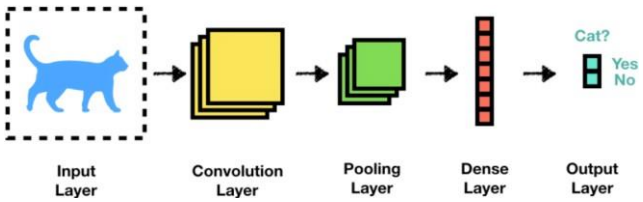

Figure: 5. The fundamentals of CNN classification

B. **CNN (Convolutional Neural Network)**

The key premises in using a deep Neural Network to classify a lung nodule. The information is transferred through a sequence of convolution operation with filters, pooling layers, completely connected layers, and soft - max layers in the CNN architecture exhibited in fig. 4. Classification of images requires extracting features from an image in order to classify trends in a dataset. Then use an ANN for image classification might be incredibly computationally expensive because the learnable parameters will become incredibly high.

Input layer

You may use an existing dataset or create your own image dataset to solve your own image classification task. Kaggle.com is a good place to start looking for datasets. You must create a tensor with the data's form. You can do this with the tf.reshape module. Throughout this module, they must announce the tensor to reshape as well as the tensor's form. A first statement is the data's characteristics, which are described in the function's argument.

Convolution Layer

It's the first stage, and it is responsible for extracting the various representations of the input images. In this layer, the convolution mathematical operation can be done between the input image and a filter of a particular size MxM. Sliding the filter over the input image yields the absolute value between both the filter and the parts of the input image in terms of the sum of the filter (MxM). The result is the Function diagram, which includes information about either the images corners and edges. This function vector is then moved on to other stages, which use the source images to learn a number of other features.

Pooling Layer

During a Convolutional Layer, a Pooling Layer is usually applied. The primary goal of this layer is to shrink the preprocessed feature map in order to minimize operational errors. These are achieved by decreasing the relationships between layers and operating on each feature map separately. Depending on the method, different forms of pooling activities exist.

In Max Pooling, the external wall is gathered from the feature diagram. Mean Pooling is used to measure the total of the elements in a pre - specified sized Image section. The total number of the items in the predefined section is calculated using Sum Merging. Between the Convolutional Layer and the FC Layer, the Pooling Layer typically acts as a connection.

Dense Layer

The title suggests that the neurons in a network layer are fully connected (dense). Growing neuron in a layers receives feedback from most of the neurons in the layer before it, making them densely linked. This layer is a completely associated layer, which means that each layer's neurons are connected to those in the next layer.

This layer learns features from so many previous layer's combinations, while a convolutional layer focuses on high level of performance with a small repetitive region.

Output Layer

As previously stated, the output layer in a CNN is a completely connected layer that flattens and sends the input from the other layers in order to convert the result into the class labels needed by the network.

RELATED WORK

Gowri Laksshmi et al. [1] proposed Entropy Weighted Residual Convolution Neural Network is used to complete the ensemble classification integration (EWRCNN). Finally, the findings are contrasted between the tests, and the addition of rule-based

classification increased the CAD system's detection accuracy as FP elimination with Faster R-CNN alone was lower. The goal of this review is to use CT and X-ray images to classify and predict the correct lung cancerous nodule.

Shabi M et al. [2] proposed a new approach for predicting the malignancy of nodules that uses a global feature extractor to analyse the size and shape of the nodule, as well as a local feature extractor to examine the nodule's density and composition. The deep Local–Global network can retrieve both locally and globally features with precision.

Panpan et al. [13] Studies in lung computed tomography (CT) images from the readily viewable LIDCIDRI database are used to validate this method. The ten-fold cross-validation approach GoogleNet, ShuffleNet, DenseNet, and MobileNetV2.The accuracy, sensitivity, specificity, and position under the receiver operator are all used to evaluate their efficiency. GoogleNet is the best CNN structure for CT lung tumour detection, **according to** research observations, with a precision of 94.53 percent, a yielded an average accuracy of 98.23% and a false positive rate of 1.65 percent. As compared with the traditional support vector machine (SVM)-based CAD scheme, our approach improved accuracy by 9.96%. In comparison to the InceptionV3 & VGG19 model convolutional neural networks, the number of false positives fell by 2.07% and 2.22 %, accordingly.

Meng et al. [16] To compare the clinical significance of a deep learning-based lung nodule segmentation and classification algorithm to other CT enhancement techniques. Another well approach was put to the test on 363 new tests using two parameters: density classification accuracy and nodule segmentation Dice coefficient. The variance analysis of various different modeling approaches was used to statistically evaluate the results under 3 different testing techniques. Under various CT modeling techniques, a deep learning algorithm combining 3D convolution neural network and recurrent neural network (rnn) has shown to be reasonably constant in segmentation and classification of lung nodules.

Trajanovski et al. [17] The deep learning - based model: (i) generalises well throughout all datasets, with AUCs ranging from 86 to 94 percent; (ii) outperforms the commonly used PanCan Risk Model, with an AUC of 11 percent higher; (iii) outperforms the state-of-the-art in lung transplantation as represented by the results of the Kaggle Data Science Bowl 2017 contest; (iv) performs similarly to radiologists in predicting cancer risk at the individual stage. Ashhar et al.

[18] To distinguish lung tumours into benign and malignant groups, researchers used LIDC- IDRI databases to test the efficiency of five newly established Convolutional Neural Network architectures: SqueezeNet, specificity of 99.06 percent, a sensitivity of 65.67 percent, and an AUC of 86.84 percent. Asuntha et al. [22] This study employs innovative Deep learning approach for detecting the position of tumour lung nodules. Learning is used to classify features in this case. FPSOCNN is a novel FPSOCNN that aims to minimize complexities of CNN. Wavelet transform-based functions, Histogram of directed Gradients (HoG), Local Binary Pattern (LBP), Scale Invariant Function Multimedia Tools Applications Transform (SIFT), and Zernike Moment are all used in this study. After removing the texture, the good function is chosen using a geometric, volumetric, and Fuzzy Particle Swarm Optimization (FPSO) algorithm.

Huang et al. [23] On CT scan images of the lung, an unique method merging DTCNN and ELM is suggested for effective and precise automatic benign–malignant nodules analysis. DTCNN has demonstrated an amazing high extraction performance, while ELM has also been suggested as an optimized and effective classifier. On the LIDC- IDRI dataset, the suggested DTCNN-ELM approach obtained a precision of 94.57 percent, and on the FAHGMU database, it achieve a precision of 100 percent.

Table 1: Image Recognition Techniques in Lung Nodules: A Comparison

Reference	Dataset	Techniques	Result
Panpan et al. [13]	LIDC-IDRI	SVM based CAD System	**Accuracy- 98.23%**
Naik et al. [14]	LUNA-16	CNN. SVM	Accuracy- 93.53% Sensitivity – 86.62% Specificity – 96.55%
Ali et al. [15]	LUNGx	SVM, Ada Boost M2 algorithm, Deep-CNN	Accuracy – 90.46%
Meng et al. [16]	Public dataset	3D-CNN, RNN	Accuracy- 98.67%
Trajanovski et al.[17]	NLST (National Lung Screening Trail)	CT Lung Screening	Accuracy – 94%
Ashhar et al. [18]	GoogleNet LIDC-IDRI	CNN, CT	Accuracy- 94.53% Sensitivity –65.67% Specificity – 99.06%
			AUC – 86.84%
Cohen et al.[19]	LIDC/IDRI/NLST	CNN features a 3D roto translation community	Sensitivity- 96.4%
Yang et al. [20]	LUNA 16	CNN Boosting	Sensitivity- 86.42%
Zuo et al. [21]	LUNA 16	MR-CNN	Accuracy- 97.33% Sensitivity –97.26% Specificity – 97.38%
Asuntha et al. [22]	LIDC & Private data	Fuzzy Particle Swarm Optimization(FPSO) & CNN	Accuracy- 95.62% Sensitivity –96.23% Specificity – 95.89%
Huang et al.[23]	LIDC-IDRI & FAM-GMU	Extreme Learning Machine & Deep transfer, CNN	Accuracy – 94.57%

CONCLUSION

Lung cancer is one of the most deadly diseases that have ever occurred. Sadly, once this disease has progressed to a significant degree or reached a critical point, it is extremely difficult to treat. Computer-Aided Detection (CAD) is a rapidly evolving technology that aids in the detection of cancer by feeding in specific inputs including patient-related data. The output of CNN architectures, such as GoogleNet, LIDC-IDRI, LUNA-16, NLST, as well as others, are studied and contrasted in order to distinguish between benign and malignant tumours in CT images of the lungs. As a result, further research is only needed to improve the accuracy of tumors in CT images.

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AN EMPIRICAL RELATIONSHIP BETWEEN THE HAZEN-WILLIAMS AND DARCY-WEISBACH EQUATIONS FOR FOUR TYPES OF PIPE MATERIAL

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ABSTRACT

This article presents an empirical relationship between Darcy-Weisbach and Hazen-Williams equations for four types of pipe materials (Ductile iron, GRP, concrete, and plastic) using WaterCAD V8i. Two hydraulic models have been developed to estimate the head loss in pipes of different diameters (from 800 mm to 1200 mm) for the flow rate (1.16 m^3/s), (from 1600 mm to 2000 mm) for the flow rate (4. 63 m^3/s). The head loss values obtained from the Darcy-Weisbach and Hazen-Williams equations were used to correlate them using IBM SPSS Statistics. The correlation coefficient between both equations turned out to be equal (0.991, 0.990, 1.00, and 1.00) for pipe materials (Ductile iron, GRP, concrete, and plastic). This relationship is very useful for designers in converting the head loss values obtained using these equations.

Keywords: *Hazen-Williams equation, Darcy-Weisbach equation, WaterCAD V8i, head loss, Correlation coefficient.*

INTRODUCTION

When designing systems for supplying and removing water in pressure conduits, it is necessary to know the hydraulic losses. This is the basis for the subsequent selection of pipe sizes and the necessary hydromechanical equipment to ensure the operation of the pipeline system [1]. The Hazen-Williams (H-W) and Darcy-Weisbach (D-W) formulas are the two most common drag equations for pressurized flow. Although the application of the former is quite widespread in practice, the latter has a much more reasonable basis and is acceptable in the academic literature [2] [3]. The empirical equation (H-W) uses a clear factor (C) for each type of pipe material. However, the coefficient of friction (f) of the dimensionally consistent equation (D-W) is a function of material property (absolute roughness,) and Reynolds number (Re) in turbulent flows, the most common flow regime in water networks [4]. Consequently, the manufacturer must verify the pipe performance using both equations to assure his customers that the product produced meets all applicable codes and standards. However, the frequency of using both equations varies. As mentioned by Rossman [5], equation (H-W) was developed only for water and is applicable for a pipe in which a turbulent flow is flowing, while equation (D-W) is applicable for all flow regimes and can be used for any type of fluid. However, the (H-W) equation is fairly easy to use compared to the other because all the parameters involved are readily available in the literature [6-13].

OBJECT OF THE STUDY

Find an empirical relationships between the Hazen-Williams and Darcy-Weisbach equations for various types of project pipes for transporting treated wastewater in the city of Karbala (Iraq) using the WaterCAD V8i program.

The Hazen-Williams and Darcy-Weisbach equations

The flow characteristics and frictional losses of the pipe must be within the specified range to make it suitable for commercial use. Various equations are available in the literature. For calculating pressure losses in pipes. However, Darcy-Weisbach and Hazen-Williams theory has gained widespread acceptance in fluid mechanics due to its proven accuracy compared to other equations.

Williams and Hazen (1933) empirically derived the Equation and this Formula is often used in the analysis of pressure pipeline systems (such as water distribution networks and sewers) [14]:

$$h_f = \frac{K\,L}{D^{4.87}}\left(\frac{Q}{C}\right)^{1.85}$$

Where: h_f- head loss (m), Q - section flow rate (m^3/ s), C - Hazen-Williams "capacity" coefficient, C value ranges from 80 for very coarse pipe to about 150 for smooth pipe, k - Constant (0.85 for SI units, 1.32 for US units), D - Pipe diameter (m), L - pipe length (m), g - gravitational acceleration constant (m / s2).

Due to its non-empirical origin, the Darcy-Weisbach equation is considered by many engineers as the most accurate method for modeling friction losses. Most often it takes the following form:

$$h_f = f\,\frac{L}{D}\frac{V^2}{2g}$$

Eq.2

Where: h_f- head loss (m), f - hydraulic resistance coefficient (Darcy-Weissbach friction coefficient), D - Pipe diameter (m), L - pipe length (m), V - flow velocity (m / s), g - constant of gravitational acceleration (m / s2).

We denote

$$f = 2\,f\left(Re, \frac{\Delta}{d}\right)$$

$$R_e = \frac{\rho v d}{\mu}$$

Eq.3

Eq.4

Where: $\boldsymbol{R_e}$ - Reynolds numbers (dimensionless), $\boldsymbol{\rho}$ - flow density ($\boldsymbol{kg}$ / $\boldsymbol{m3}$), $\boldsymbol{V}$ - average flow rate ($\boldsymbol{m}$ / $\boldsymbol{s}$), d - length index or pipe diameter ($\boldsymbol{m}$), $\boldsymbol{\mu}$ - dynamic viscosity ($\boldsymbol{kgm}$ /. $\boldsymbol{s}$), Δ - wall roughness ($\boldsymbol{m}$).

Recall that in the laminar flow regime:

$$f = \frac{64}{R_e}$$

Eq.5

However, for the transitional and turbulent flows for which Re ≥ 2000, friction factor is the main issue in the (D-W) equation. Colebrook (1939) proposed an implicit equation (Eq. 6) for the solution of f, which is known as Colebrook-White equation that is recognized to be the most accurate for the solution of Darcy's friction factor

$$\frac{1}{\sqrt{f}} = -2.0\,log\left(\frac{\varepsilon/_D}{3.72} + \frac{2.51}{R_e\sqrt{f}}\right)$$

Eq.1

where f is the friction factor (dimensionless), ε is the roughness height, D is the diameter of the pipe (m) and Re is Reynolds Number (dimensionless).

Experiments show that the energy loss in a turbulent fluid flow in pipes of constant cross-section (i.e., frictional head loss) is significantly higher than in a laminar one. This increase in hydraulic losses is caused by the formation of large vortices and their disintegration, turbulent mixing of significant masses of liquid and curvature of the trajectories and streamlines of motion of liquid particles. If, in a laminar flow regime, friction head losses increase in proportion to the velocity (and also to the flow rate) to the first degree, then during the transition to the turbulent regime, a certain jump in resistance is noticeable and then a steeper increase in the value of hf along a curve close to the second degree parabola [1].

RESEARCH METHOD

Information has been collected on the treated wastewater treatment plant in Karbala (Iraq), where the current flow is 1.16 m^3/s, and it is hoped that 4. 63 m^3/ s will complete the construction of the sewer network for the entire period. The two hydraulic models have been designed with these flow rates in mind and pipe diameters ranging from 800mm to 1200mm and 1600mm to 2000mm using WaterCAD V8i software. The head loss was estimated for each model for all considered materials and pipe diameters. The Re values calculated for the above flow conditions ranged from 1050735 to 1584063 for the first model and from 2905443 to 3645734 for the second model, indicating that the flow was turbulent in each model. This satisfies the condition of applicability of both equations (D-W) and (H-W), justifying a common basis for comparing the results of both equations. In addition, the head loss of the relationship between the two equations was found using IBM SPSS Statistics. As shown in the following picture:

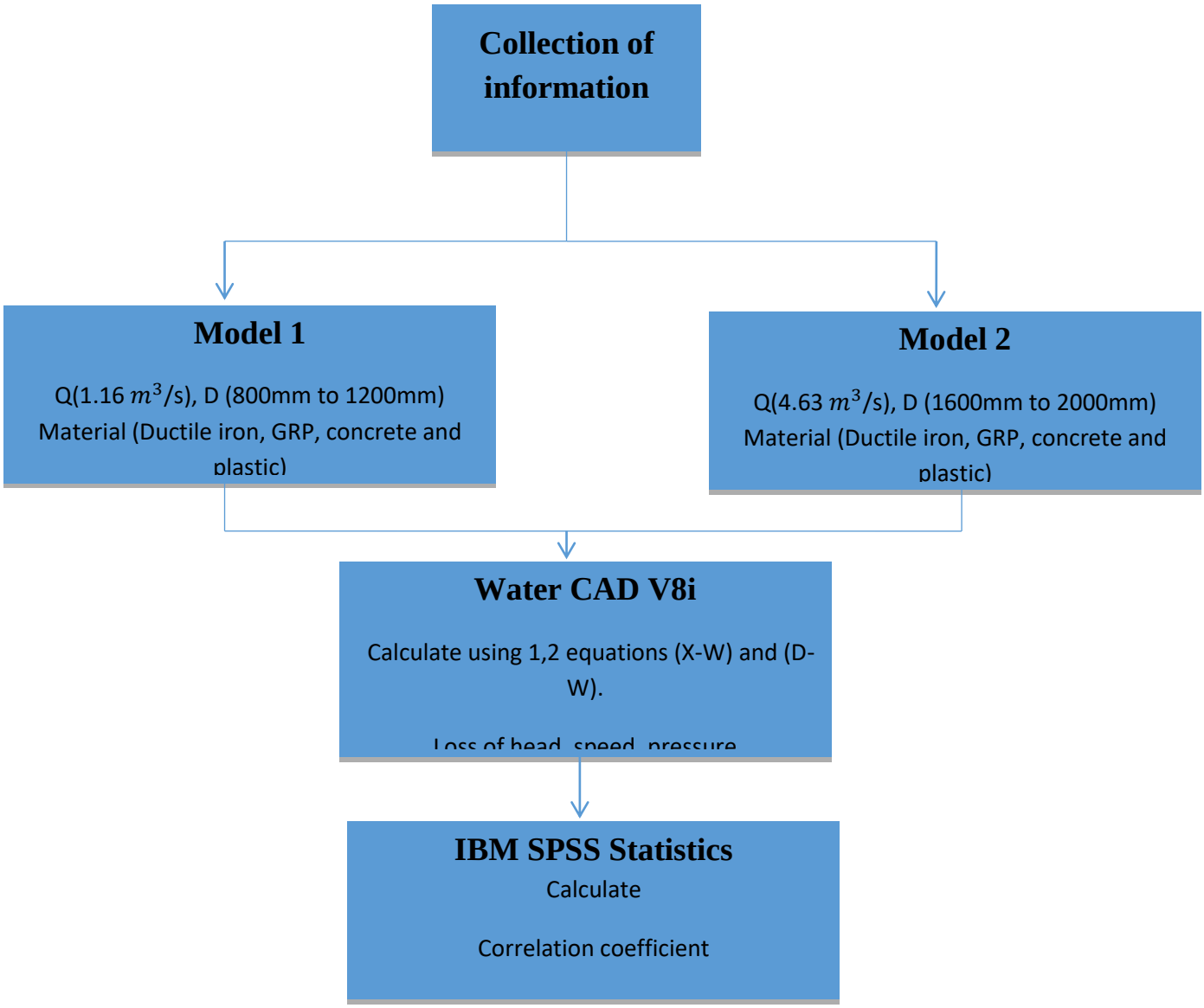


Fig. 2. Research methodology

BUILD THE MODEL

The model was built using the WaterCAD V8i software with all the necessary initial data. Figure 3. shows a model built for pumping water from a new water treatment plant through a main transport pipe to the city of Kerbala.

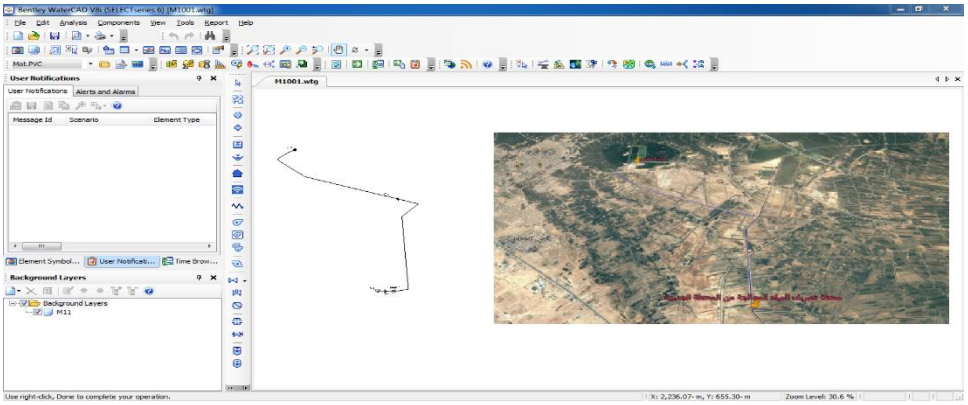
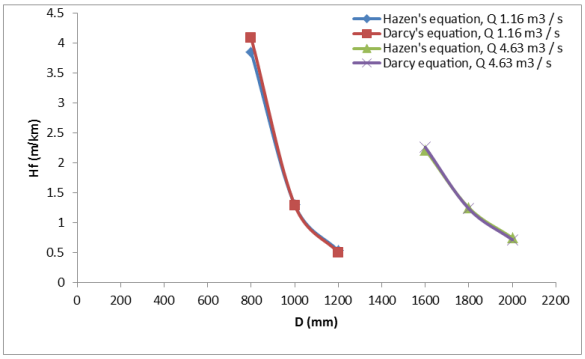


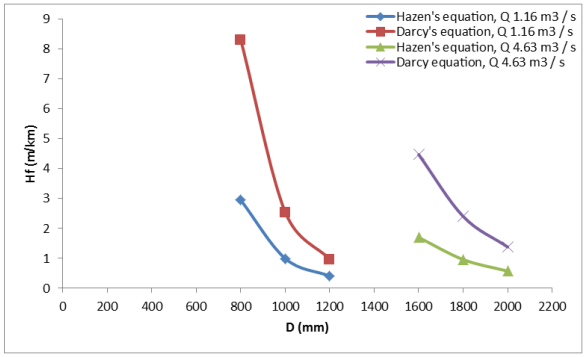
Fig. 3. Constructed model

RESEARCH RESULTS

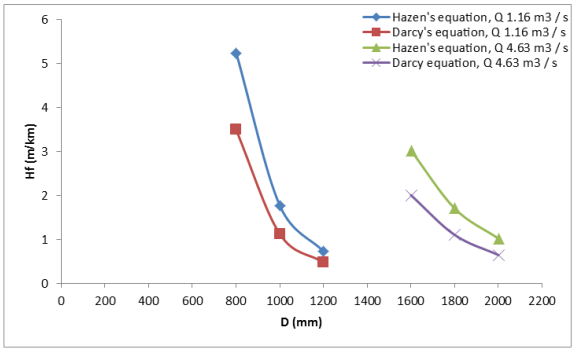
Figure 4 shows the different of head loss obtained using equations (D-W) and (H-W) versus pipe diameter for four materials and for two hydraulic models.



a. Ductile iron



b. GRP



c. Concrete

d. Plastic

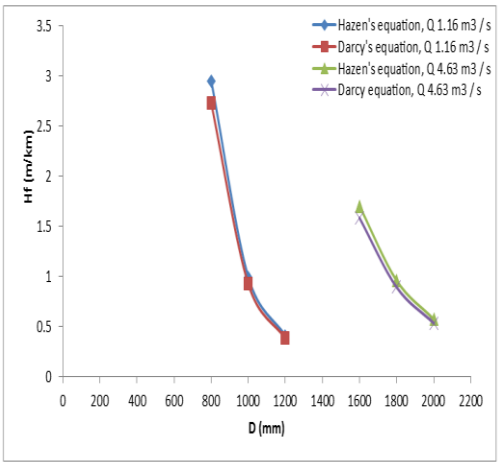


Fig. 4. Relationship between head loss and pipe diameter for different materials.

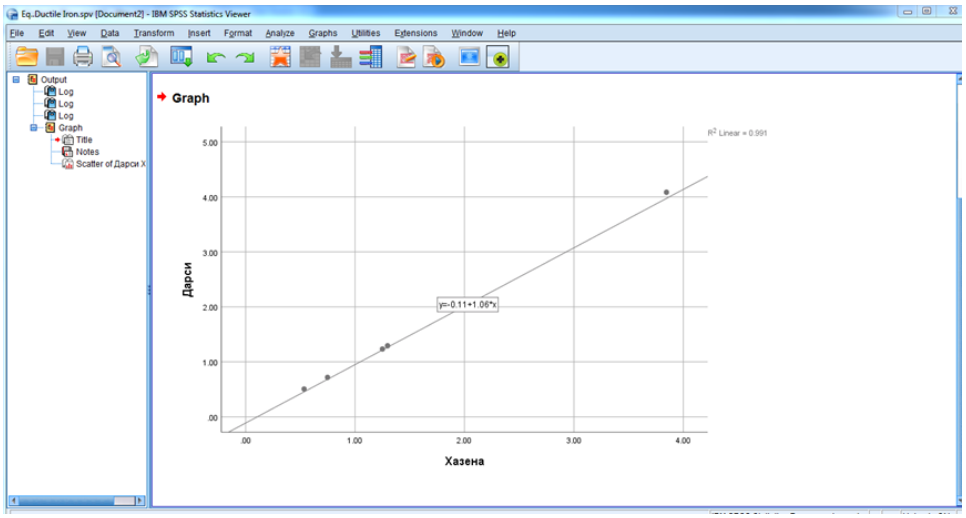
In general, an increase in head loss can be observed as the pipe diameter decreases for both equations. The results also showed that the head loss values in Darcy's equation were higher for materials (Ductile iron, GRP), while they were lower for materials (Concrete, Plastic) for both models.

For the first model, the figures above show that the highest recorded head loss values were at 800 mm diameter, this was 8.312 m / km for GRP in the Darcy equation, while the lowest value recorded for the same diameter was 2.727 m / km. or plastic in the same equation, because of the difference in the type of pipe material and therefore the difference in the roughness factor, which they consider to be the most important factors. It contains a Darcy correction for calculating the head loss.

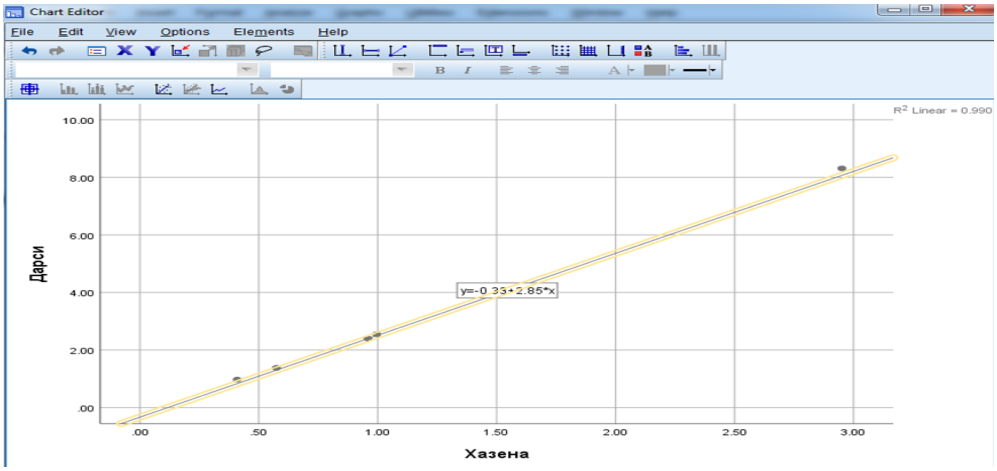
For the second model, the figures above show that the highest recorded head loss values were at 800 mm diameter, which was 4 m / km for GRP in the Darcy equation, while the smallest value recorded for the same diameter was 1.582 m / km. km for plastic in the same equation.

The main part of data analysis is to establish the relationship between both known equations. Consequently, the head loss values for a pipe of four materials obtained

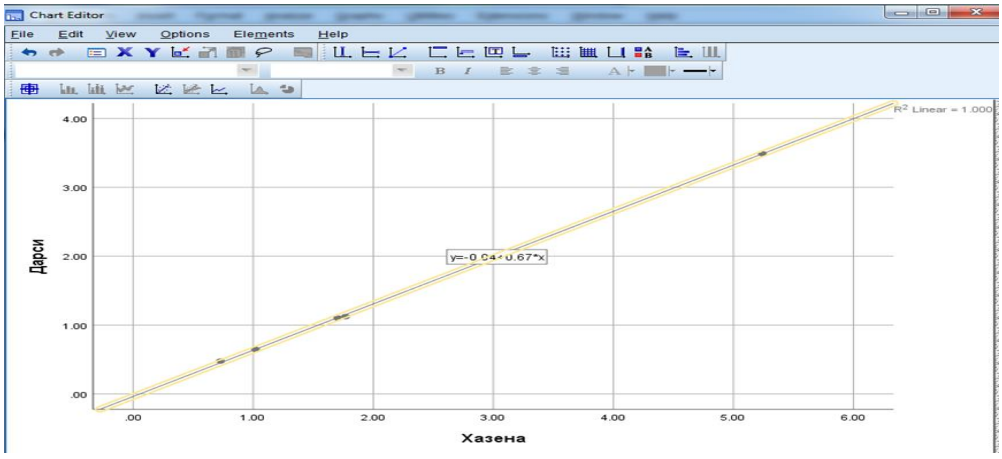
from the two models were plotted as shown in Figure 5.



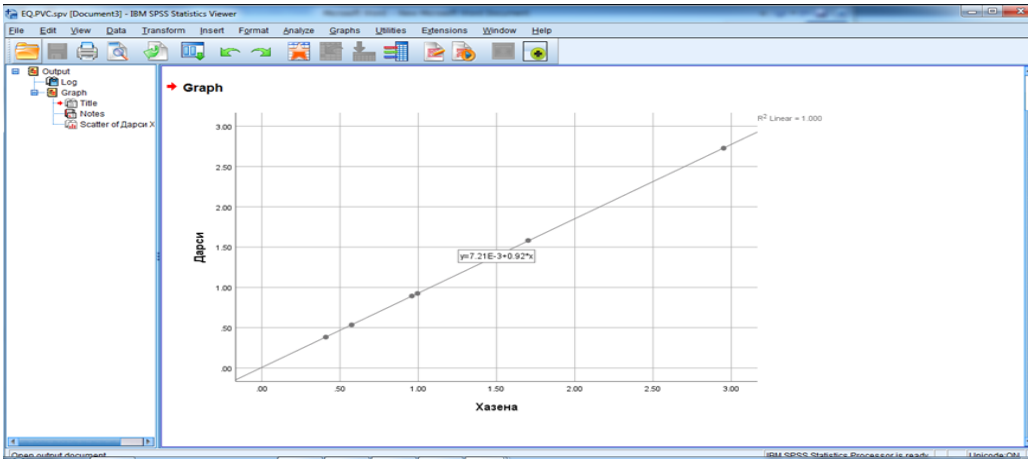
a. Ductile iron



b. GRP



c. Concrete



d. Plastic

Рис.5. Darcy-Weisbach equation vs. Hazen-Williams

It has been noticed that the values are very accurate, close to each other and follow a certain pattern. Direction plotted for the scatter line, whose equation was obtained using the IBM SPSS Statistics program:

For ductile iron

$$y = 0.11 + 1.06 * x \qquad \text{Eq.7}$$

Equation (7) can be rewritten in terms of the studied variables as: (D-W) and (H-W)

$$(\mathrm{D} - \mathrm{W}) = 0.11 + 1.06 * (\mathrm{H} - \mathrm{W}) \qquad \text{Eq.8}$$

The same is with the rest of the pipe materials.

For GRP $(\mathrm{D} - \mathrm{W}) = 0.33 + 2.85 * (\mathrm{H} - \mathrm{W})$ Eq.9

For concert $(\mathrm{D} - \mathrm{W}) = 0.04 + 0.67 * (\mathrm{H} - \mathrm{W})$ Eq.10

For Plastic $(\mathrm{D} - \mathrm{W}) = 7.21E - 3 + 0.92 * (\mathrm{H} - \mathrm{W})$ Eq.11

where (D-V) and (H-V) are the head losses in meters. per kilometer (m / km) of pipe obtained by the **Darcy-Weisbach** and **Hazen-Williams** equations, respectively. Equations (8-11) are an empirical relationship that will evolve in the current research. The trend line R^2 was found to be (0.991, 0.990, 1.00 and 1.00) for pipe materials (Ductile iron, GRP, concrete and plastic), indicating excellent statistical accuracy.

CONCLUSION

An empirical relationship between Darcy-Weissbach (D-W) and Hazen Williams (H-W). The equation was developed using four types of pipe materials. The data for establishing the proposed relationship was obtained from hydraulic models designed to match pipe diameters from 800 to 2000 mm for the two models and flow rates (1.16 m^3/ s, 4. 63 m^3 / s). A unique feature of this ratio is that it can be used to directly determine the head loss obtained using Equation (D-W) without calculating the friction coefficient and Reynolds number when the corresponding value from Equation (H-W) is available for similar flow parameters. This feature simplifies the job of pipe manufacturers and related industries.

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A MULTI BAND CONFORMAL MICROSTRIP PATCH ANTENNA WITH 7X1 ARRAY FOR X BAND APPLICATIONS

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ABSTRACT

A conformal array antenna for multi band applications is designed and simulated for various applications in X band. The antenna is designed with a rectangular patch, and then it has iterated with a 7X 1 array in order to achieve the multi band properties. The antenna is designed using four different substrate materials and the best antenna is considered for the X band. The antenna is tested using various substrates which are fr4_Epoxy, Rogers RT duroid 5880tm, Rogers 4003 and Rogers 3003. The simulation is carried out using HFSS v15 and the conformal is tested using 10,30 and 60 degrees respectively. The antenna possess a good return loss, vswr and high gain with multiple resonating points.

Index Terms—*antenna, radial-waveguide, conformal array, X band.*

INTRODUCTION

Multiple Input Multiple output is an enhancement and it is originally designed for wireless communication where the information can be trans-received using the mobile technology. Later the trend changes and many applications evolved where the MIMO is dominated, the areas are like radar technology for vehicle tracking, bio medical, miniature communication, ball tracking and various other applications. This system is fabricated using multiple antennas in various designs and in matrix formats for more comfortable and compatible in nature. The basic idea is to improve the quality of communication and make the antenna conformal such that it can be placed at any surface. Antennas are designed in such a way that the electromagnetic distribution is done in a very much better way and can be used for multiple applications. In this paper we will discuss about the conformal antenna which is best suitable for X band with the operating resonance frequency of 10GHz.

The basic idea for making the antenna as a conformal is because the antenna can be placed on the base of the carrier without disturbing the dimensions of it nor the structural imbalance. This proposed antenna is considered as one of the prominent antenna in the field of vehicular communication, WiFi and LORA. This antenna structure can be implemented on any surface and at any heights depending on the applications. The antenna performance is not at all effected due to environmental conditions such as snow, fog, dust and heavy rain.

This paper present a proposed conformal antenna which uses the concept of MIMO and can be used in 5G futuristic frequencies. The antenna is tested on band of frequency from 9.5GHz to 10.5GHz. The antenna is designed and simulated using HFSSv18. Proposed Antenna is an conformal in nature antenna with cylindrical in shape and the carrier axis and the patch are configured with the angle of inclination with 65 degrees. The antennas are designed using 1X5 patch pattern which can be helpful to increase the major lobe, total gain and VSWR.

Related Work

The basic element in the conformal structure is a regular rectangular patch antenna, which is most of the time attributed as radiation element. The first step always starts with the mathematical analysis of the antenna with reference to the selection of operating frequency and the substrates used in the design.

The author [1] proposed an antenna which is used to maximise the wireless channel link in vehicular networks. The antenna design is a state of the art which has a combination of patch antenna with various PIN diodes which are used to provide multi band operations for the frequencies which ranges from 2GHz to 12GHz. Three different stages were implemented with a pair of diodes which are used to switch the frequencies and provide

multi band applications. Eight antennas were designed such that the gain can be optimized for the said frequencies. FR4 substrate was used with each antenna unit set to a dimension of 30 X 30 mm. The gain was greater than 1.8dBi throughout theoperational bandwidth and efficiency greater than 86% under Ultra wide band mode.

The author [2] proposed an antenna which is conformal in nature and can be placed on a windshield of a vehicle. The proposed frequency band is at 1.575GHz and can be used for Global Positioning System (G.P.S). Sputtering and electroplating is used as a substrate to achieve low VSWR and good reflection coefficient. Antenna was tested by placing at three different places on the vehicle, front, rear windshield and rear quarter respectively. A angle of 60 degrees conformal was achieved with good reflection coefficient of about -38dB.

The author [3] proposed low-profile dual-band antenna with different polarization and radiation properties over two bands for vehicular communications. A fully functional prototype was designed and tested at the frequency ranging from 3.54GHz to 4.40GHz. Two circular patches are used along with a rectangular patch as two layer design which was implemented on a vehicle for communicating with another vehicle. The antenna possess a good gain with Uni-directional circular polarization and omnidirectional linear polarization.

The author [4] proposes aregular hexagon broadband micro-strip antenna with a frequency band of 4.74GHz to 6.79GHz for the existing Vehicle to Vehicle communication. It acquires an Omni directional pattern whose out of roundness is less than 0.5dB. Three major V cuts and three minor V cuts were introduced on the patch to make the antenna work for broad band which incorporates WiFi, GPS and LTE on it. The substrate thickness was kept to 3mm as it was proposed to be placed on the roof of the vehicle. The antenna was tested on AgilentTechnologies N5242A vector network analyser for the said frequencies and it possess a very good reflection coefficient and gain.

The author [5] discuss about the vehicular technology and how in the real time scenario as number of vehicles with vehicular communication increases, their exist fading of the signal at the road side unit (RSU). Two models were proposed which are constant correlation (CC) and exponential correlation (EC). The paper also discuss about how the cooperation takes place between the vehicles using single helperselection (SHS), multi-hop cooperative selection (MCS) and multiple helper selection (MHS). These techniques are used to transfer the information from one vehicle to the road side unit with the help of other vehicles.

The packet error probability was considered using the correlation of antenna gain at road side unit, which implies that if the gain of the antenna is around 3dB, the error probability will be less.

The author [6] proposed a low cost, compact conformal antenna for vehicular communications applications with good gain and the material used to fabricate the antenna was poly vinyl chloride with a dimensions of 55mm X 40mmX 3mm. The antenna is used for various applications under 4G environment. The antenna was based on fractal geometry with various iterations made for calculating the antenna parameters. The maximum bend angle was up-to 120 degrees and tested for the frequency ranging from 1.8GHz to 6.4GHz.

The author [7] proposed a dual band full duplex antenna design for vehicular communications with two ports of antenna, one for transmitting and one for receiving. Two duplex channels of 4.58-4.83GHz and 5.86-6.2GHz were used. Hairpin patch antenna was used with six resonators which were used to provide better characteristics of the antenna. A 2x2 full duplex mode was fabricated with two ports with a frequency ranging from 4.4GHz to 6.6GHz.

The author [8] proposed a wide band 3D antenna for roof top vehicles with a unique design which can be used for LTE

applications. The structureconsists of folded metal sheets welded together buildinga geometry that allows covering two LTE bands. A U-cut and a V-cut antenna was fabricated for the frequency ranging from 850MHz to 2GHz. The antenna exhibits a very good return loss and coupling for the dual band.

The author [9] proposed a 2X1 micro strip patch array antenna for vehicular communication with primary and secondary feeds with frequency ranging from 5.2GHz to 6.5GHz. The antenna is fabricated on a FR4 Epoxy substrate with a thickness of 1.6mm. The antenna performance was measured for a single patch, 1X2 and 2X1 array. A maximum gain of 9.6dB achieved using the multi array concept.

The author [10] proposed a circularly polarised wide-beam width Fern Fractal shaped antenna for vehicular communications. The size of the patch was reduced by a 44 percent as the fractal geometry was introduced on the patch. The author proposed the antenna for eliminating blind spots form the vehicle, which was a drawback with the present available mirror concept. A hexagonal patch was used which later converted to fern like structure which was used to increase the performance of the antenna.

The author [11] proposed an antenna with Rigorous Electromagnetic Channel Modeling for 5G applications. The frequency range was in ultra wide band up-to 5.9GHz. The antenna possess a better return loss and placed on the roof top of the vehicle. The coverage area reached was around 50mts.

The author [12] proposed a left handed circularly polarized antenna array for vehicular communication with a resonating frequency of 5.9GHz. The antenna was designed using patch truncated corners and a square shaped radiator. The antenna was tested for single element and two element array for better performance. The efficiency was above 82% with very good return losses.

The author [13] proposed an integrated Wideband End-Fire5G Beam Steerable Array antenna for mobile terminals in vehicular communication. An array consisting for four elements were used to provide good return losses and tested for frequency ranging from 22GHz to 30GHz.

The author [14] proposed a diversity antenna for vehicular communication which can be used for two different frequencies simultaneously. It was tested for two separate frequency of 5.9GHz and 60GHz respectively. It was a two antenna system with two different frequencies implemented at the same instant of time using covariance matrix method.

ANTENNA DESIGN

In this section, the designing procedure of proposed antenna is described where The first step of the MIMOconformal design is the establish a rectangular patch which is shown in figure1, with the dimensions of patch and substrates as available in the figure. The antenna is designed using the mathematical equations followed with the design using HFSS tool and then fabricated it and testing the antenna. The antenna is tested under multiple substrate conditions in order to find the perfect substrate for the antenna. Single patch analysis is carried out following with the array.

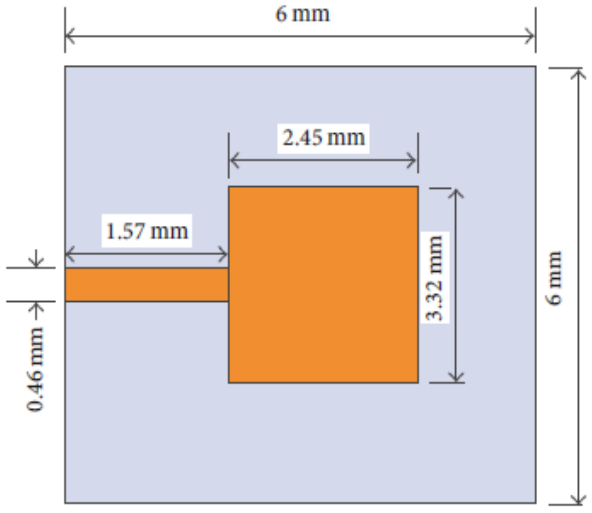

Fig 1: Single patch Microstrip patch antenna

This rectangular patch is made with the dimensions of 3.32 mm X 2.45 mm with a feed length of 1.57mm and the total

dimension of each patch is 6mm X 6mm. The next step with the patch antenna is designing an array with five elements. These elements are placed as a conformal in structure. The array figure is shown below.

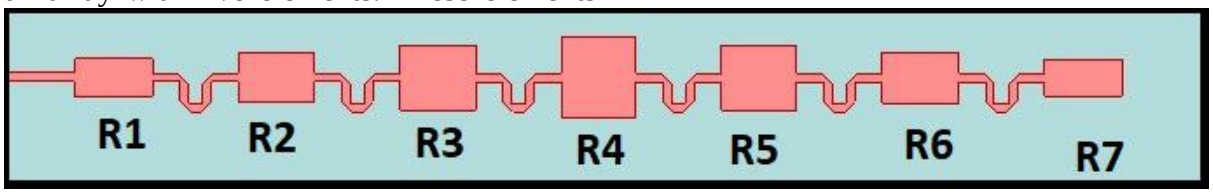

Fig2: 7X1Array Microstrip patch antenna

*W*and*L* of the patch are adjusted while the simulation process is carried out in order to provide a proper design for the array. The size of the patch directly provides an impact on resonant frequency, and ground mainly affects impedance matching of the antenna with the feed line. Through simulation and optimization, we get that*W* = 3.32mm and *L* = 2.45mm, the width of feed line*w* = 0.46mm, and the centre of the feed line is midpoint of*W*.The dimensions are provided in Table 1

Table 1: Dimensions and Parameters

Parameters	Dimensions	Parameters	Dimensions
R1	1.8 X 2.2	R6	2.1 X 2.6
R2	2.1 X 2.6	R7	1.8 X 2.2
R3	2.5 X 2.9	Substrate	26 X 48 X0.25
R4	3.2 X 3.5	U-Shape	1 X 1
R5	2.5 X 2.9	Ground	26 X 48

The antenna is designed using the conformity which means the antenna can be folded according to the surface placed on the element. The antenna is simulated with the angle rate from zero, fifteen, forty-five, sixty and ninety degrees. The antenna is flipped using the angular mode of HFSS with a cylindrical structure placed and the patch is placed on the curved substrate in order to simulate for obtaining the conformal nature. Figure 3 provides the analysis of the antenna for various bend angles and the substrate in conformal nature.

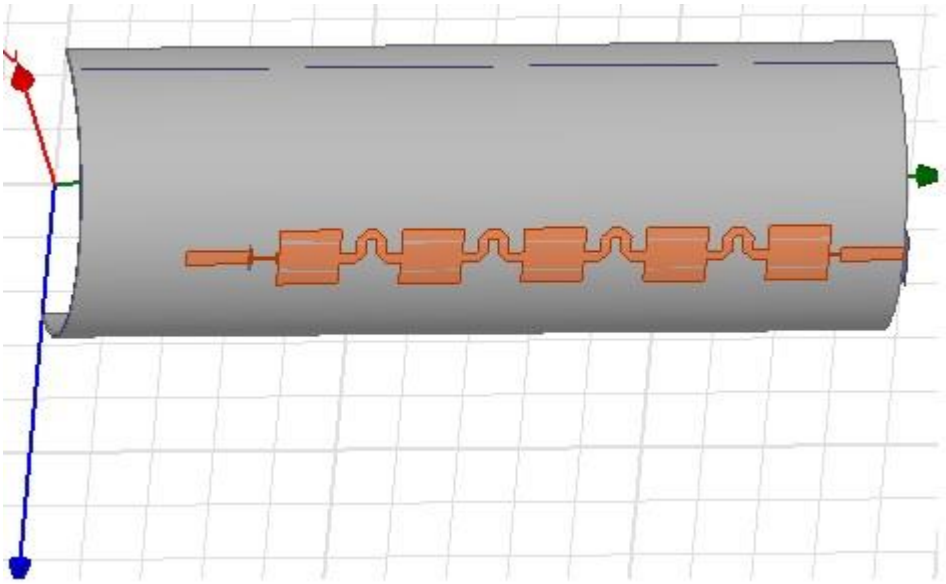

Fig3: Antenna using conformal in structure

The antenna is simulated in HFSS v15 and the simulation discussion is done in the matter of return loss, vswr, total gain and radiation patter for various substrate and

analysis is carried out for various bend angles and various substrates in order to analyse the parameters of the antenna.

Let us discuss the return loss with various different types of substrates as shown in the figure 4(a). The substrates simulation is carried out using four different substrates Rogers 5880tm, 4003 tm, 3003 tm and fr4_Epoxy with the relative permittivity are 2.2,3.55,3 and 4.4. The antennas are simulated and the results project that the rogers 5880 provides better reflection coefficient compare to all other substrates.

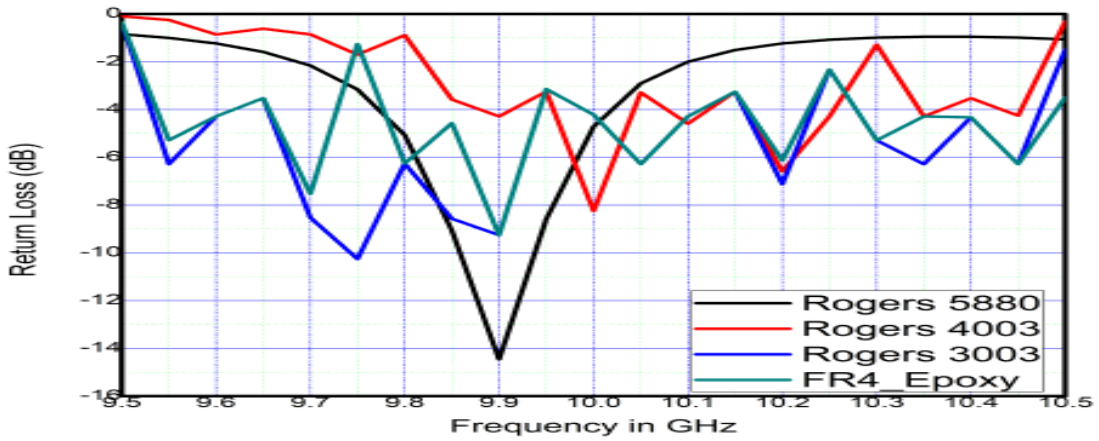

Fig4(a): Return loss of antenna for various substrates

Figure 4(b) refers to the parametric study of the various steps carried out on the antenna with three stages, first sage is a single patch antenna of rectangular in shape, then the antenna is processed with array and the reflection coefficient is carried out. The substrate is used is arlon material whose substrate dielectric is similar to rogers 5880 as to fabricate the antenna for conformal in nature.

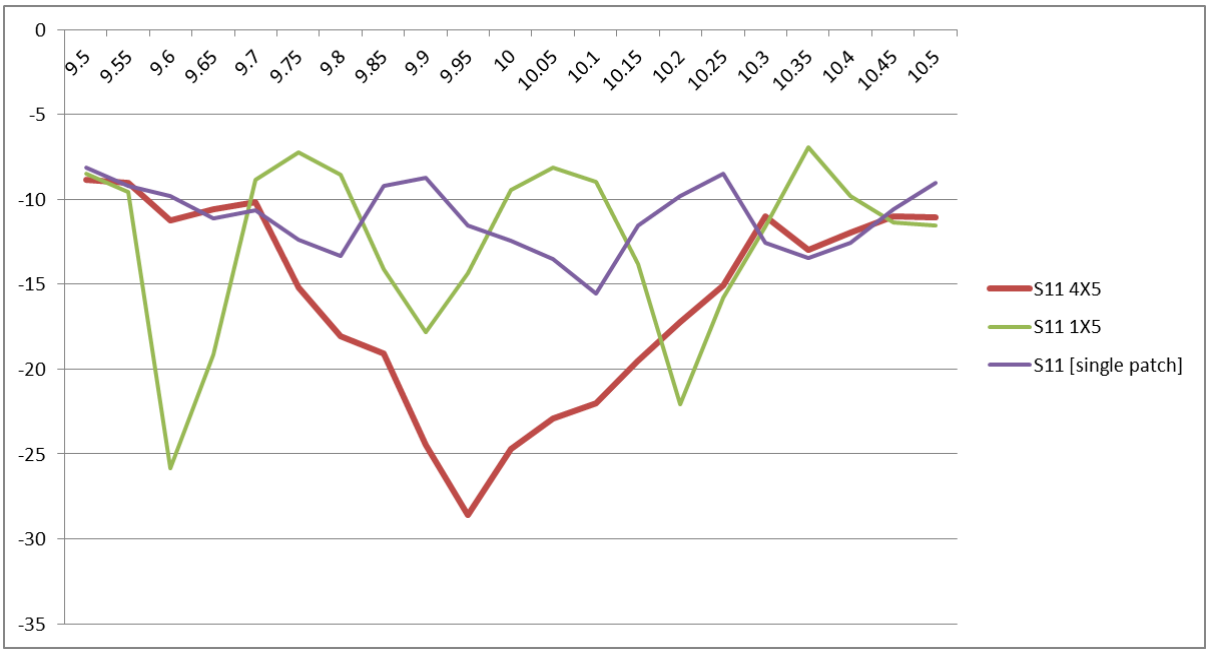

Fig4(b): Parametric study of the antenna for the step-by step process

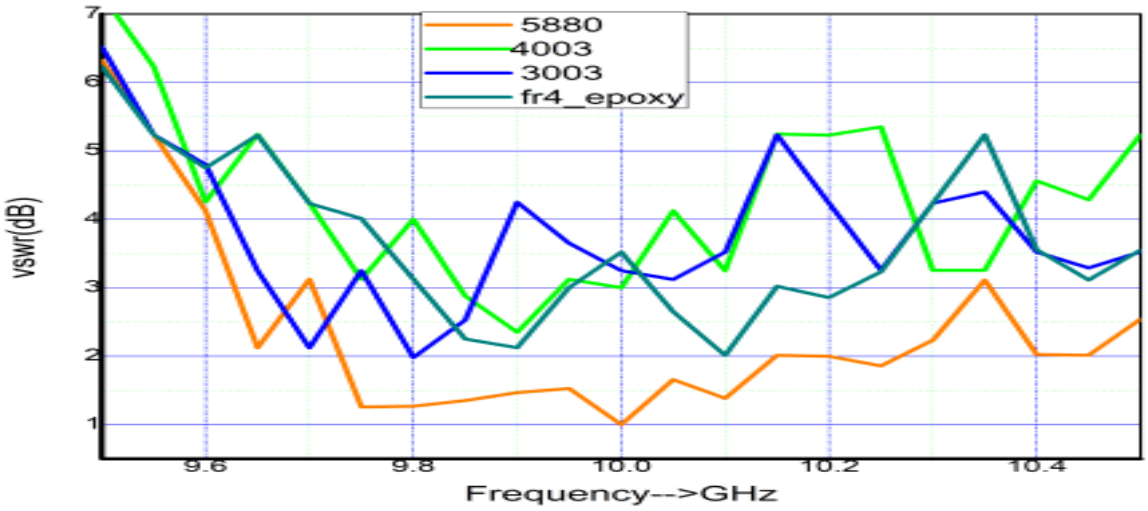

Fig5:vswr of antenna for various substrates

The standing wave ratio for any antenna will be 4dB or less than the value, and in the figure 5 it is clearly mentioned that the 5880 material possesses a very good voltage standing wave ration and it is 30% less than the rest of the material, due to which the selection of material depends on the simulation results can be decided. The minimum vswr recorded is 1.01dB compare to the rest of the materials at the resonating frequency of 10GHz.

Gain Is one of the key factor in order to decide the performance of the antenna for any specific application, and as per the simulation of the proposed antenna is concerned, better gain is obtained at the resonating frequency, making the antenna all the three parameters successful in order to calculate the significant bandwidth as to make the significance, it is very important to keep the antenna reflection coefficient less than -10dB and vswr less than 4dB and making the gain more than 3dB. The maximum gain achieved is 4dB at the resonating frequency as per the figure 6 using 3D plot, which is similar to the actual performance of the antenna .The maximum gain achieved is 4dB with a bandwidth of 700MHz as shown in the below figure 6, and the specific bandwidth can be used for any application related to X band.

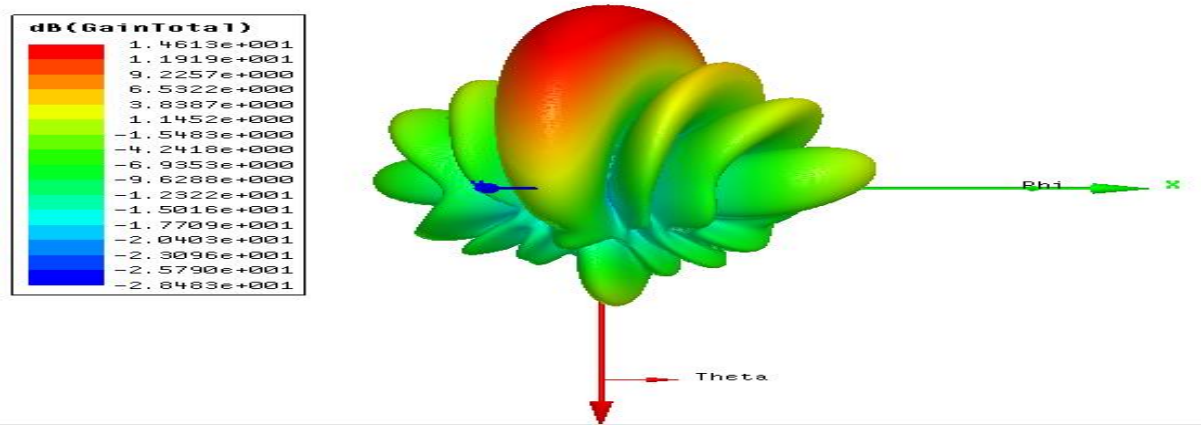

Fig 6: Gain of the antenna achieved in the form of 3D plot

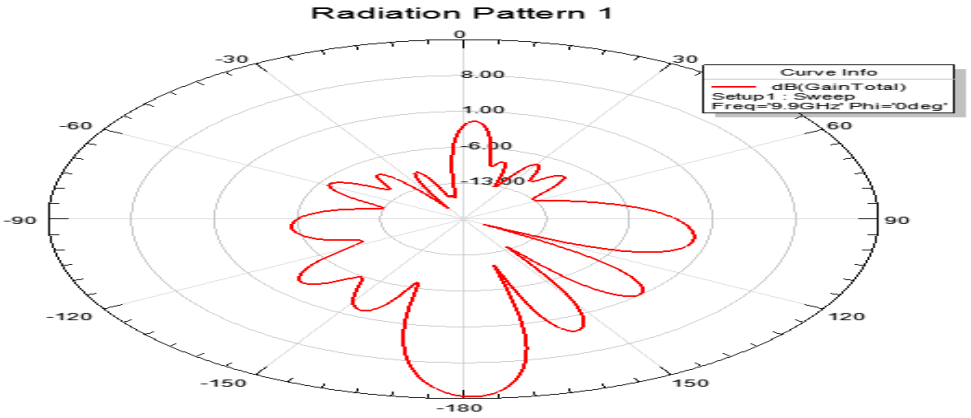

Fig7: Radiation Pattern of the Antenna

Figure 7 provides the radiation pattern of the proposed antenna at the resonating frequency with almost omni directional and it is observed that the antenna can provide better radiation with better forward 3dB lobe compare to side and back lobes. All the parameters are calibrated and simulated, and it is observed that the simulation results are in good relation with all the requirements of an antenna used for any specific application. After the simulation is carried out and the results achieved are satisfactory, it is fabrication to be carried out. In the next section we will discuss about the fabrication and measured results compare to the simulated results.

The antenna is fabricated using Arlon material in order to achieve the conformal in nature and the antenna is tested using Network AnalyzerZVL, Signal Generator68147B, SpectrumAnalyzer8593E in order to achieve the antenna parameters. Figure 8 provides the fabrication of the antenna and it is clearly specifies that the antenna is fabricated on the conformal substrate which can be used for any compact application which has a structural bend around 90 degrees. The fabrication is carried out in the laboratory where the research is carried out and the material used is arlon whose substrate dielectric behaviour is similar to rogers 5880.

FABRICATION AND TESTING

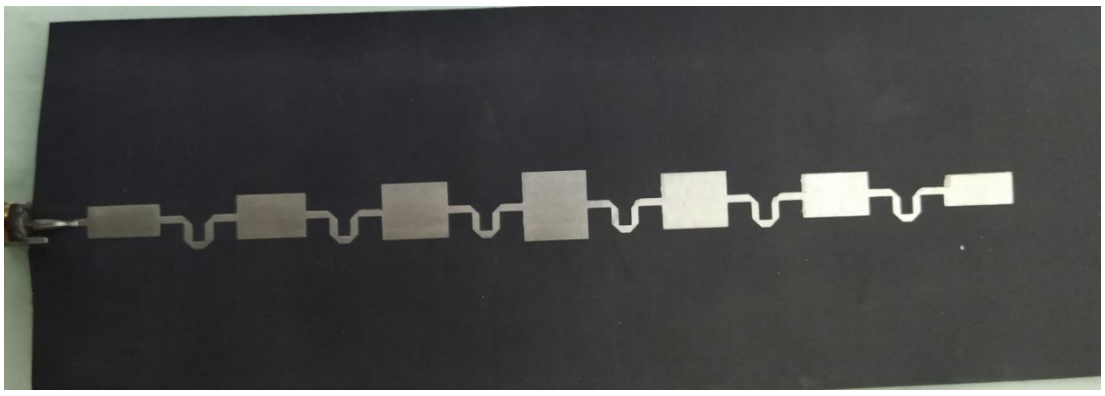

Fig 8: Fabrication of the proposed antenna

The antenna is tested to get the parameters such as s11,vswr and gain which will define the bandwidth of the antenna. The measuring of the various parameters are conducted under test conditions with the vector network analyser kept input at 1dB point and 2dB point and s-parameters are calculated. Figure 9 provides the idea of measuring the S11 of the proposed antenna using Vector network analyser. It is observed that the simulation and measured results are in comparison and only 2% deviation is observed in figure 10.

Fig9: Testing Process of Fabricated antenna

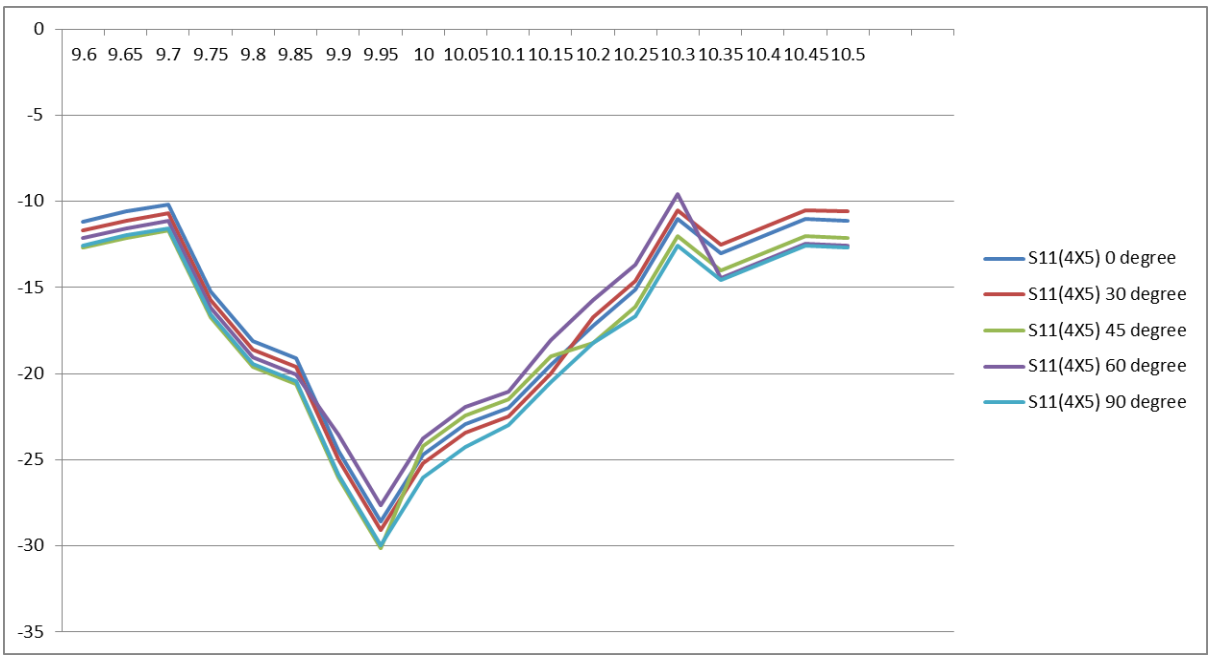

Fig10: Return loss of fabricated antenna for various bend angles

It is observed from figure 10, that the antenna conformity is tested for the various angles such as 0 degree, 30 degree,45degree, 60 degree and 90 degrees and it is observed that the parameters are stable and can be used for any surface with a maximum of bending angle of 90 degrees. The s-parameters obtained using VNA and simulated results are in accordance and it is clearly observed that the antenna can be used for practical applications and hence with all the parameters taking into consideration, the antenna can be used for X-band applications

CONCLUSION

This paper provides an multi band Microstrip patch array for X band applications. The antenna is first designed with single patch and multiple substrates are tested for the patch. The antenna is then fabricated with 7X1 array on conformal material in order to make the antenna wearable. The antenna possesses very good return loss, vswr and high gain. The antenna achieved 400MHz bandwidth which can be used for multiple applications in X band. The antenna is tested using vector network analyser and spectrum analyser for obtaining the bend angle parameters. The antenna is tested under 0 degrees, 30degrees, 45 degrees, 60 degrees and 90 degrees.

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NODAL PRICING CALCULATION IN DISTRIBUTED ENVIRONMENT WITH ZIP LOAD

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ABSTRACT

Distributed environment in power system is one of the factors to adopt the real time pricing structure for efficient operation of distribution networks. It is the distribution network operator's key responsibility to determine the real time prices based tariff structure for smart distribution systems. The prices must take into account the effect of load and be based on the change in the operating state of the system. The main contributions of the paper are: (i) Nodal prices determination in the presence of harmonic and ZIP load, (ii) impact of Solar (PV) based DG on nodal prices. The method uses marginal loss coefficients (MLCs) to obtain the nodal prices at each bus. The results are obtained for IEEE 33 bus test system and compared with realistic ZIP and Normal or constant power (CP) loads.

Keywords: *Distribution system, load model, harmonic load, nodal prices, solar (PV) based DG.*

Introduction

The distribution system is a crucial element of connecting the consumers to the power supply and provides many vital services viz. Grid connection, metering and billing services, power delivery, reliability, Standby service, supplemental service, Ancillary services, power factor correction and other power quality services, access to markets for the sale of supply [1]. Competitive electricity market sustainability and market efficiency are dependent on the transparent pricing structure. It is observed that the techniques used for the transmission pricing can also be applied to the distribution system, such as nodal pricing, which is an efficient method for calculation of the marginal cost of energy along with the marginal cost of losses [4]. A dispersed generation is considered to allocate the losses using marginal loss coefficients and direct loss coefficients to determine the nodal price [5]. Distributed environment have become an essential part of the distribution network due to environmental constraints and regulatory policies worldwide, and it is essential to determine their impact on the prices at the nodes. Authors in [9] studied the impact of renewable energy integration on nodal prices considering the effect of loads that normally operate a fraction of a 24 hour period. Loads that normally operate a fraction of a 24 hour period usually called intermittent load. Nodal pricing based method is also used for the location of DG as discussed in [16]. In [2] the solar energy generation according to the demand side and nodal price is found by OPF formulation.

European study says it is essential to improve the implementation of zonal pricing before searching into the introduction of nodal prices[24]. Nodal pricing merits like increased efficiency in the dispatch of the generating units, reduced redispatch cost, providing incentives to both generators and consumers based on the physical constraints, and incentives could reduce overall cost. Two questions addressed here are 1). when investing in new capacity 2). when trading energy. On the other hand, the nodal pricing method has some demerits, like nodal prices neither provide optimal signals for the grid expansion to the system operator nor ensure the recovery of the grid's fixed cost. Nodal pricing under certain circumstances may decrease liquidity.

The nodal price behavior considering the ZIP and RIC loads is considered in [17] with the load flow based formulation. An optimal power flow based approach for distribution system nodal prices with seasonal load impact was presented in [18]. However, the impact of renewable energy with its cost was not considered

Mathematical Model for Radial Distribution Systems

The harmonic load flow algorithm is developed in this paper based on forward and backward sweep methods. This method does not require formation of BIBC, BCBV matrices and identification of the nodes beyond each branch. The proposed method reduces data preparation to solve load flow in the distribution system, uses simple equations and requires less computation time per iteration. A simple radial distribution system with a source at one end and load at the other end with two nodes with voltages and impedance is shown in Figure1. The mathematical model is presented in this section considering the impact of normal and realistic ZIP loads into account. The load flow algorithm used in this paper consists of forward and backward sweep methods. The forward sweep is mainly a voltage drop calculation from sending end to receiving end of a feeder or a lateral and the backward sweep is primarily a current summation based on voltage updates from far end of the feeder to sending end.

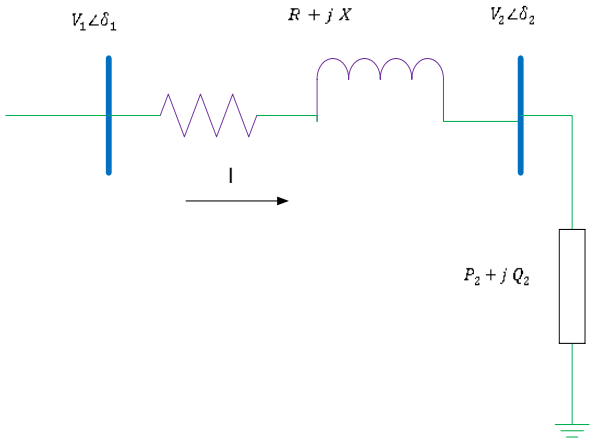

Figure1 Equivalent circuit model of RDS

The steps involved in the proposed harmonic load flow method are given below.

(a). Load currents calculation

$$IL[k] = \left[\frac{PL(k)+QL(k)}{v(k)}\right]^* fork = 1,2,3,\ldots.n \quad (1)$$

$$IL3[k] = \left[\frac{PL3(k)+QL3(k)}{v3(k)}\right]^* fork = 1,2,3,\ldots.n \quad (2)$$

$$IL5[k] = \left[\frac{PL5(k)+QL5(k)}{v5(k)}\right]^* fork = 1,2,3,\ldots.n \quad (3)$$

$$IL7[k] = \left[\frac{PL7(k)+QL7(k)}{v7k}\right]^* fork = 1,2,3,\ldots.n \quad (4)$$

Where

$IL$are the load currents.

$IL3, IL5$ and $IL7$ are load currents for 3rd, 5th and 7th harmonics.

$v$are the bus voltages

$v3$, $v5$ and $v7$ are harmonic voltages.

$PL, QL$are the real and reactive power load demand.

$PL3$, $PL5$ and $PL7$ are real harmonic powers injected taken as 1%, 0.5% and 0.25% of PL respectively.

$QL3$, $QL5$ and $QL7$ are reactive harmonic powers injected taken as 1%, 0.5% and 0.25% of QL respectively.

$n$is total number of buses.

(b). Backward sweep to sum up line section current: starting from the last branch and moving towards the root node, the current in branch $I_H$is:

IL_H(se (i)) =IL_H(se (i))+IL_H(re (i)) for i=1,2,3,…nb, where H=1,3,5,7

$$I_H = IL_H(re)$$

where

H is order of harmonic taken as 1st (fundamental), 3rd, 5th and 7th.

$I_H$are the branch currents for all harmonics

nb is the total number of branches.

$se, re$are sending and receiving end nodes respectively.

(c). Forward sweep to update nodal voltages: starting from the first node and moving towards the last node.

(i). Voltage drops in each branch are:

$$\Delta V_H(k) = Z_H(k) * I_H(k)$$

Here Z_H= R + j*X_H and X_H= (H*X) where H=1, 3, 5 and 7

(ii). The voltages at the receiving end node i is:

$$V_H\big(re(k)\big) = V_H\big(se(k)\big) - \Delta V_H(k)$$

$$fork = 1,2,3,\ldots n \quad (8)$$

(iii). Voltage deviations in present and previous iterations:

$$delV_H = V_H - v_H$$

$$delV_{max}[H] = (\max(delV_H))$$

(v). Updating Voltages in each phase (1)

$$v_H = V_H$$

Knowing branch currents, the real (2) and reactive power losses can be obtained as:

(3)

$$Ploss_H(i) = I_{H(i)}^2 \times R(i) fori = 1,2,3,\ldots nb$$

$$Qloss_H(i) = I_{H(i)}^2 \times X_H(i) fori = 1,2,3,\ldots nb \quad (4)$$

The total real as well as reactive power loss TPL and TQL is given by

$$\mathrm{TPL}_H = \sum_{i=1}^{nb} \mathrm{Ploss}_H(\mathrm{i}) \quad (13)$$

$$\mathrm{TQL}_H = \sum_{i=1}^{nb} \mathrm{Qloss}_H(\mathrm{i}) \quad (14)$$

Algorithm for proposed load flow solution

Step 1: Read bus data and line data.
Step 2: Initialize the bus voltages as $v(k) = 1.0$ and corresponding $v_h(k)$ as 10%, 7.5% and 5% for H= 3, 5 and 7 respectively.
Step 3: Calculate load currents $IL_H[k]$ using eqns. (1-4).
Step 4: Calculate branch currents using eqns. (5-6).
Step 5: Calculate the voltage drops in all three phases using eqn. (7).
Step 6: After calculating voltage drops find receiving end voltages in the forward direction
Using eqn. (8)
Step 7: Find $delV_H$ using eqns. (9). Update the voltages in all three phases as shown in eqn. (11).
Step 8: Find error in voltage$i.\, edelV_{max}[H]$. If it is less than 0.00001 then load flow is Converged otherwise go to step 3.
Step 9: Once load flow is converged bus voltages and branch currents are known, then find
Power loss using eqns. (12-14)
Step 10: Stop.
The eqn. (5-6) is used to find branch currents, and it is explained using four bus radial systems as follows—figure2 shown the four bus radial distribution system.

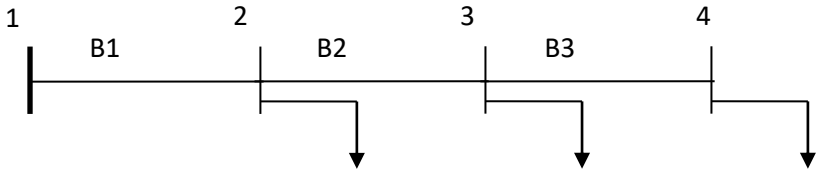

Figure 2 Sample radial distribution system

Branch	Sending end	Receiving end
1	1	2
2	2	3
3	3	4

Load currents are calculated using the eqn. (1)
For four buses, the load currents

$$\mathrm{IL}=\begin{bmatrix}0\\ \times\\ \times\\ \times\end{bmatrix}$$

Let ILL=IL
nb is the number of branches (nb=3)
for k=nb:-1:1
ILL(se(k))=ILL(se(k))+ILL(re(k))
end
k=3
ILL(3)=ILL(3)+ILL(4)
k=2
ILL(2)=ILL(2)+ILL(3)
k=1
ILL(1)=ILL(1)+ILL(2)
Branch currents Ibr=ILL(re)

$$\mathrm{Ibr}=\begin{bmatrix}ILL(2)\\ ILL(3)\\ ILL(4)\end{bmatrix}==\begin{bmatrix}ILL(2)+ILL(3)+ILL(4)\\ ILL(3)+ILL(4)\\ ILL(4)\end{bmatrix}$$

Modeling of Solar (PV) Units

The Beta probability distribution function (BPDF) require for estimating the hourly solar irradiance [1]. BPDF is based on historical data collected for three years [2]. The solar irradiance sample and wind speed samples produced by MCS. In the Monte Carlo method, a simulation can typically involve over 20000 evaluations of the model, which is computationally expensive.

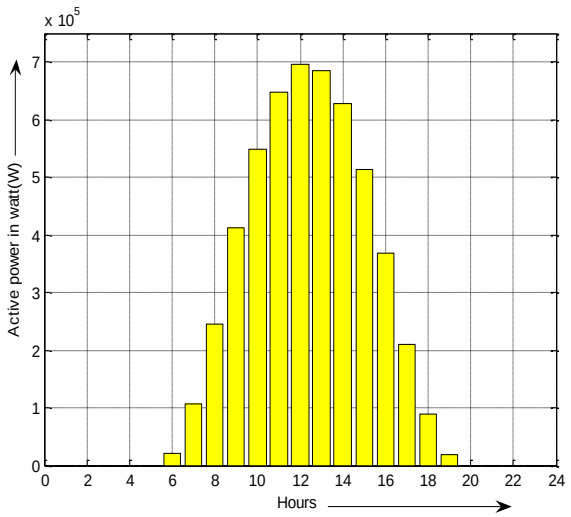

Figure3. 24 hours active power of PV Units

The 24 hours output power of each Solar (PV) Units is obtained based on the above maintained data. It is shown in Figure3. However, we have to use the average power output of day in the Solar (PV) Units. The average value of active power generation of Solar (PV) unit is 0.216MW respectively.

Nodal Pricing of Distribution Networks

In order to obtain the nodal prices at each bus of a distribution system, the MLCs have to be defined first. MLCs are coefficients that indicate the marginal or incremental deviation in total active power loss due to the changes in active and reactive power injections at a particular node of the system [17].

$$\rho_{Pk} = \frac{\partial L}{\partial P_k} \quad (15)$$

$$\rho_{Qk} = \frac{\partial L}{\partial Q_k} \quad (16)$$

where
L: The total power loss
ρ_Pk: The active power MLC at node $k$of the system
ρ_{Qk}: The reactive power MLC at node k of the system
The connection point between the distribution and transmission system is called as the power supply point (PSP). If λ is the electricity price (in $/MWh) or the active power price at PSP, then the nodal prices of active and reactive powers at various nodes can be obtained as follows:

$$N_{Pk} = \lambda + \lambda.\rho_{Pk} = \lambda(1 + \rho_{Pk})$$

$$N_{Qk} = \lambda.\rho_{Qk}$$

whereN_{Pk}($/MWh) and N_{Qk}($/MVARh) are the active and reactive power nodal prices at node k of the system respectively. The reactive power price at PSP is taken as zero.

Charges for marginal losses for loads

The charges for marginal losses for loads can be calculated as [16]:

$$CL_k = \sum_{t=1}^{T} \lambda_t \left(\frac{\partial L_t}{\partial P_{k,t}}\right) P_{i,t} + \left(\frac{\partial L_t}{\partial Q_{k,t}}\right) Q_{k,t}$$

where
CL_k: The marginal loss charges for load at node k of the system

λ_t: Electricity price at PSP for hour t

$P_{k,t}, Q_{k,t}$: Load active and reactive power demands at node k of the system for hour t

T:The total number of hours of the study

Determination of Marginal Loss Coefficients

The active and reactive power MLCs are determined using the Jacobian matrix method. This method of determining the MLCs was proposed by the authors in [15]. The method is designed based on the fact that there exists no direct correlation between the power losses and power injections. Hence, the intermediary variables such as bus voltages and angles obtained from AC power flows are utilized to determine the MLCs. The following sets of linear equations are utilized in this method.

$$\begin{bmatrix} \rho_{Pk} \\ \rho_{Qk} \end{bmatrix} = \begin{bmatrix} \frac{\partial P_1}{\partial \theta_1} & \frac{\partial P_2}{\partial \theta_1} & \cdots & \frac{\partial P_n}{\partial \theta_1} & \frac{\partial Q_1}{\partial \theta_1} & \frac{\partial Q_2}{\partial \theta_1} & \cdots & \frac{\partial Q_n}{\partial \theta_1} \\ \vdots & \ddots & & \vdots & \vdots & \ddots & & \vdots \\ \frac{\partial P_1}{\partial \theta_n} & \frac{\partial P_2}{\partial \theta_n} & \cdots & \frac{\partial P_n}{\partial \theta_n} & \frac{\partial Q_1}{\partial \theta_n} & \frac{\partial Q_2}{\partial \theta_n} & \cdots & \frac{\partial Q_n}{\partial \theta_n} \\ \frac{\partial P_1}{\partial V_1} & \frac{\partial P_2}{\partial V_1} & \cdots & \frac{\partial P_n}{\partial V_1} & \frac{\partial Q_1}{\partial V_1} & \frac{\partial Q_2}{\partial V_1} & \cdots & \frac{\partial Q_n}{\partial V_1} \\ \vdots & \ddots & & \vdots & \vdots & \ddots & & \vdots \\ \frac{\partial P_1}{\partial V_n} & \frac{\partial P_2}{\partial V_n} & \cdots & \frac{\partial P_n}{\partial V_n} & \frac{\partial Q_1}{\partial V_n} & \frac{\partial Q_2}{\partial V_n} & \cdots & \frac{\partial Q_n}{\partial V_n} \end{bmatrix}^{-1} \begin{bmatrix} \frac{\partial L}{\partial \theta_1} \\ \vdots \\ \frac{\partial L}{\partial \theta_n} \\ \frac{\partial L}{\partial V_1} \\ \vdots \\ \frac{\partial L}{\partial V_n} \end{bmatrix}$$

$$\frac{\partial P_k}{\partial \theta_j} = V_k V_j [G_{kj} \sin(\theta_k - \theta_j) - B_{kj} \cos(\theta_k - \theta_j)]$$

$$\frac{\partial P_k}{\partial \theta_k} = -B_{kk} V_i^{\,2} - \sum_{j=1}^{n} V_k V_j [G_{kj} \sin(\theta_k - \theta_j) - B_{kj} \cos(\theta_k - \theta_j)] \quad (22)$$

$$\frac{\partial P_k}{\partial V_j} = V_k [G_{kj} \cos(\theta_k - \theta_j) + B_{kj} \sin(\theta_k - \theta_j)]$$

$$\frac{\partial P_k}{\partial V_k} = G_{kk} V_k + \sum_{j=1}^{n} V_j [G_{kj} \cos(\theta_k - \theta_j) + B_{kj} \sin(\theta_k - \theta_j)] \quad (24)$$

$$\frac{\partial Q_k}{\partial \theta_j} = -V_k V_j [G_{kj} \cos(\theta_k - \theta_j) + B_{kj} \sin(\theta_k - \theta_j)]$$

$$\frac{\partial Q_k}{\partial \theta_k} = -G_{kk} V_k^{\,2} + \sum_{j=1}^{n} V_k V_j [G_{kj} \cos(\theta_k - \theta_j) + B_{kj} \sin(\theta_k - \theta_j)] \quad (26)$$

$$\frac{\partial Q_k}{\partial V_j} = V_k [G_{kj} \sin(\theta_k - \theta_j) - B_{kj} \cos(\theta_k - \theta_j)]$$

$$\frac{\partial Q_k}{\partial V_k} = -B_{kk} V_k + \sum_{j=1}^{n} V_j [G_{kj} \sin(\theta_k - \theta_j) - B_{kj} \cos(\theta_k - \theta_j)] \quad (28)$$

The total loss of the distribution system is given by

$$L = \frac{1}{2} \sum_{k=1}^{n} \sum_{j=1}^{n} G_{kj} [V_k^{\,2} + V_j^{\,2} - 2 V_k V_j \cos(\theta_k - \theta_j)]$$

From this equation, the derivative of loss with respect to voltage angles and magnitudes can be derived as follows:

$$\frac{\partial L}{\partial \theta_k} = 2 \sum_{j=1}^{n} V_k V_j G_{kj} \sin(\theta_k - \theta_j)$$

$$\frac{\partial L}{\partial V_k} = 2 \sum_{j=1}^{n} G_{kj} [V_k - V_j \cos(\theta_k - \theta_j)]$$

where

V_k, V_j: **The voltage magnitudes at the sending and receiving end nodes respectively** (21)

θ_k, θ_j: **The voltage angles at the sending and receiving end nodes respectively**

G_{kj}: **The conductance of the $k - j^{th}$ element of the Y-bus matrix**

B_{kj}: **The susceptance of the $k - j^{th}$ element of the Y-bus matrix**

n : **The total number of nodes in the system.** (23)

Reconciliated Marginal Loss Coefficients

The approximate total losses of the system can also be obtained from the MLCs as follows:

$$L_{approx} = \sum_{k=1}^{n} [\rho_{Pk} . P_k + \rho_{Qk} . Q_k]$$

where P_k and Q_k are the active and reactive power injections at node k respectively. As concluded by authors in [16], it was observed that the value of losses approximated using MLCs were almost as twice as the actual losses of the system. This leads to over estimation of the nodal prices of the system. Hence, the MLCs have to be adjusted in order to estimate the exact cost of losses, which is done using the factor of reconciliation (Rf). (25)

$$Rf = \frac{L}{L_{approx}} \quad (27)$$

With the application of reconciliation, the new active and reactive nodal prices are obtained as shown below:

$$N_{Pk} = \lambda + \lambda . Rf . \rho_{Pk} = \lambda (1 + Rf . \rho_{Pk})$$

$$N_{Qk} = \lambda . Rf . \rho_{Qk}$$

Realistic ZIP Load Modeling (29)

The realistic time varying load model which is voltage dependent is used in this work. For each hour of the study, the load is assumed to be a combination of residential, industrial and commercial loads. (30)

$$P_k(t) = P_{ko}(t) \left[\alpha(t) \left(\frac{V_k(t)}{V_o} \right)^{npr} + \beta(t) \left(\frac{V_k(t)}{V_o} \right)^{npc} + \gamma(t) \left(\frac{V_k(t)}{V_o} \right)^{npk} \right] \quad (31)$$

$$Q_k(t) = Q_{ko}(t)\left[\alpha(t)\left(\frac{V_k(t)}{V_o}\right)^{nqr} + \beta(t)\left(\frac{V_k(t)}{V_o}\right)^{nqc} + \gamma(t)\left(\frac{V_k(t)}{V_o}\right)^{nqk}\right] \quad (87)$$

where $\alpha(t)$, $\beta(t)$ and $\gamma(t)$ are the fractions of residential, commercial and industrial load for time t at each bus of the system, shown in Appendix A. $P_k(t)$, $Q_k(t)$ and $V_k(t)$ are the active power, reactive power and voltage at bus k for time t respectively.$V_o$is the nominal voltage of the system (1.00 p.u.). The active and reactive power exponents and the fraction of residential, industrial and commercial loads for each hour used are given in Table I.

Table I Exponential coefficient values of residential, commercial and industrial loads

Load type	**Residential**		**Commercial**		**Industrial**	
	npr	***nqr***	***npc***	***nqc***	***npi***	***nqi***
Coefficient values	**0.72**	**2.96**	**1.25**	**3.50**	**0.18**	**6.00**

Results and Discussion

The studies are conducted on the IEEE 33 bus radial distribution system. The base power of the 33 bus RDS is 100 MVA and the base voltage is 12.66 KV. The total connected active power load is 3.72 MW and reactive power load is 2.30 MVAR. The reactive power price at Power supply point (PSP) is taken as 0 $/MVARh. In this paper harmonic nodal prices were obtained for dominant 3rd, 5th and 7th harmonics only.

Table 4 Total Power losses for both normal and ZIP load including harmonics

Harmonic level	**Normal load without PV Power**		**Normal load with PV Power**		**ZIP load without PV Power**		**ZIP load with PV Power**	
	Tpl (KW)	**Tql (KVAR)**	**Tpl (KW)**	**Tql (KVAR)**	**Tpl (KW)**	**Tql (KVAR)**	**Tpl (KW)**	**Tql (KVAR)**
Fundamental	210.9933	143.0294	196.0723	133.9860	201.7606	136.6556	187.1149	127.7751
3rdharmonic	2.3938	4.8817	2.2356	4.5938	2.2783	4.642	2.1234	4.3599
5thharmonic	1.1861	4.0418	1.4639	5.3456	1.1228	3.822	1.4115	5.1580
7thharmonic	0.8953	4.3029	1.0812	5.4569	0.8242	3.9553	1.0166	5.1366

The total active and reactive power losses for each harmonic with both normal and ZIP loads at without and with Solar (PV) power are shown in Table 4. It observed that in case of the fundamental and 3rd harmonic load, active and reactive power loss are reduced in the participation of wind power for both (normal and ZIP) loads. But in case of 5th harmonic load, reactive power loss is increased and active power loss are reducing in both loads. In case of 7th harmonic, active and reactive power loss are increased for participation of solar (PV) power in both loads. Table 5 shows the voltage profile and total harmonic distortion at each bus for each harmonic including fundamental with ZIP loads at without and with solar (PV) power. Table 6 shows the fundamental nodal prices for ZIP load with out and with reconciliation at without and with solar (PV) power. Table 7 -9 shows the nodal prices for 3rd, 5th and 7th harmonic with out and with reconciliation considering ZIP load at without and with wind power. The fundamental nodal prices for normal (CP) load with out and with reconciliation at without and with participation of solar (PV) power are shown in Table 10.

Table 5 Voltage profile for ZIP load with harmonics at without and with solar (PV) Power

bus no:	**ZIP load without PV Power**					**ZIP load with PV Power**				
	fundamental	**3rd harmonic**	**5th harmonic**	**7th harmonic**	**THD (%)**	**fundamental**	**3rd harmonic**	**5th harmonic**	**7th harmonic**	**THD (%)**
1	1	0.1	0.075	0.0513	13.5117	1.0000	0.1000	0.0750	0.0513	13.5117
2	0.9971	0.0995	0.0746	0.0508	13.4735	0.9973	0.0996	0.0747	0.0509	13.4801
3	0.9832	0.0973	0.0724	0.0484	13.2824	0.9846	0.0975	0.0731	0.0487	13.3231
4	0.9759	0.0961	0.0712	0.047	13.166	0.9772	0.0962	0.0719	0.0473	13.2088
5	0.9686	0.0949	0.07	0.0456	13.0487	0.9700	0.0950	0.0707	0.0459	13.0936
6	0.9506	0.0914	0.0663	0.041	12.6337	0.9520	0.0915	0.0670	0.0414	12.6852
7	0.9472	0.0905	0.0653	0.0397	12.5056	0.9486	0.0907	0.0660	0.0401	12.5588
8	0.9339	0.0883	0.0631	0.0372	12.2859	0.9353	0.0885	0.0639	0.0376	12.3427
9	0.9277	0.0873	0.0621	0.0361	12.1865	0.9291	0.0875	0.0630	0.0365	12.2449
10	0.922	0.0864	0.0612	0.0351	12.0956	0.9235	0.0865	0.0621	0.0355	12.1553
11	0.9212	0.0862	0.0611	0.035	12.0902	0.9226	0.0864	0.0620	0.0355	12.1496
12	0.9197	0.086	0.061	0.0349	12.0789	0.9211	0.0862	0.0618	0.0354	12.1382
13	0.9137	0.085	0.06	0.0339	11.9797	0.9152	0.0852	0.0608	0.0343	12.0402
14	0.9115	0.0846	0.0596	0.0335	11.9348	0.9129	0.0848	0.0604	0.0339	11.9955
15	0.9101	0.0844	0.0594	0.0333	11.91	0.9116	0.0846	0.0602	0.0338	11.97

					9					95
16	0.9088	0.0842	0.0592	0.0333	11.9055	0.9102	0.0844	0.0601	0.0337	11.9657
17	0.9068	0.0839	0.0589	0.033	11.8701	0.9083	0.0840	0.0597	0.0334	11.9303
18	0.9062	0.0838	0.0588	0.033	11.8678	0.9077	0.0839	0.0597	0.0334	11.9275
19	0.9965	0.0995	0.0745	0.0507	13.4672	0.9968	0.0995	0.0746	0.0508	13.4737
20	0.993	0.0989	0.074	0.0502	13.4259	0.9932	0.0989	0.0741	0.0503	13.4325
21	0.9923	0.0988	0.0738	0.0501	13.4162	0.9925	0.0988	0.0740	0.0502	13.4229
22	0.9916	0.0987	0.0737	0.05	13.4067	0.9919	0.0987	0.0738	0.0501	13.4134
23	0.9797	0.0968	0.0719	0.0479	13.243	0.9820	0.0970	0.0730	0.0483	13.3069
24	0.973	0.0957	0.0709	0.047	13.1628	0.9775	0.0962	0.0730	0.0477	13.2834
25	0.9698	0.0952	0.0705	0.0465	13.1236	0.9762	0.0959	0.0737	0.0480	13.3317
26	0.9487	0.091	0.0659	0.0406	12.5978	0.9501	0.0912	0.0667	0.0410	12.6497
27	0.9462	0.0906	0.0655	0.0401	12.5483	0.9476	0.0907	0.0662	0.0405	12.6008
28	0.9351	0.0881	0.0629	0.037	12.2359	0.9365	0.0883	0.0637	0.0374	12.2926
29	0.927	0.0864	0.061	0.0348	12.0082	0.9285	0.0866	0.0618	0.0352	12.0677
30	0.9236	0.0857	0.0603	0.034	11.9303	0.9250	0.0859	0.0611	0.0345	11.9906
31	0.9195	0.085	0.0596	0.0332	11.8509	0.9210	0.0852	0.0604	0.0337	11.9121

32	0.9186	0.0848	0.0594	0.0331	11.8341	0.9201	0.0850	0.0602	0.0335	11.8952
33	0.9184	0.0848	0.0593	0.0331	11.8296	0.9198	0.0849	0.0602	0.0335	11.8904

Table 6 Fundamental nodal prices for ZIP load at without and with solar (PV) power

bus No:	**Without reconciliation at without PV power**		**Without reconciliation at with PV power**		**With reconciliation at without PV power**		**With reconciliation at with PV power**	
	Npi ($/MWh)	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**
1	44.5	0	44.5000	0	44.5	0	44.5000	0
2	44.5114	0.0058	44.5106	0.0054	44.5067	0.0034	44.5061	0.0031
3	45.5185	0.6451	45.4098	0.6349	45.1039	0.3825	45.0235	0.3653
4	46.0555	1.0226	45.9508	1.0118	45.4223	0.6063	45.3348	0.5822
5	46.595	1.4045	46.4820	1.3947	45.7422	0.8328	45.6404	0.8025
6	47.7657	2.2586	47.6459	2.2439	46.4363	1.3392	46.3102	1.2911
7	47.924	2.345	47.8051	2.3279	46.5302	1.3904	46.4018	1.3395
8	49.008	2.8649	48.8852	2.8463	47.1729	1.6987	47.0232	1.6378
9	49.5271	3.1081	49.4020	3.0945	47.4807	1.8429	47.3206	1.7806
10	50.0132	3.3402	49.8796	3.3188	47.7689	1.9805	47.5954	1.9097
11	50.0953	3.3801	49.9671	3.3580	47.8176	2.0042	47.6458	1.9322
12	50.2383	3.4478	50.1124	3.4265	47.9024	2.0443	47.7294	1.9716
13	50.7535	3.6853	50.6153	3.6627	48.2079	2.1851	48.0187	2.1075

14	50.9262	3.7613	50.7931	3.7412	48.3103	2.2302	48.1211	2.1527
15	51.0535	3.8041	50.9120	3.7819	48.3858	2.2555	48.1895	2.1761
16	51.1772	3.8512	51.0405	3.8328	48.4591	2.2835	48.2634	2.2054
17	51.338	3.9156	51.2008	3.8892	48.5544	2.3217	48.3556	2.2379
18	51.3898	3.9383	51.2505	3.9173	48.5852	2.3351	48.3843	2.2540
19	44.5446	0.0207	44.5430	0.0185	44.5265	0.0123	44.5247	0.0106
20	44.7741	0.1232	44.7754	0.1206	44.6625	0.0731	44.6585	0.0694
21	44.8159	0.1418	44.8156	0.1405	44.6873	0.0841	44.6816	0.0809
22	44.8524	0.1581	44.8527	0.1536	44.709	0.0938	44.7030	0.0884
23	45.7711	0.7683	45.5678	0.7612	45.2537	0.4556	45.1144	0.4380
24	46.2324	0.9893	45.8265	0.9748	45.5272	0.5866	45.2633	0.5609
25	46.4661	1.1009	45.8673	1.0814	45.6657	0.6527	45.2868	0.6222
26	47.8973	2.3914	47.7814	2.3715	46.5144	1.418	46.3881	1.3646
27	48.0709	2.5739	47.9524	2.5569	46.6173	1.5261	46.4865	1.4712
28	48.6942	3.2674	48.5699	3.2436	46.9869	1.9373	46.8418	1.8664
29	49.1401	3.7937	49.0144	3.7656	47.2513	2.2494	47.0976	2.1668
30	49.3726	4.0956	49.2480	4.0687	47.3891	2.4284	47.2320	2.3411
31	49.6888	4.2543	49.5582	4.2255	47.5766	2.5225	47.4105	2.4313

32	49.7549	4.2886	49.6250	4.2597	47.6158	2.5428	47.4490	2.4510
33	49.7714	4.2993	49.6460	4.2698	47.6255	2.5492	47.4610	2.4569

Table 7 3rd harmonic nodal prices for ZIP load at without and with solar (PV) power

bus No:	**Without reconciliation at without PV power**		**Without reconciliation at with PV power**		**With reconciliation at without PV power**		**With reconciliation at with PV power**	
	Npi ($/MWh)	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**
1	0	0	0	0	0	0	0	0
2	0.0527	0.0267	0.0501	0.0255	0.0003	0.0002	0.0003	0.0001
3	2.2737	0.3638	2.0986	0.4383	0.0137	0.0022	0.0121	0.0025
4	3.5503	0.623	3.4287	0.7256	0.0214	0.0038	0.0198	0.0042
5	4.8571	0.8847	4.7186	0.9807	0.0293	0.0053	0.0273	0.0057
6	8.522	1.7274	8.3617	1.8159	0.0514	0.0104	0.0484	0.0105
7	9.1084	1.9645	8.9412	2.0295	0.0549	0.0118	0.0518	0.0117
8	12.1114	1.945	11.9308	2.0100	0.073	0.0117	0.0691	0.0116
9	13.5712	1.9027	13.3710	1.9668	0.0818	0.0115	0.0774	0.0114
10	14.9528	1.8544	14.8053	1.9637	0.0901	0.0112	0.0857	0.0114
11	15.1178	1.8572	14.9534	1.9527	0.0911	0.0112	0.0866	0.0113

12	15.4078	1.8589	15.2394	1.9629	0.0929	0.0112	0.0882	0.0114
13	16.9565	1.7851	16.7857	1.8893	0.1022	0.0108	0.0972	0.0109
14	17.5761	1.799	17.3936	1.8948	0.1059	0.0108	0.1007	0.0110
15	17.9597	1.7383	17.7668	1.8191	0.1082	0.0105	0.1028	0.0105
16	18.3063	1.6873	18.1055	1.7732	0.1103	0.0102	0.1048	0.0103
17	18.8804	1.6763	18.7061	1.7916	0.1138	0.0101	0.1083	0.0104
18	19.0286	1.6591	18.8644	1.7864	0.1147	0.01	0.1092	0.0103
19	0.1331	0.0233	0.1377	0.0287	0.0008	0.0001	0.0008	0.0002
20	0.6777	0.0074	0.6993	0.0134	0.0041	0	0.0040	0.0001
21	0.7882	0.0084	0.8007	0.0052	0.0048	0.0001	0.0046	0.0000
22	0.8879	0.0066	0.8953	0.0033	0.0054	0	0.0052	0.0000
23	2.8359	0.3401	2.5297	0.5253	0.0171	0.002	0.0146	0.0030
24	3.9369	0.2916	3.2304	0.6481	0.0237	0.0018	0.0187	0.0038
25	4.4948	0.2606	3.4041	0.8130	0.0271	0.0016	0.0197	0.0047
26	8.8971	1.8493	8.6983	1.9118	0.0536	0.0111	0.0503	0.0111
27	9.403	2.024	9.2372	2.1099	0.0567	0.0122	0.0535	0.0122
28	11.798	3.0046	11.6151	3.0736	0.0711	0.0181	0.0672	0.0178
29	13.6078	3.7628	13.3727	3.8009	0.082	0.0227	0.0774	0.0220

30	14.3949	4.0965	14.1879	4.1438	0.0868	0.0247	0.0821	0.0240
31	15.4853	4.1043	15.2501	4.1300	0.0933	0.0247	0.0883	0.0239
32	15.7287	4.1151	15.5138	4.1655	0.0948	0.0248	0.0898	0.0241
33	15.7969	4.1299	15.6021	4.2096	0.0952	0.0249	0.0903	0.0244

Table 8 5th harmonic nodal prices for ZIP load at without and with solar (PV) power

bus No:	**Without reconciliation at without PV power**		**Without reconciliation at with PV power**		**With reconciliation at without PV power**		**With reconciliation at with PV power**	
	Npi ($/MWh)	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**
1	0	0	0	0	0	0	0	0
2	0.1324	0.0669	0.1690	0.0864	0.0004	0.0002	0.0007	0.0004
3	3.5779	0.2567	2.3080	1.9902	0.0103	0.0007	0.0097	0.0084
4	5.6644	0.4819	4.3264	2.2066	0.0163	0.0014	0.0182	0.0093
5	7.8327	0.6981	6.4358	2.4129	0.0225	0.002	0.0271	0.0102
6	14.3061	1.7716	12.7884	3.4756	0.0411	0.0051	0.0538	0.0146
7	15.3802	2.256	13.9014	3.9693	0.0442	0.0065	0.0585	0.0167
8	20.6941	1.6538	19.0091	3.3422	0.0595	0.0048	0.0800	0.0141
9	23.3129	1.2613	21.4406	2.8925	0.067	0.0036	0.0902	0.0122

10	25.8053	0.8387	23.8586	2.4930	0.0742	0.0024	0.1004	0.0105
11	26.0567	0.7847	24.1116	2.4519	0.0749	0.0023	0.1015	0.0103
12	26.5075	0.6866	24.6142	2.3813	0.0762	0.002	0.1036	0.0100
13	29.3555	0.1705	27.4411	1.9329	0.0844	0.0005	0.1155	0.0081
14	30.5317	0.0891	28.5818	1.8443	0.0878	0.0003	0.1203	0.0078
15	31.2195	0.1277	29.2687	1.6458	0.0897	0.0004	0.1232	0.0069
16	31.8247	0.3305	29.7379	1.3577	0.0915	0.001	0.1252	0.0057
17	32.9063	0.4651	30.8521	1.2985	0.0946	0.0013	0.1299	0.0055
18	33.1407	0.5497	30.9783	1.1378	0.0953	0.0016	0.1304	0.0048
19	0.2464	0.0475	0.2955	0.0816	0.0007	0.0001	0.0012	0.0003
20	1.0176	0.0982	1.0539	0.0753	0.0029	0.0003	0.0044	0.0003
21	1.1779	0.117	1.2098	0.1027	0.0034	0.0003	0.0051	0.0004
22	1.3243	0.1284	1.3967	0.0566	0.0038	0.0004	0.0059	0.0002
23	4.386	0.0991	1.5419	3.8396	0.0126	0.0003	0.0065	0.0162
24	5.9977	0.2049	0.8671	7.6202	0.0172	0.0006	-0.0036	0.0321
25	6.8158	0.375	4.3720	11.1577	0.0196	0.0011	-0.0184	0.0470
26	14.9673	1.88	13.3701	3.5463	0.043	0.0054	0.0563	0.0149
27	15.8681	2.0419	14.2960	3.7288	0.0456	0.0059	0.0602	0.0157

28	20.4388	3.3866	18.6516	4.9635	0.0588	0.0097	0.0785	0.0209
29	24.001	4.388	22.1551	5.9812	0.069	0.0126	0.0933	0.0252
30	25.5046	4.6973	23.6324	6.2964	0.0733	0.0135	0.0995	0.0265
31	27.6163	4.4606	25.6572	6.0401	0.0794	0.0128	0.1080	0.0254
32	28.0899	4.4249	26.1592	6.0521	0.0807	0.0127	0.1101	0.0255
33	28.2198	4.4345	26.2466	5.9959	0.0811	0.0127	0.1105	0.0252

Table 9 7th harmonic nodal prices for ZIP load at without and with solar (PV) power

bus No:	**Without reconciliation at without PV power**		**Without reconciliation at with PV power**		**With reconciliation at without PV power**		**With reconciliation at with PV power**	
	Npi ($/MWh)	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**
1	0	0	0	0	0	0	0	0
2	0.7936	0.3988	0.9237	0.4724	0.0007	0.0003	0.0010	0.0005
3	9.9016	2.2172	8.8330	5.6828	0.0082	0.0018	0.0096	0.0062
4	16.2049	3.7016	15.0324	7.1090	0.0134	0.0031	0.0163	0.0077
5	23.054	5.1724	21.7703	8.5340	0.0191	0.0043	0.0236	0.0093
6	44.6689	11.3635	43.2380	14.5720	0.037	0.0094	0.0469	0.0158
7	49.037	14.1727	47.8048	17.4522	0.0406	0.0117	0.0518	0.0189

8	69.3586	12.9781	67.7838	16.1918	0.0575	0.0108	0.0735	0.0176
9	79.9044	11.5815	78.1289	14.7995	0.0662	0.0096	0.0847	0.0160
10	90.1595	9.6638	88.2565	12.9799	0.0747	0.008	0.0957	0.0141
11	90.6647	9.4166	88.4964	12.6479	0.0751	0.0078	0.0959	0.0137
12	91.9521	8.9371	89.6799	12.1580	0.0762	0.0074	0.0972	0.0132
13	104.1331	6.2638	101.9595	9.7778	0.0863	0.0052	0.1105	0.0106
14	109.2028	5.5419	106.9732	9.0504	0.0905	0.0046	0.1160	0.0098
15	111.6422	4.1965	109.2880	7.6213	0.0925	0.0035	0.1185	0.0083
16	113.5191	2.9576	111.2007	6.3963	0.0941	0.0025	0.1205	0.0069
17	117.9819	1.8536	115.7051	5.3143	0.0978	0.0015	0.1254	0.0058
18	118.0378	1.2392	116.0728	4.8465	0.0978	0.001	0.1258	0.0053
19	0.9671	0.3612	1.1216	0.4590	0.0008	0.0003	0.0012	0.0005
20	2.1384	0.0724	2.3117	0.1826	0.0018	0.0001	0.0025	0.0002
21	2.3847	0.0306	2.5593	0.1325	0.002	0	0.0028	0.0001
22	2.6115	0.003	2.7831	0.1066	0.0022	0	0.0030	0.0001
23	11.3482	1.849	8.2292	9.7622	0.0094	0.0015	0.0089	0.0106
24	14.2966	1.1178	4.8118	18.5399	0.0119	0.0009	0.0052	0.0201
25	15.7989	0.6939	1.7377	26.7782	0.0131	0.0006	0.0019	0.0290

26	46.9499	11.7635	45.5664	15.0058	0.0389	0.0098	0.0494	0.0163
27	50.1516	12.356	48.6397	15.5569	0.0416	0.0102	0.0527	0.0169
28	68.1815	18.0178	66.3803	21.0777	0.0565	0.0149	0.0720	0.0228
29	83.4488	21.8718	81.3342	24.8319	0.0692	0.0181	0.0882	0.0269
30	89.6563	22.5876	87.0294	25.3562	0.0743	0.0187	0.0943	0.0275
31	99.2788	20.9429	96.4711	23.7987	0.0823	0.0174	0.1046	0.0258
32	101.2114	20.4429	98.6775	23.6546	0.0839	0.0169	0.1070	0.0256
33	101.5461	20.2144	99.0216	23.4338	0.0842	0.0168	0.1073	0.0254

Table 8 Fundamental nodal prices for Normal load at without and with solar (PV) power

bus No:	**Without reconciliation at without PV power**		**Without reconciliation at with PV power**		**With reconciliation at without PV power**		**With reconciliation at with PV power**	
	Npi ($/MWh)	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**	**Npi ($/MWh)**	**Nqi ($/MVARh)**
1	44.5	0	44.5000	0	44.5	0	44.5000	0
2	44.5119	0.0061	44.5111	0.0057	44.5071	0.0036	44.5064	0.0033
3	45.5389	0.6557	45.4351	0.6478	45.1147	0.388	45.0377	0.3725
4	46.092	1.0391	45.9822	1.0372	45.442	0.6149	45.3522	0.5963
5	46.6432	1.4327	46.5312	1.4293	45.7682	0.8477	45.6678	0.8218

6	47.8471	2.3156	47.7291	2.2977	46.4805	1.3701	46.3565	1.3210
7	48.012	2.4037	47.8903	2.3862	46.5781	1.4223	46.4492	1.3719
8	49.1312	2.9488	49.0095	2.9219	47.2403	1.7448	47.0927	1.6799
9	49.6706	3.1918	49.5417	3.1705	47.5595	1.8886	47.3987	1.8229
10	50.1761	3.4351	50.0450	3.4125	47.8586	2.0326	47.6880	1.9620
11	50.2614	3.4839	50.1230	3.4486	47.9091	2.0614	47.7329	1.9827
12	50.4084	3.5531	50.2693	3.5175	47.996	2.1024	47.8170	2.0223
13	50.9492	3.7964	50.8024	3.7661	48.316	2.2464	48.1235	2.1653
14	51.1246	3.8703	50.9816	3.8454	48.4198	2.2901	48.2265	2.2109
15	51.2583	3.9237	51.1080	3.8925	48.4989	2.3216	48.2992	2.2380
16	51.3805	3.9696	51.2375	3.9439	48.5713	2.3488	48.3736	2.2675
17	51.5518	4.0391	51.4035	4.0070	48.6726	2.39	48.4691	2.3038
18	51.6074	4.0609	51.4589	4.0286	48.7055	2.4028	48.5010	2.3162
19	44.5443	0.0192	44.5435	0.0188	44.5262	0.0113	44.5250	0.0108
20	44.7768	0.1213	44.7760	0.1209	44.6638	0.0718	44.6587	0.0695
21	44.817	0.1413	44.8161	0.1408	44.6876	0.0836	44.6818	0.0810
22	44.8541	0.1544	44.8533	0.1539	44.7095	0.0914	44.7031	0.0885
23	45.7978	0.7772	45.5870	0.7700	45.2679	0.4599	45.1250	0.4427

24	46.2634	1.0047	45.8518	0.9884	45.5434	0.5945	45.2772	0.5683
25	46.4995	1.1138	45.8927	1.0951	45.6831	0.6591	45.3007	0.6296
26	47.98	2.452	47.8614	2.4337	46.5591	1.4509	46.4326	1.3992
27	48.165	2.6351	48.0416	2.6239	46.6686	1.5592	46.5362	1.5086
28	48.8086	3.3559	48.6812	3.3306	47.0494	1.9857	46.9039	1.9149
29	49.2657	3.9002	49.1362	3.8727	47.3199	2.3078	47.1655	2.2266
30	49.5019	4.2058	49.3801	4.1817	47.4596	2.4886	47.3058	2.4042
31	49.8326	4.3709	49.6982	4.3455	47.6553	2.5863	47.4887	2.4984
32	49.9001	4.4056	49.7705	4.3860	47.6953	2.6068	47.5302	2.5217
33	49.9161	4.4192	49.7880	4.3906	47.7048	2.6149	47.5403	2.5243

Table 09 Active nodal prices with reconciliation at both load without and with solar (PV) power

Bus no:	**CP load without PVpower**			**CP load with PV power**			**ZIP load without PV power**			**ZIP load with PV power**		
	fundamental	**Fund+ 3^{rd}+5^{th} harmonic**	**Fund+3^{rd}+ 5^{th}+7^{th} harmonic**	**fundamental**	**Fund+ 3^{rd}+5^{th} harmonic**	**Fund+3^{rd}+ 5^{th}+7^{th} harmonic**	**fundamental**	**Fund+ 3^{rd}+5^{th} harmonic**	**Fund+3^{rd}+ 5^{th}+7^{th} harmonic**	**fundamental**	**Fund+ 3^{rd}+5^{th} harmonic**	**Fund+3^{rd}+ 5^{th}+7^{th} harmonic**
1	44.5	44.5	44.5	44.5000	44.5000	44.5000	44.5	44.5	44.5	44.5000	44.5000	44.5000

2	44.5071	44.5078	44.5085	44.5064	44.5074	44.5085	44.5067	44.5074	44.5081	44.5061	44.5071	44.5081
3	45.1147	45.1389	45.1473	45.0377	45.0604	45.0700	45.1039	45.1279	45.1361	45.0235	45.0453	45.0549
4	45.442	45.4803	45.4941	45.3522	45.3911	45.4076	45.4223	45.46	45.4734	45.3348	45.3728	45.3891
5	45.7682	45.8214	45.8412	45.6678	45.7234	45.7475	45.7422	45.7939	45.8131	45.6404	45.6948	45.7184
6	46.4805	46.5756	46.6142	46.3565	46.4604	46.5083	46.4363	46.5288	46.5658	46.3102	46.4124	46.4593
7	46.5781	46.6801	46.7225	46.4492	46.5613	46.6144	46.5302	46.6293	46.6699	46.4018	46.5120	46.5639
8	47.2403	47.3768	47.4374	47.0927	47.2448	47.3210	47.1729	47.3054	47.3629	47.0232	47.1723	47.2458
9	47.5595	47.7133	47.7835	47.3987	47.5702	47.6581	47.4807	47.6295	47.6958	47.3206	47.4883	47.5730
10	47.8586	48.028	48.1073	47.6880	47.8789	47.9787	47.7689	47.9332	48.0079	47.5954	47.7816	47.8772
11	47.9091	48.0802	48.1603	47.7329	47.9256	48.0258	47.8176	47.9836	48.0588	47.6458	47.8338	47.9298
12	47.996	48.1712	48.2524	47.8170	48.0127	48.1142	47.9024	48.0714	48.1477	47.7294	47.9212	48.0184
13	48.316	48.5094	48.6016	48.1235	48.3404	48.4558	48.2079	48.3945	48.4808	48.0187	48.2314	48.3419
14	48.4198	48.6205	48.7173	48.2265	48.4519	48.5731	48.3103	48.504	48.5945	48.1211	48.3421	48.4580
15	48.4989	48.704	48.8029	48.2992	48.5302	48.6540	48.3858	48.5838	48.6763	48.1895	48.4155	48.5340
16	48.5713	48.7803	48.881	48.3736	48.6093	48.7354	48.4591	48.6609	48.755	48.2634	48.4934	48.6139
17	48.6726	48.8885	48.9932	48.4691	48.7128	48.8440	48.5544	48.7628	48.8606	48.3556	48.5938	48.7192
18	48.7055	48.9233	49.0277	48.5010	48.7462	48.8778	48.5852	48.7951	48.893	48.3843	48.6238	48.7497
19	44.5262	44.5277	44.5285	44.5250	44.5271	44.5282	44.5265	44.528	44.5288	44.5247	44.5268	44.5280

20	44.6638	44.6706	44.6724	44.6587	44.6670	44.6693	44.6625	44.6696	44.6713	44.6585	44.6670	44.6695
21	44.6876	44.6954	44.6974	44.6818	44.6915	44.6941	44.6873	44.6955	44.6974	44.6816	44.6913	44.6941
22	44.7095	44.7186	44.7207	44.7031	44.7141	44.7168	44.709	44.7181	44.7203	44.7030	44.7140	44.7170
23	45.2679	45.298	45.3075	45.1250	45.1467	45.1557	45.2537	45.2834	45.2928	45.1144	45.1356	45.1445
24	45.5434	45.5848	45.5965	45.2772	45.2935	45.2991	45.5272	45.5681	45.58	45.2633	45.2783	45.2835
25	45.6831	45.7301	45.7431	45.3007	45.3035	45.3026	45.6657	45.7124	45.7255	45.2868	45.2881	45.2862
26	46.5591	46.658	46.6986	46.4326	46.5419	46.5924	46.5144	46.611	46.6499	46.3881	46.4947	46.5441
27	46.6686	46.7736	46.8168	46.5362	46.6514	46.7053	46.6173	46.7196	46.7612	46.4865	46.6002	46.6529
28	47.0494	47.183	47.2423	46.9039	47.0527	47.1265	46.9869	47.1167	47.1733	46.8418	46.9876	47.0595
29	47.3199	47.4754	47.5482	47.1655	47.3398	47.4307	47.2513	47.4023	47.4714	47.0976	47.2683	47.3564
30	47.4596	47.6251	47.7035	47.3058	47.4909	47.5889	47.3891	47.5492	47.6235	47.2320	47.4136	47.5080
31	47.6553	47.8335	47.9206	47.4887	47.6892	47.7979	47.5766	47.7493	47.8316	47.4105	47.6068	47.7114
32	47.6953	47.8766	47.9656	47.5302	47.7340	47.8453	47.6158	47.7913	47.8752	47.4490	47.6489	47.7558
33	47.7048	47.8866	47.9756	47.5403	47.7453	47.8569	47.6255	47.8019	47.886	47.4610	47.6618	47.7692

Table 10 Reactive nodal prices with reconciliation at both load without and with solar (PV) power

Bus no	**CP load without PV power**			**CP load with PV power**			**ZIP load without PV power**			**ZIP load with PV power**		
	Fundamental	**Fund+ $3^{rd}+5^{th}$**	**Fund+3^{rd}+**	**fundamental**	**Fund+ $3^{rd}+5^{th}$**	**Fund+3^{rd}+**	**fundamental**	**Fund+ $3^{rd}+5^{th}$**	**Fund+3^{rd}+**	**fundamental**	**Fund+ $3^{rd}+5^{th}$**	**Fund+3^{rd}+**

:		harmonic	$5^{th}+7^{th}$ harmonic		harmonic	$5^{th}+7^{th}$ harmonic		harmonic	$5^{th}+7^{th}$ harmonic		harmonic	$5^{th}+7^{th}$ harmonic
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0.0036	0.004	0.0043	0.0033	0.0038	0.0043	0.0034	0.0038	0.0041	0.0031	0.0036	0.0041
3	0.388	0.391	0.3931	0.3725	0.3835	0.3895	0.3825	0.3854	0.3873	0.3653	0.3762	0.3824
4	0.6149	0.6202	0.6237	0.5963	0.6099	0.6177	0.6063	0.6115	0.6145	0.5822	0.5957	0.6034
5	0.8477	0.8556	0.8606	0.8218	0.8379	0.8474	0.8328	0.8401	0.8444	0.8025	0.8184	0.8276
6	1.3701	1.3865	1.3973	1.3210	1.3465	1.3632	1.3392	1.3547	1.3641	1.2911	1.3163	1.3321
7	1.4223	1.4416	1.4549	1.3719	1.4009	1.4209	1.3904	1.4087	1.4205	1.3395	1.3679	1.3869
8	1.7448	1.7623	1.7749	1.6799	1.7065	1.7256	1.6987	1.7152	1.7259	1.6378	1.6635	1.6810
9	1.8886	1.9049	1.9164	1.8229	1.8474	1.8648	1.8429	1.8579	1.8675	1.7806	1.8042	1.8202
10	2.0326	2.0469	2.0566	1.9620	1.9850	2.0006	1.9805	1.9941	2.0021	1.9097	1.9315	1.9456
11	2.0614	2.0756	2.0853	1.9827	2.0055	2.0208	2.0042	2.0176	2.0254	1.9322	1.9538	1.9675
12	2.1024	2.1166	2.1258	2.0223	2.0445	2.0592	2.0443	2.0575	2.0649	1.9716	1.9930	2.0062
13	2.2464	2.2585	2.2653	2.1653	2.1848	2.1966	2.1851	2.1964	2.2016	2.1075	2.1266	2.1372
14	2.2901	2.3018	2.3079	2.2109	2.2299	2.2408	2.2302	2.2413	2.2459	2.1527	2.1714	2.1812
15	2.3216	2.3322	2.337	2.2380	2.2562	2.2653	2.2555	2.2656	2.2691	2.1761	2.1936	2.2018

16	2.3488	2.3585	2.3622	2.2675	2.2845	2.2923	2.2835	2.2927	2.2951	2.2054	2.2214	2.2283
17	2.39	2.3991	2.4018	2.3038	2.3202	2.3266	2.3217	2.3304	2.332	2.2379	2.2537	2.2595
18	2.4028	2.4118	2.4137	2.3162	2.3318	2.3377	2.3351	2.3435	2.3446	2.2540	2.2692	2.2744
19	0.0113	0.0116	0.0119	0.0108	0.0113	0.0117	0.0123	0.0126	0.0129	0.0106	0.0111	0.0116
20	0.0718	0.0714	0.0715	0.0695	0.0693	0.0695	0.0731	0.0727	0.0728	0.0694	0.0692	0.0694
21	0.0836	0.0831	0.0832	0.0810	0.0809	0.0810	0.0841	0.0837	0.0837	0.0809	0.0805	0.0806
22	0.0914	0.091	0.0911	0.0885	0.0883	0.0884	0.0938	0.0934	0.0934	0.0884	0.0882	0.0883
23	0.4599	0.4624	0.4643	0.4427	0.4615	0.4716	0.4556	0.4579	0.4594	0.4380	0.4572	0.4678
24	0.5945	0.5958	0.5971	0.5683	0.6034	0.6222	0.5866	0.5877	0.5887	0.5609	0.5967	0.6168
25	0.6591	0.6597	0.6607	0.6296	0.6799	0.7068	0.6527	0.6532	0.6538	0.6222	0.6739	0.7029
26	1.4509	1.4682	1.4793	1.3992	1.4261	1.4433	1.418	1.4345	1.4443	1.3646	1.3906	1.4069
27	1.5592	1.5782	1.5898	1.5086	1.5368	1.5546	1.5261	1.5442	1.5545	1.4712	1.4991	1.5160
28	1.9857	2.015	2.0318	1.9149	1.9548	1.9789	1.9373	1.9652	1.9801	1.8664	1.9050	1.9279
29	2.3078	2.3447	2.3649	2.2266	2.2751	2.3036	2.2494	2.2847	2.3028	2.1668	2.2139	2.2409
30	2.4886	2.5288	2.5497	2.4042	2.4560	2.4853	2.4284	2.4666	2.4853	2.3411	2.3916	2.4191
31	2.5863	2.6254	2.6447	2.4984	2.5494	2.5768	2.5225	2.5601	2.5774	2.4313	2.4807	2.5065
32	2.6068	2.6461	2.6653	2.5217	2.5723	2.5995	2.5428	2.5803	2.5973	2.4510	2.5006	2.5263
33	2.6149	2.6538	2.6724	2.5243	2.5755	2.6024	2.5492	2.5868	2.6036	2.4569	2.5065	2.5319

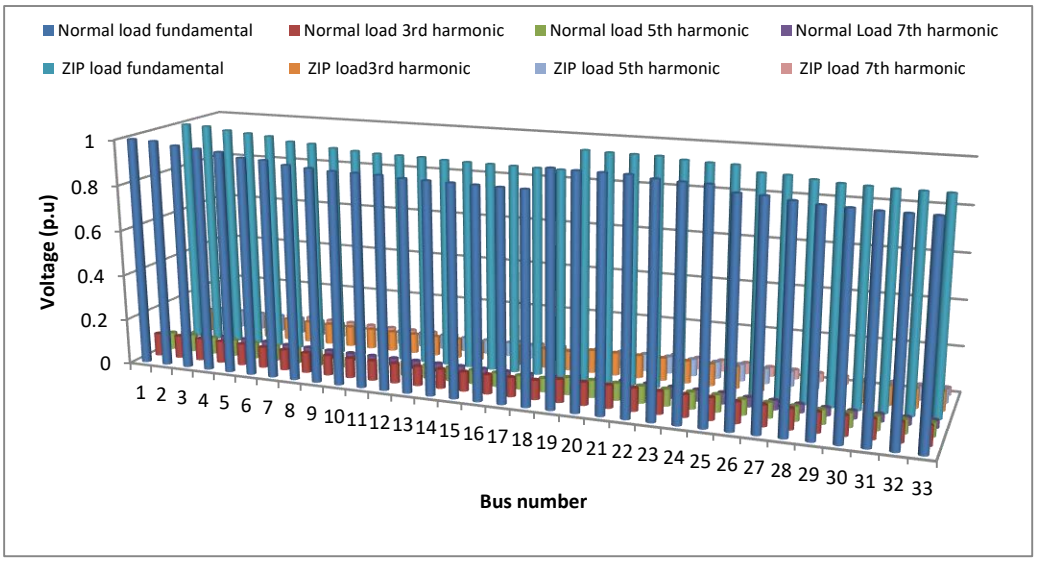

Fig.4 Voltage profile for all harmonics with both loads at solar (PV) power

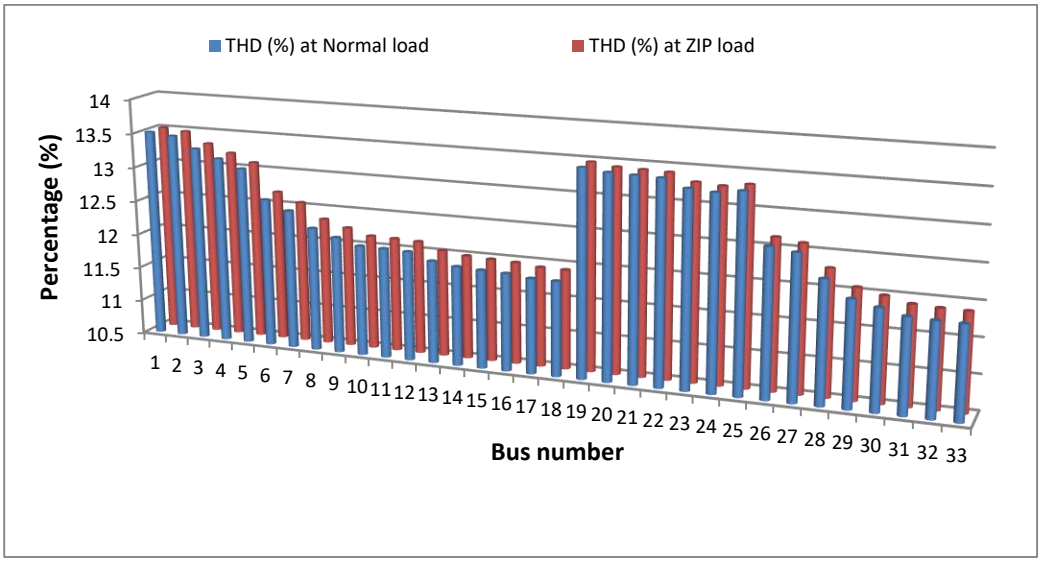

Fig.5 Total harmonic distortions (THD) in voltage for both loads at solar (PV) power

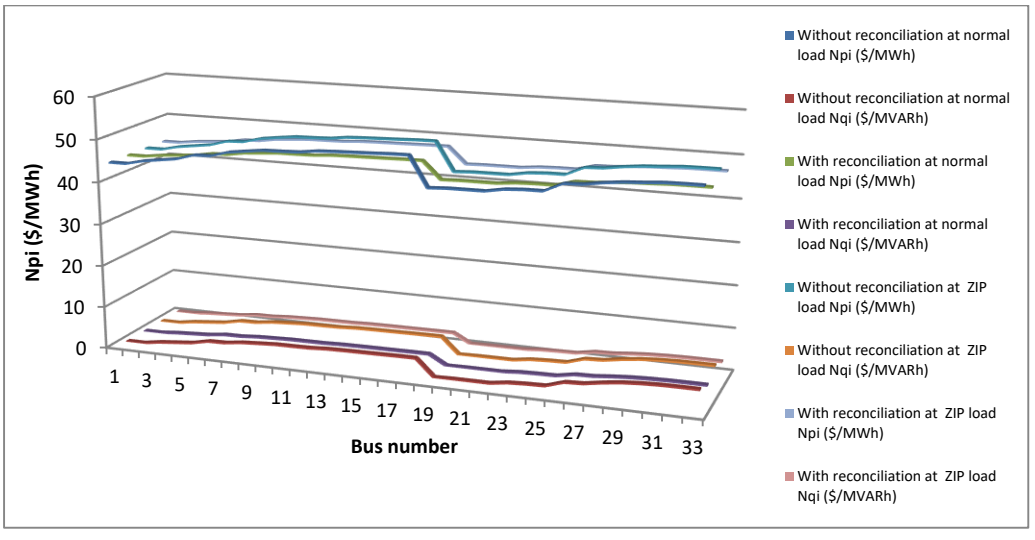

Fig.6 Fundamental nodal prices for both loads at solar (PV) power

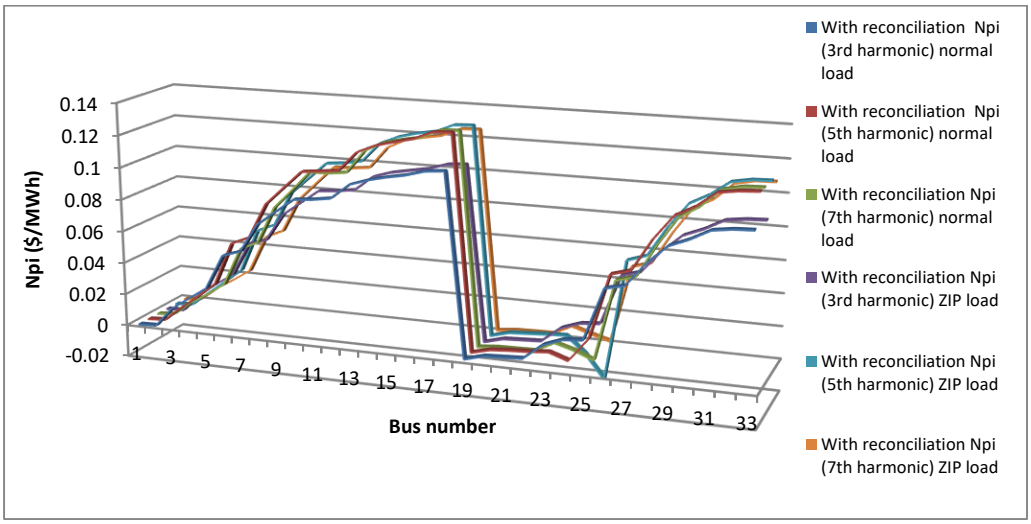

Fig.7 Harmonic active nodal prices for both loads at solar (PV) power

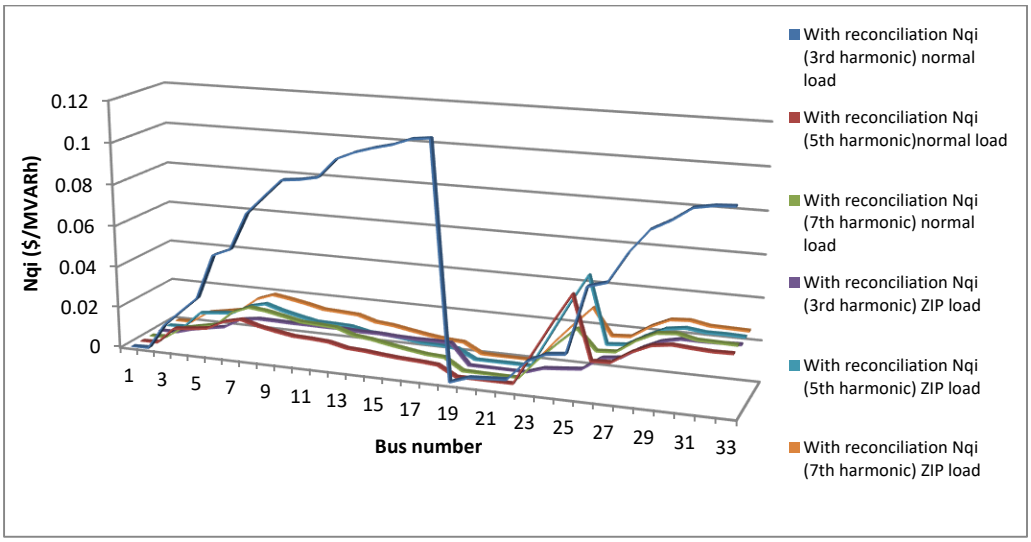

Fig.8 Harmonic reactive nodal prices for both loads at solar (PV) power

The voltage profile of both loads for harmonics with the participation of wind power has been shown graphically in Figure 4. Figure 5 shows the total harmonic distortion in voltages for normal and ZIP loads. It has been obtained that, in case of ZIP load the voltage profile for all harmonics are improved as comparison of normal load and total harmonic distortion in voltage are less as compare to average load. Figure 6 shows the fundamental nodal prices for both (normal and ZIP) loads without and with reconciliation at wind power participate in the RDS. Figure 7 and Figure 8 show active and reactive nodal prices with both (normal and ZIP) loads for 3^{rd}, 5^{th} and 7^{th} harmonics, respectively. It is evident from these results that harmonic power losses are less for ZIP load compared to normal load. Loss and voltage values of system are reduced going towards higher order harmonics. Harmonic distortion in voltage is high for ZIP load. Both fundamental and harmonic nodal prices are reduced with reconciliation and this reduction is more ZIP load. Finally, nodal prices are increased with the presence of 3^{rd} and 5^{th} harmonics and are further increased with including 7^{th} harmonic in both loads and these are higher for average load compared to ZIP load.

Conclusions

In this study, the nodal prices were obtained for CP (normal), and ZIP loads, and harmonic load with dominant 3^{rd} ,5^{th} and 7^{th} harmonics. Based on the study conducted, the following observations were made:

- With harmonic load, the losses are higher compared to the CP and ZIP load.
- Nodal prices reduce with PV for all types of loads.
- Harmonic distortion in voltage is obtained high for ZIP load.
- The nodal prices are higher with the presence of harmonics and these are higher for CP load compared to ZIP load.

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REVIEW ON VARIOUS MACHINE LEARNING TECHNIQUES FOR EARLY PREDICTION OF MELANOMA SKIN CANCER

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ABSTRACT

The abnormal development of skin cells is known as skin cancer. It's a common cancer that can develop anywhere on the body, although it's most commonly found on sun-exposed skin. UV radiation from the sun can damage the DNA in your skin cells, leading to the formation of malignant cells over time. Skin cancer can affect anyone, however certain factors can raise one's risk. Lighter skin, a history of sunburns, and a personal or family history of skin cancer are all risk factors. The chances of surviving skin cancer differ depending on the type of malignancy. When not treated early, some types of skin cancer can be fatal, while others have a low mortality risk. Melanoma is a cancer that is fatal after it has spread, but it is treatable in its early stages. Melanoma treatment requires an early diagnosis and recognition method based on dermoscopy. Dermatologists with advanced training, on the other hand, have a significant advantage in terms of diagnosis accuracy. Many efforts are being made to build automatic image analysis systems in order to overcome this challenge. In this paper, various machine learning techniques used for early prediction of melanoma skin cancer is discussed.

Keywords: *Skin Cancer, Melanoma, Machine Learning Techniques, Early Prediction, Dermatology*

INTRODUCTION

One of the common cancers that frighten the people throughout the world is skin cancer. According to the American Cancer Society (ACS), approximately 106110 new cases of melanoma will be diagnosed in the United States by 2021, and around 7180 people will die from melanoma.Melanoma is responsible for approximately 1% of all diagnosed cases of skin cancer (Melanoma, basal cell carcinoma, and squamous cell carcinoma shown in figure 1), but it accounts for over 75% of all skin cancer-related deaths. Melanoma claims 10,000 lives per year, which equates to one death every 52 minutes. According to the Melanoma Research Alliance, melanoma stages 0, 1, and 2 have a five-year survival rate of 98.4 percent. After five years, stage 3 melanoma had a survival rate of 63.6 percent[1].. The survival rate for stage 4 melanoma is 22.5 percent. Melanoma spreads quickly, therefore good monitoring and diagnosis of skin lesions are critical for improving the disease's survivability.

One of the most essential procedures for examining skin lesions is Dermoscopy because it can obtain high-resolution images of the skin without being interrupted by reflections on the surface. This high-resolution imaging is used by specially educated professionals to assess the likelihood of melanoma early on, with diagnostic accuracy of up to 80% [2]. However, only limited experienced dermatologist is available throughout the world. In the academic research community, there has been an effort to construct machine-driven image analysis software to identify different skin-related disorders using dermoscopy images in order to solve this problem. For two primary reasons, previous computer-aided classification systems have been less successful: 1) The database isn't quite up to par as previous research relied on a small number of dermoscopy skin lesion images, algorithms were unable to learn and extract valuable information. 2) Because people's computing abilities were restricted in the past, they had few ideas for dealing with a large number of photos.

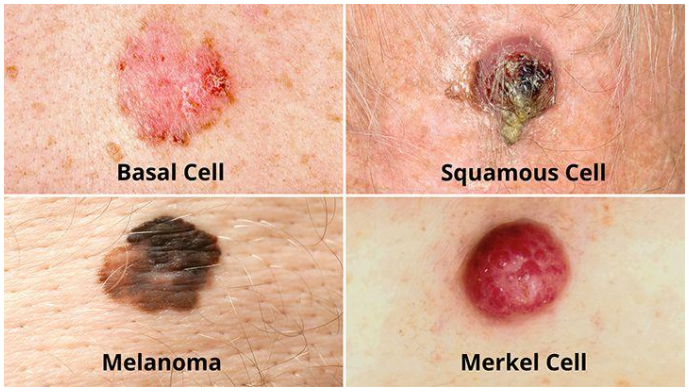

Fig.1 Types of cancer

Dermatologists created the ABCDEs, a mnemonic that highlights recognized visual traits and cues of malignant Melanoma moles, to help with appropriate detection and suspicious mole tracing. Asymmetrical shape, Diameter, Color, Evolution over time and Border irregularities, are the acronyms for the ABCDE mnemonic. The shape, location on the body, and arrangement of lesions can also reveal details about the skin condition [3].Convolution neural networks (CNNs) have been employed in recent research in digital skin diagnostics to categorize images of melanoma and nevi with accuracies comparable to those attained by dermatologists [4-6]. Prior studies used a huge number of photos to train their algorithms, which were then confirmed by consensus decisions. When images are validated in this way, there is a strong chance that the CNN will learn the dermatologists' decision-making process, including all probable errors. The purpose of this paper is to find the various Machine Learning[ML] algorithms available for pre detecting the melanoma skin cancer, its advantages and disadvantages.

ROLE OF ARTIFICIAL INTELLIGENCE AND ML IN DERMATOLOGY

Artificial intelligence (AI) is a discipline of computer science that employs machines and programs to replicate intelligent human behavior, whereas machine learning (ML) is a tool made up of a subset of AI that allows AI to fulfill its aims. Logistic regression, random forest, and deep learning are examples of ML algorithms and statistical methodologies. Although machine learning may appear mysterious at first, it is closely related to classic statistical models that most dermatologists are familiar with. Machine Learning Technique is divided into three types:

1. **Supervised Learning** – Need input called features and output called Labels. The algorithm is trained on labeled images of melanoma and benign pigmented lesions before being applied to a new collection of skin images that have never been seen before. The most common type of learning in dermatology is supervised learning.[7]
2. **Unsupervised Learning** – Need only input unlabeled data. This method can detect unknown data clusters or anomalies.[7]
3. **Reinforcement Learning** – Combination of Supervised and Unsupervised techniques that uses trial and error approach.[7]

In dermatology, a variety of machine learning methods are routinely utilized. Most machine learning algorithms are statistical learning methods; for example, linear regression, logistic regression, k-nearest neighbor (k-NN), support vector machine (SVM), random forest (RF), and natural language processing are some of the most prominent statistical learning methods (NLP). The k-NN algorithm is used to classify and predict data depending on the number of k neighbors [8,9]. SVMs are used to categorize data by locating a hyperplane that separates groups [10].RFs produce a network of random decision trees in order to discover the most frequent result across all of the randomly produced decision trees [11]. NLP examines enormous amounts of text in order to detect patterns [12].

DERMATOLOGY AND MACHINE LEARNING

Deep learning is a kind of machine learning that simulates how neurons process information using statistical and mathematical models. Artificial neural networks (ANNs), also known as neural networks (NNs), are made up of interconnected units (such as nodes, neurons, and process layers). The human brain's network of neurons is the inspiration for ANNs. The ANN's neurons, or nodes, are grouped into layers, which are linear arrays. Each node receives data from other connections with weighted connections. Choosing the number of nodes in each layer, the number of layers in the network, and the path of the connections between the nodes are all part

of the process of creating an ANN [13]. Input layers, output layers, and hidden layers are all present in a conventional ANN. Through a learning process, ANNs are taught to execute certain tasks, such as categorization. ANNs can learn either supervised or unsupervised; however supervised learning is more prevalent. A training set in supervised learning contains examples of input and output targets [13]. The weights of the inputs are modified as the ANN is trained to reduce the error between the network output and the proper output [13].

MELANOMA AND MACHINE LEARNING

Melanoma is the fifth most frequent invasive cancer in the United States, and its prevalence is on the rise globally [14, 15]. Melanomas are also the cause of the majority of skin cancer-related deaths [14]. A total body skin examination is used to screen for skin cancer. Unfortunately, according to statistics from the National Health Interview Survey, screening rates are shockingly low (16 percent for men and 13 percent for women) [16]. As a result, the earliest deep learning algorithms targeted on classifying melanoma in order to overcome low screening rates and better respond.

Esteva et al. in 2017 [17] published one of the first landmark studies to accurately diagnose malignant melanoma. The CNN employed in this investigation was Google Inception V3, which has been pretrained on 1.28 million images of general items. The authors used 129,450 dermoscopic and clinical images to train the algorithm using transfer learning. This was the first classifier to classify keratinocyte cancer versus seborrheic keratosis and malignant melanoma vs benign nevi with the same accuracy as dermatologists. The CNN was accurate 72.1 percent of the time, while two dermatologists were accurate 65.56 and 66 percent of the time, respectively. The CNN's total area under the receiveroperating characteristic (AUROC or AUC) was [91 percent], which was similar to 21 dermatologists' average output predictions.

SS Hans et al (2018) used 12 clinical images for classifying skin cancer using deep learning algorithms.They used biopsy-proven images from the Asan test dataset and the Edinburgh dataset to compare the performances of the panel of dermatologists and their algorithm.Because of disparities in patient ethnicity and variations in total image contrast due to differential lighting and backdrop, the Edinburgh dataset's diagnosis accuracy was slightly lower than the Asan dataset's.

Limitations: This is limited to classify only 12 clinical images.To properly reflect the world's population, these algorithms must be trained and validated across a wider range of population sets. The majority of algorithms are tested on Caucasian or Asian patients. [18]

H. A. Haenssle et al (2018) compared a CNN's diagnostic performance to that of a large worldwide group of 58 dermatologists, 30 experts. They showed CNN outperforms well and coincides with the dermatologists' decision on skin cancer.

Limitations: The limitation of this method includes their study's test sets did not include the complete range of lesions, due to a lack of authenticated images, melanocytic lesions from various skin types and genetic backgrounds were few.[19]

CNN design was proposed by Rehman et al. [2018], which consisted of 16 distinct filters with 7*7 kernel sizes and pooling layers for down sampling. Melanoma, Seborrheic keratosis, and nevus were used to train the suggested model for both malignant and benign illnesses. The segmented image's RGB channels are normalized with a zero mean and unit variance. This normalized matrix was input to CNN for feature extraction, and the fully connected layer is made up of three layer ANN classifiers that classify skin lesions as benign or malignant.[20]

The proposed approach by Lopez et al [2019] is based on the VGGNet (Very Deep Convolutional Network for Large-Scale Visual Recognition) convolutional neural network architecture and employs the transfer learning paradigm.It makes use of a pre-existing convolutional neural network (CNN)

architecture called VGGNet, which was created by the University's Visual Geometry Group of the University of Oxford in three ways: (i) training the CNNfrom the ground up; (ii) applying the transfer learning paradigmuse features from a VGGNet that has been pre-trained on a larger dataset(iii) maintaining the transfer learning paradigm while fine-tuning the CNN architecture.

Limitations:(i)Not using a larger dataset to reduce the danger of overfitting; (ii) No fine-tuning hyper parameters and regularization modifications; and (iii) training the architecture with Imagenet, a general dataset. [21]

Brinker et al [2019] trained a convolutional neural network (CNN) using advanced deep learning methods with 12,378 open-source dermoscopic images,. They compared the CNN's performance against that of 157 dermatologists from 12 German university hospitals using 100 images. The deep neural network outperformed dermatologists in terms of sensitivity, specificity, and receiver operating characteristics.

Limitations: Still additional clinical data are to be considered for better performance of the proposed method[22].

Cui X et al [2019] proposed an Artificial Intelligence method for detecting Melanoma skin cancer. There were two portions to the regular machine learning and deep learning methods, with a total of four experiments. They tested four image segmentation algorithms with groundtruths that were built by three dermatologists and then re-checked by a senior dermatologist in the standard machine learning experiment. After feature extraction, four melanoma classifiers were compared using the best segmentation findings. Comparative tests were conducted on four popular models in recent years in the deep learning segment, and the best model for melanoma diagnosis was chosen.

Limitations: The limitations includes: the severity of the melanoma samples utilized in this experiment is not divided, and all of the non-melanoma samples are benign nevi. As a result, further research is needed to define the severity of melanoma, and the data utilized to do so should be expanded to cover certain problematic situations like dysplastic nevus. Due to the limited quantity of data used in the experiment, machine learning outperforms deep learning in this case. However, as the amount of data grows, the benefits of deep learning will become more apparent. More information should be gathered and used in future research [23].

JinenDaghrir [2020] presented a system based on three separate ways of prediction: Two traditional machine learning classifiers and a convolutional neural network were trained with a set of data identifying the borders, texture, and color of a skin lesion. The results of these systems are then pooled using majority vote to improve their performance. Experiments have demonstrated that combining the three strategies yields the maximum level of accuracy. [24]

Limitations: Scalability Issues

Vijayalakshmi M M [2020] proposed a hybrid approach using CNN and Support Vector Machine and finally predicted the Melanoma Skin cancer using image processing tools. She did preprocessing steps to remove hair, shadow and glare. She used ISIC dataset. [25].

Limitations: This is limited to only few datasets

M.A. Kadampur [2019] suggested a cloud-based model-driven architecture that employs deep learning algorithms in its core implementations to build models that aid in the more accurate prediction of skin cancer. The work demonstrates how to create models and use them to classify dermal cell pictures.They devised a platform that allows anyone with no programming experience to create complicated deep learning models. It hinted at general techniques and looping patterns in the building of deep learning models, allowing for more flexibility in creating deep learning classifiers.

Limitations: Their approaches are not programmatically implemented.[26]

A. Dascalu et al.[2019] used sonification and a rudimentary skin magnifier with polarized(SMP) light to investigate the effects of image quality on diagnosis accuracy .SMP dermoscopy images were sonified after being processed by a first deep

learning system. A supplementary Deep Learning was used to examine the audio output. SMP's study criteria outcomes were specificity and sensitivity, which were further processed by an F2-score, which gives sensitivity twice as much weight as positive predictive values.

Limitations: The claim that SMP image quality is diagnostically equivalent to that of an advanced dermoscope could be one of the study's limitations. The raw quality of the images, which are hazy and display fuzzy edges on high magnification, make diagnosis difficult, make it unlikely that SMP will obtain a high quality image that is close to the Advanced Dermoscope (AD). The study may encounter a random mistake because to the small number of patients tested, but owing to the system's great sensitivity, which includes fine features of dysplastic nevi, missing a Malignant Melanoma is improbable.[27]

The safest method to employ ML, according to Price et al. [2019], is to utilize it exclusively as a confirmatory tool to support existing decisionmaking processes and to double-check with particular malpractice insurers. Physicians are expected to have an impact on how machine learning is utilized in practice and when it should be utilized instead of human decision-making.[28].

The following table 1 gives the overall idea about the works discussed above.

Author	**Method**	**Dataset**	**Accuracy**
Esteva et al [17]	CNN – Google Inception V3	129,450 dermoscopic and clinical images	72.1 %
Hans et al [18]	Deep Learning	Edinburg and Asan Dataset – 12 clinical images	86.4% in Asan and 85.1% Edinburg dataset
H. A. Haenssle et al [19]	Google's Inception v4 CNN	100 Dermoscopic images dataset	86%
Rehman et al. [20]	CNN and ANN	16 distinct filters with 7*7 kernel sizes and pooling layers	81%
Lopez et al [21]	VGGNet and CNN	Dermofit Image Library and Dermnet	81.33%
Brinker et al [22]	Enhanced Deep Learning with CNN	100 Dermoscopic images	84.5%
Cui X et al[23]	AI methods comparison	2200 Dermoscopic images	93.74%
Vijayalakshmi MM	CNN with SVM	ISIC dataset	85%
Dascalu et al	Sonification and a rudimentary skin magnifier with polarized(SMP)	Dermascopy Images	81.8%

Table 1. COMPARISON OF VARIOUS METHODS FOR MELANOMA DETECTION

CONCLUSION

In this paper, various machine learning techniques available for early prediction of Melanoma skin cancer are discussed. Further, the methods recently proposed by the authors, the dataset used by them and the accuracy they obtained are also discussed. For the diagnosis of melanoma, current dermatologists' knowledge is invaluable. Incorporating expert knowledge into the deep learning process is an important research topic due to the scarcity of medical data and many quality challenges.

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Improvisational Behavior and Consequences on Business Performance and Stress of Entrepreneurs during Economic Downturn

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ABSTRACT

Small and medium-sized companies (SMEs), which include self-employed individuals, account for 90% of all businesses and 70% of all jobs globally. An estimated tens of millions of people's employment are in jeopardy due to the Covid-19 outbreak. The findings of a worldwide investigation performed in 2020 are presented in this paper. Entrepreneurs in 23 nations account for more than three-quarters of the world's gross domestic product. Most small company owners faced severe threats to their viability. We also witness resilience in how businesses dealt with the epidemic by being agile, adaptable, exploring new possibilities, employing government backing, giving back to society, and even harbouring development dreams beyond the pandemic itself. In the pandemic, the emotional well-being of entrepreneurs decreased by 12 per cent, putting their firms at risk. To remain productive, entrepreneurs use a variety of well-being tools, including social support and self-care measures. To wrap up the paper, we look at five themes that will shape the post-Covid economy: digitalization, 'local' emphasis; inclusive business models; increasing personal and business resilience, and we provide five practical strategies for entrepreneurs to safeguard their well-being amid these developments.

1. Introduction:

Economic growth depends on entrepreneurship. According to the World Bank, small and medium-sized firms (SMEs) make up 90 per cent of businesses worldwide1 (99.8 per cent in the European Union2 and 99.9 per cent in the United States). 70% of the world's workforce is employed in the service sector, accounting for 50% of GDP in OECD nations and 40% in developing economies. Because of their smaller size, these enterprises are more susceptible to economic downturns than their larger counterparts. Job losses at small and medium-sized firms (SMEs) are often overlooked in the media, even though the total number of SMEs losing jobs is likely more significant than that of big businesses. In light of the current severity of the Covid-19 epidemic, it is necessary to have a better understanding of the challenges faced by entrepreneurs and their expectations for the future, both short-term and long-term. More than 5,000 entrepreneurs from 23 countries were surveyed for this research. An entrepreneur had to be the company's CEO and own a significant portion of it to be included in the study. According to the European Union's definition of small and medium-sized enterprises (SMEs), we had both established and start-up entrepreneurs running businesses of all sizes with a maximum of 250 workers. Our sample includes 3,796 SME owners and managers and 1,410 self-employed people. Australia, Bangladesh, Bosnia and Herzegovina, Canada, Chile, China, Colombia, Denmark, France, Germany, India, Italy, Japan, New Zealand, Norway, Pakistan, Poland, Slovakia, Spain, Sweden, UK, and the United States were the 23 participating nations. These 23 nations account for 75% of the world's GDP and 56% of the world's population.

With the support of entrepreneurial groups, chambers of commerce, and direct

contact with SME owner-managers and the self-employed, we conducted a comprehensive survey of entrepreneurs. During the first wave of the pandemic (between April and the end of August 2020), lockdowns were implemented in most nations to restrict the spread of the Coronavirus, which was assessed in this report. Many schools, colleges, and companies were shut down during data collecting, despite differing lockdown legislation in different nations.

2. Methodology:

A total of 5,206 entrepreneurs from 23 countries were surveyed between April and August 2020 for this research. We were unable to discern any significant differences between the early and late responses7. Therefore we decided to merge the data.

Entrepreneur associations, chambers of commerce, and direct email contact with SME owner-managers and the self-employed were used to conduct the poll.Associations were invited to pass forward invitations to participate in our online survey to their members. The survey was not paid for participation by entrepreneurs. When participants completed the study, they were given comments on their psychological resources for coping with stress and adversity.

We looked at how well our sample of entrepreneurs represented the entrepreneurial culture in each country we studied (see Appendix). We compared our results to those from the Global Entrepreneurship Monitor (GEM), the world's most significant entrepreneurship research initiative, which polls representative household samples of entrepreneurs.

Requests for the entire comparison and sample descriptions may be made. Overall, firms in our sample are more active in the business service sector (53.3 per cent) than GEM (21.9 per cent), less involved in the extractive (2.6 per cent) and manufacturing (13.6 per cent) sectors, and more active in consumer-oriented services (30.5 per cent) than GEM (44%). There are 13.1 workers in our sample, compared to GEM's 4.25 employees, although they are of comparable age (11.12 vs 11.1 years). When compared to GEM samples of entrepreneurs, entrepreneurs in our research are somewhat older (45.6 against 44.2 years old), more educated (75.6 per cent have a university degree versus 29.9 per cent in GEM), and more likely to be male (68.2 versus 61.4 per cent). In Japan, we had 84 participants, whereas, in the United States, we had 1081.

3. Entrepreneurs' businesses were affected by the pandemic:

The Covid-19 epidemic harmed entrepreneurs in this sector. While some businesses are doing well, most indicate that the epidemic has badly impacted their company and are concerned about its survival. The main issue was reduced commerce, but businesses also faced payment delays and paying for company maintenance. As a consequence, several companies had to decrease employment.

3.1.Impact on entrepreneurs' businesses:

Worryingly, the epidemic jeopardized the very survival of 61% of enterprises. In our survey, entrepreneurs in China (95.3%), Bangladesh (91.6%), and Pakistan (71.7%) were the most pessimistic, while entrepreneurs in Norway (40.8%), Poland (43.5%), and Denmark (47.2%) were the most optimistic. Even in these nations, however, over 40% of entrepreneurs feared for their enterprises' survival. So, only in our sample, 3,162 enterprises and 41,578 people are in danger.

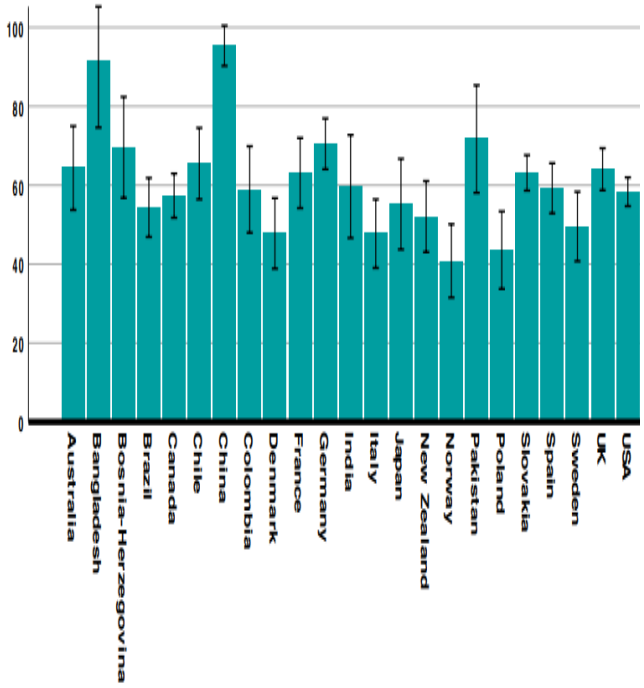

Figure 1. Existence of business under threat

Following these results, most businesses (74.9%) in our survey reported trade losses. Figure 2 demonstrates that most companies in China (99.4%), Germany (92.7%), and Bangladesh (92.4%) reported sales losses, whereas entrepreneurs in Norway (57.8%), Italy (61.8%), and Poland (64.2%) reported sales gains (Figure 1). "I have lost all booked clients – training company" (self-employed from Canada) and "Many clients have put projects on hold, reduced scope or slowed the project" (start-up entrepreneur from Australia) (SME entrepreneur from Canada). Unlike the loss of revenue, most firms in our sample had not yet lost jobs. Most entrepreneurs (72.1%) had not yet laid off personnel, while 27.9% had. Following the example of France (0.04%), Italy (7.4%), and New Zealand (14.7%), more than 40% of enterprises in Norway (47.2%), Japan (45.3%), and China (40.6%) had to decrease employment.

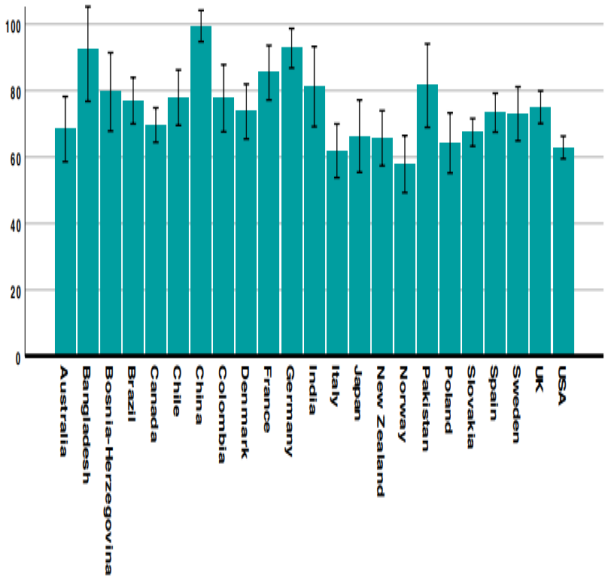

Figure 2. Loss in trading

3.2.Main challenges in the business:

I have problems paying for my business upkeep (e.g., loan repayments, rent, utilities, insurance), my customers don't pay me or pay late, and nothing has changed. We show the three most often reported issues worldwide:

Late payments, issues paying for company maintenance, and 'nothing has changed.

During the pandemic, non- or late-paying consumers were the most significant issues for nearly a quarter of enterprises (27.8%). As demonstrated in Figure 3, clients in China (42.9%), Pakistan (376.6%), Bosnia and Herzegovina (368.6%) and Brazil (36.5%) have the most significant issues paying. During the pandemic, less than 20% of entrepreneurs in Denmark (13.4%), New Zealand (17.1%), Chile (19.5%) and Japan (19.9%) described this as their top issue. In our analysis, an average of 26.8% of businesses cited financial problems. As shown in Figure 4, entrepreneurs in Germany (44.5%), China (40.7%), and Bangladesh (377.7%) had the most significant difficulty paying for company maintenance, while entrepreneurs in Sweden (13.9%), New Zealand (13.5%), and Denmark (10.8%) had the slightest difficulty.

Finally, 25.9% of businesses stated nothing had changed. Companies in Spain (41.5%), New Zealand (38.8%) and Italy (37.1%) reported no substantial changes during the pandemic's initial phase (Figure 5). In contrast, less than 20% of entrepreneurs in Bangladesh (19.5%), Chile (18.6%), Germany (17.6%), Pakistan (17.4%), Bosnia and Herzegovina (15.2%) and China (15%) stated nothing had changed.

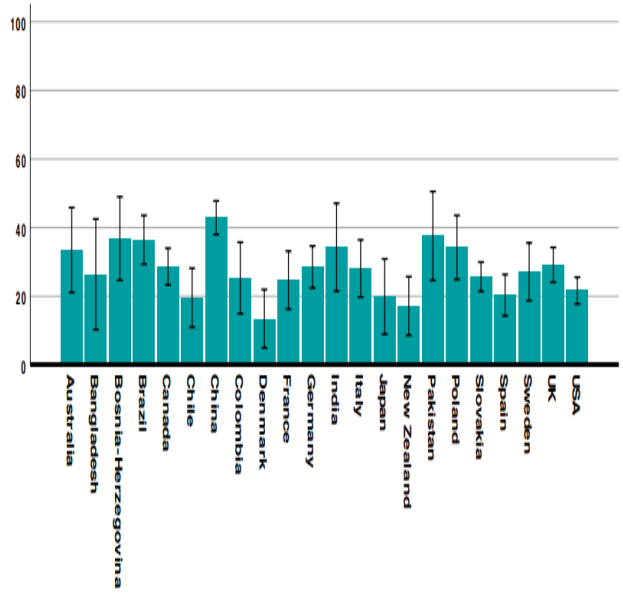

Figure 3. Main challenges in the business: late paying customers

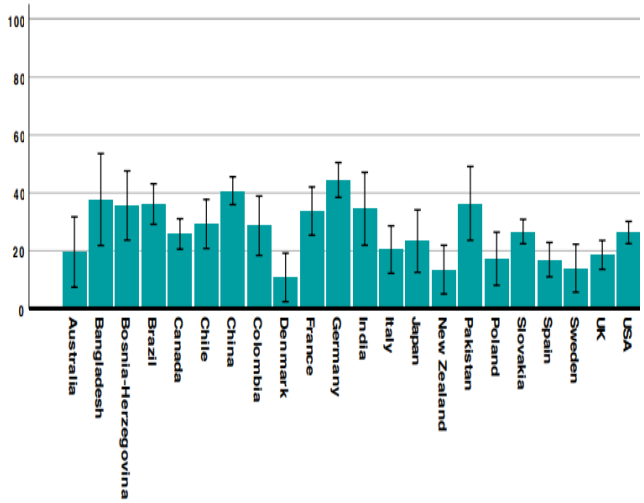

Figure 4. Main challenges in the business: problems paying for upkeep

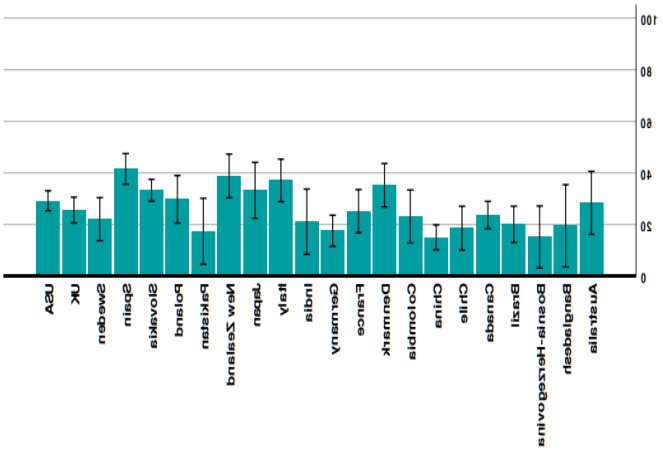

Figure 5. Main challenges in the business: nothing has changed

3.3.Main challenges in the business:

I have problems paying for my business upkeep (e.g., loan repayments, rent, utilities, insurance), my customers don't pay me or pay late, and nothing has changed. We show the three most often reported issues worldwide:

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3.4.Remote working:

The pandemic increased remote working, which was one of the key developments. It was no different for entrepreneurs, including juggling remote work with kids. Schools and nurseries disappeared, forcing almost a fifth of entrepreneurs (22.6%) to care for their children at home. Some remarked 'restricted hours owing to kids being off school'.

According to our poll, a third of entrepreneurs (32.5%) indicated they were still working at their company' premises and that their primary place of employment had not changed owing to the epidemic. As shown in Figure 6, the majority of entrepreneurs that did not relocate during the pandemic were from Bosnia and Herzegovina (81.6%), Norway (58.5%), and France (55.9 per cent). Less than half of all entrepreneurs (42.1%) expanded or began working from home. Due to the epidemic, almost a fifth of entrepreneurs (21.3%) now work entirely from home. Especially true for entrepreneurs in Italy (32.4%) and China (31.8%), where over 30% increased time spent in home offices (Figure 6). Due to the pandemic, another fifth (20.8%) of businesses began working from home.

As demonstrated in Figure 6, the pandemic forced nearly 40% of new businesses in Chile (45.4%) and India (41.7%) to work from home. While some entrepreneurs found benefits such as 'saving time by completing all my meetings on Zoom' (UK SME entrepreneur), others cited 'reduced productivity owing to working from home.

A fifth (20.1%) of all entrepreneurs reported working from home before the pandemic. Figure 6 shows that previous to Covid-19, Australia (40%) and New Zealand (38.5%) had the most significant percentage of businesses working remotely from home (30.6 per cent).

Finally, the Covid-19 epidemic prevented 4.4 per cent of our sample from working. As shown in Figure 6, this was the case for entrepreneurs in Germany (26%) and Norway (23%) but not in Canada, Poland, or Denmark.

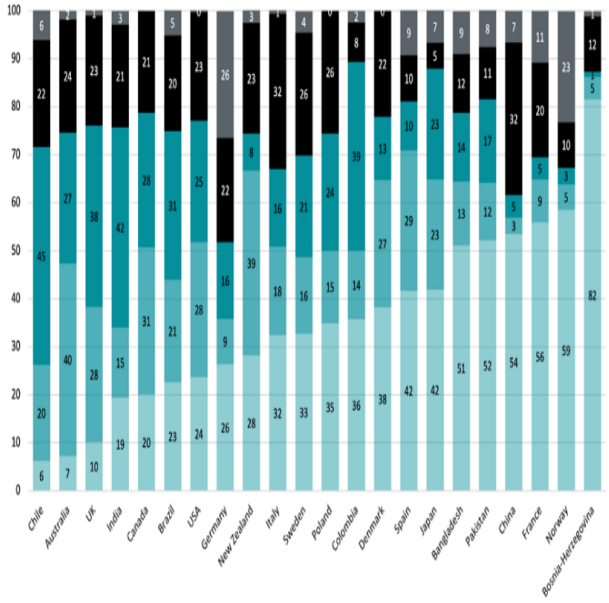

Figure 6. Changes to place of work

4. Longer term opportunities and realities:

Even though we saw in the previous chapters that entrepreneurs' businesses suffered in the pandemic, encouragingly, entrepreneurs had generally positive expectations for their business in the long term beyond the pandemic. This suggests resilience, although there are also short-term vulnerabilities (e.g.,

in terms of businesses' financial position). First, we discuss these long-term expectations beyond the pandemic regarding entrepreneurs' general expectations for their business-related to survival, growth, and favourable long-term impact. Secondly, we explore businesses' preparedness in terms of planning, contributing to their ability to act upon future opportunities. Lastly, we examine a business' financial position and survival prospects.

4.1.Expectations beyond Covid-19: survival, growth, and job creation

In terms of general expectations beyond the pandemic, nearly half of all entrepreneurs in our study (48.3% agreed or strongly agreed) were optimistic that – despite suffering significantly – their business would eventually survive. More than a third of all entrepreneurs (38.1% overall) even expected their business to grow more prominent it was before the pandemic. The two charts below (Figures 7& 8) show how strongly entrepreneurs across the 23 countries agreed with statements regarding their business' resilience (on a 5-point scale from 1 strongly disagree to 5 strongly agree). As shown in Figure 7, entrepreneurs in China (3.7), Bangladesh (3.7), India (3.6), Colombia (3.5) and Pakistan (3.5) were the most optimistic with regards to business survival;. In contrast, entrepreneurs in Norway (2.7), Poland (2.8) and Japan (2.9) were less happy. Figure 3.2 shows that entrepreneurs in Brazil (3.6), Italy (3.6) and Poland (3.5) were most confident about business' growth beyond the pandemic. In contrast, entrepreneurs in Germany (2.1), France (2.2) and China (2.5) were less optimistic that their business would be more significant than it was before Covid. The overall positive outlook is also reflected in entrepreneurs' job growth expectations. Over 70% of all entrepreneurs expected to create additional employment beyond the pandemic, i.e., they expected to create new jobs relative to the work they offered before the pandemic. Notably, past research following entrepreneurs over time finds that such job growth expectations are a good predictor of actual employment growth in firms including in times of crisis.

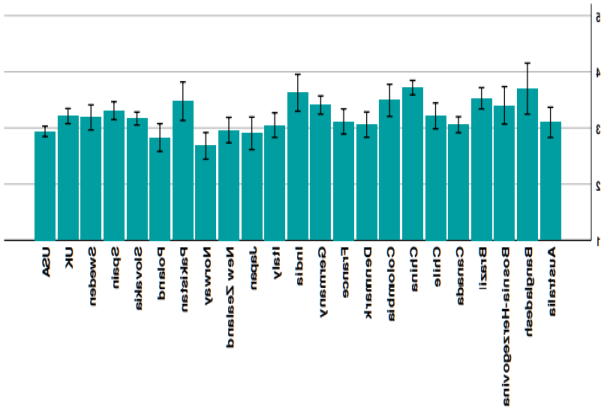

Figure 7. Business optimism/resilience: survival

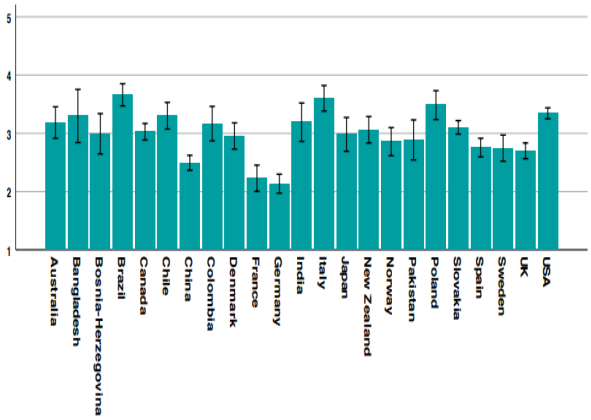

Figure 8. Business optimism/resilience: growth

4.2.Preparedness to act on long-term opportunities: financial planning and resource:

To understand businesses' preparedness to act upon future opportunities, we asked entrepreneurs how far in the future they were currently planning. Overall, more than half of entrepreneurs (52.3%) now focused their planning on the short term and were preparing for less than one year ahead. The

other 47.7% concentrated on long-term planning and were planning for more than one year early. As shown in Figure 9, entrepreneurs in Germany (44.8%), France (39.6%) and Sweden (33.6%) focused on shortterm planning and were planning ahead for three months or less. On the other hand, long-term planning for three or more years was especially prevalent in Bosnia and Herzegovina (51.6%), Chile (43.4%) and Spain (38.5%). In terms of financial resources (Figure 9), the average expected survival of businesses at the time of the survey was 7.7 months. This means that, on average, entrepreneurs in our study expected to run out of cash within the next eight months if the current situation continued. This figure is consistent with over 60% of entrepreneurs seeing the survival of their business threatened. However, it also suggests that the long-term optimism of entrepreneurs noted above might stand on weak foundations in terms of financial resources. Hence, it highlights the importance of governments providing support and financial relief to help entrepreneurs overcome short-term financing gaps. The cross-country comparison, in Figure 9, shows that entrepreneurs in Italy (9.7), Canada (9.6) and Denmark (9.4) had the most solid financial base, with sufficient resources to sustain themselves for nearly ten months on average. Entrepreneurs in Germany (4.9), Bosnia and Herzegovina (5.4), China (5.5) and France (5.5) were the most vulnerable, facing challenges to sustain themselves in the next five to six months if the pandemic continues. Relating these findings to business growth expectations beyond the pandemic, we can see that entrepreneurs in Italy – whose businesses had the most solid financial base (on average) compared to other countries – were among the most confident that their business would grow and be more significant than before the pandemic. Conversely, entrepreneurs in Germany, France and China – where businesses were the most vulnerable in terms of financial position – were among the least optimistic about business growth beyond the pandemic.

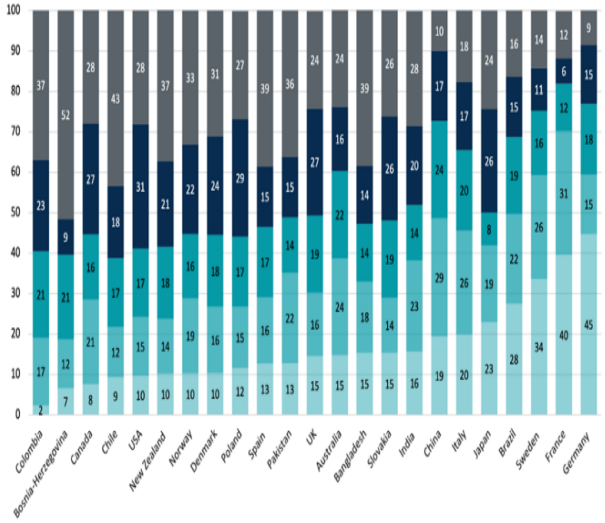

Figure 9. Future planning horizon

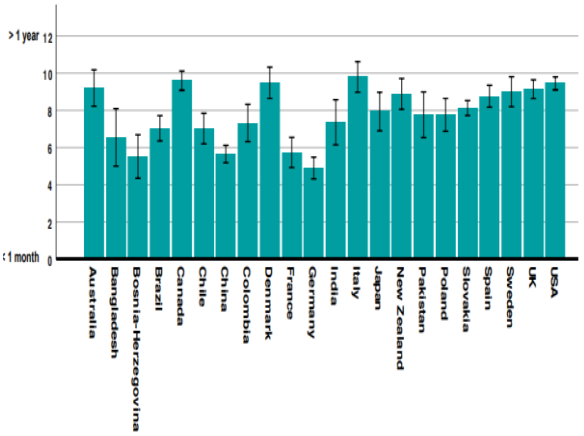

Figure 10. Financial position

5. Conclusion

Our study paints a picture of short- and long-term opportunities and the vulnerability of SMEs and entrepreneurs in the Covid-19 pandemic. Many face real challenges to sustain their businesses in the future whilst also struggling personally with their mental health. Yet there is also evidence of resilience, for instance, in identifying new business opportunities, the positive long-term outlook for the business, and the personal

resilience of entrepreneurs to cope with the uncertainty, stress and changes that the pandemic brought. Building on the insights from the survey, we reflect on five trends for the post-Covid economy. We suggest targeted support measures and policy recommendations help entrepreneurs and SMEs thrive. Two cross-cutting general trends relate to (1) Personal resilience: increased awareness of mental well-being, both for entrepreneurs and staff, and as a business opportunity, and (2) Business resilience, including developing capabilities to be agile, spot and exploit new opportunities. Three specific trends concern (3) Accelerated digitalisation; (4) A renewed focus on 'local' problems and economy; and (5) Inclusive and sustainable business models. SMEs and entrepreneurs hold much potential to help 'build back better' a more inclusive and greener post-Covid global economy. We conclude the report by discussing five practical steps entrepreneurs can take to support their well-being and build personal resilience. These draw on insights from the science of well-being, research on entrepreneurs' stress, and the findings from this study.

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NEOLITHIC CULTURES IN INDIAN SUBCONTINENT

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ABSTRACT

The Neolithic or the 'New Stone Age' is the last phase of the stone age cultures across the world and it is preceded by the Mesolithic (middle stone age). The present paper makes an argument in support of the recent academic understanding that the Neolithic culture in the Indian subcontinent was a result of local developments and was not introduced by either Mesopotamia or the Fertile Crescent. The Paper also brings out the vibrant cultural pattern across the subcontinent with the help of relevant illustrations from the different parts of the subcontinent. The Neolithic phase of Indian History was also not homogeneously spread across the length and breadth of the subcontinent. There were local variations as far as the material culture, subsistence pattern, tool technology or the chronology is concerned.

Keywords: *Food processing, archaeology, carbon dating, cultural spread, excavation, material culture, and ceramics*

Main Paper

In the Indian subcontinent as elsewhere, the neolithic phase marks the transition towards 'food processing'. This has led scholars to term this phase as a 'Revolutionary phase'. [1] A change in lifestyle has been remarkable and the Neolithic phase has been a witness to the transition of human societies from 'being hunters to breeders and gradually a food producer.' [2] The Neolithic was not only a change in lifestyle, tool technology, diet but also the ecological setting in which the early human societies were attempting to adapt to new subsistence patterns.

Large groups of human societies migrated across the world and there were many catalysts responsible for these interrelated changes. Changes in climate and environment towards the end of Pleistocene and onset of Holocene, demographic growth on account of protein rich diet and cultural and technological advancements have all been quite instrumental in shaping the way Neolithic appears today in academic circles. Brian Fagan and Nadia Durrani hint that Neolithic was perhaps the platform on which the later period civilizations developed and ushered. [3]

Initially, the scholars believed that Indian subcontinent experienced food production as an impact of western developments, but the developments after seventies brought India on the global map of prehistoric developments reaffirming the Neolithic phase of Indian history. Excavations and studies at Mehrgarh fully establish that wheat and barley were cultivated in the subcontinent almost simultaneously to the dates of the fertile crescent thus doing away with the idea of 'inspired by the west'. Some scholars forwarded the theory of diffusion of the art of cultivation to other parts of the subcontinent but the discoveries made at peninsula and north-east have also attested to the independent developments in the various regions and sub-regions of the subcontinent irrespective of the developments in the fertile crescent, Africa and China.

It can be said that the process of food production in the Indian subcontinent was spread over a vast span of time roughly from the eighth century millennium to 1000 BCE. A brief survey of early neolithic finds in the subcontinent would make it clear that the entire subcontinent was experiencing Neolithic in some form or the other in the different periods. Neolithic celts were discovered by Le Mesurie in the Raichur district and John Lubbock in the Brahmaputra valley in 1852 and 1867 respectively. Based on the vast spread of the Neolithic discoveries spread over the entire subcontinent R.S. Sharma classified the entire phase into three subcategories while V.K. Jain, on the basis of

[1] See Gordon Childe, "The Urban Revolution" in *The Town Planning Review*, 21(1); 3-17, 1950.
[2] See B. P. Sahu, *From Hunters to Breeders: Faunal Background of Early India*, Anamika Prakashan, 1988.
[3] See Brian M. Fagan and Nadia Durrani, *World Prehistory: A Brief Introduction*, Routledge, 2016.

further evidence argues in favour of six subcategories of the Neolithic phase in the Indian subcontinent.[4] Tool types, subsistence patterns and the material life was responsible for this classification. However, it also needs to be emphasised that ceramic ware and traditions were also responsible for variations in the cultural patterns and layers of habitation.

The six zones of Neolithic in Indian subcontinent are as follows:

(i) North-west, Mehrgarh area dated around 7th to 4th millennium BCE

(ii) Northern, Kashmir valley dated around 2500 to 1500 BCE

(iii) Central India, Vindhyan region dated around 4000 to 1200 BCE

(iv) Mid-Gangetic basin, eastern U.P and western Bihar dated around 2000 to 1500 BCE

(v) Eastern India dated around 1500 BCE

(vi) Peninsular India dated around 2500 to 1500 BCE

Some of the regions were contemporary to the Harappan Civilization and also furnished the evidence of copper and advanced ceramic ware besides beads and bricks.

A discussion of these six zones would further add to the argument regarding the indigenous developments of Neolithic in Indian context.

Balochistan, Indus plains and the vicinity comprise the north-western zone of the Indian Neolithic map. Geographically, this region was in close proximity to the fertile crescent and Mesopotamia but nevertheless the developments here were simultaneous and one cannot say that the developments here were solely the result of the influence coming from Mesopotamia or the fertile crescent. The major sites are Mehrgarh, Kili Ghul Muhammad, Rana Ghundai and Anjira spread over the sub-regions and localities of the North western region. Other sites discovered later were Ghumla, Rehman Dheri, Tarkai Kila and Rehman Dheri. D.K. Chakrabarti opines that the developments at Mehrgarh gradually brought the entire region under its influence. [5] The major evidence from this zone includes evidence for the cultivation of barley, hearth, non-ceramic and ceramic phases besides a variety of harvesting tools. Even the ceramic phase shows the distinction of handmade and wheel made, sun dried and kiln-fired ceramic ware.

Kashmir valley provides evidence of the Northern zone of the Neolithic phase with Burzahom, Gufkral and Kanishpur (in Baramulla district) as the prominent sites. The flood plains of river Jhelum have revealed a large number of Neolithic sites. The Kashmir neolithic sites are multicultural with evidence of megalithic and historical phases as well. There is no clear evidence of a mesolithic phase in this zone. The major features include pet burials, pit dwellings, hearths and pits with post-holes around them, domesticated varieties of wheat, barley, lentil. Remains of both wild and domesticated sheep, goat, dogs, deer, etc. Polished stone tools include large quern, tools of bone, horn, beads of steatite, handmade crude grey ware, wheel made pottery.

The Vindhyan and Kaimur ranges near Rivers Ganga, Son and Belan comprise the Neolithic zone of Central India. Prominent sites are Koldihawa, Mahagara, Mahadaha, Chopani Mando, etc. Major finds at this zone include evidence of domesticated rice, cord impressed ware, huts, post holes, burials, cattle pen, pestle, querns, pottery, etc. Pottery was handmade, initially poorly fired with rice husk and straw as tempering material. Cord impressed pottery, sometimes with designs, are the prominent finds.

The Neolithic sites in the mid-Gangetic basin are located around Ganga, Sarayu and Ghagra with prominent sites such as Narhan, Chirand, Imlidih, Sohgaura, Taradih and Senuar. The major finds include bangles, fish remains, cultivated rice, terracotta, bone and antler tools and ornaments, etc.

[4] V.K. Jain, *Prehistory and Protohistory of India*, D.K. Printworld, 2006.

[5] D.K. Chakrabarti, *India: An Archaeological History*, Oxford, 1999, p.117.

The Eastern Zone comprises sites like Pandu Rajar Dhibi, Kuchai, Golbai Sasan, Mahishdal and Baridih etc. Prominent finds include a gritty red handmade ware, mace heads, pounders and grinding stones, black and red ware, bone tools, etc.

The North-eastern zone is represented by Sarutaru, Napchik, Daojali Hading, etc. with evidence of polished stone tools, shouldered axes and cord impressed pottery. Some scholars believe that the Neolithic culture in the North-East zone has a close connection with South-East Asia and China. There is clear evidence of cultivation of rice and fishing in this zone. Interestingly, the presence of celts continued even into the later periods and the north-east settlements provide a date much later somewhere around 1500 BCE when parts of the north-west and north had been acquainted with metal either copper or iron.

The Neolithic cultural zone in South India has been very fascinating. Most of the sites are located in the peninsula and Deccan plateau and there is good evidence of animal domestication and cultivation of crops like ragi, kulathi, etc. The prominent sites are located in the proximity of rivers Bhima and Kaveri in the Raichur-Shorapur doab and are Sanganakallu, Hallur, Tekkalkotta, Kupgal, Piyampalli, T. Narsipur, Piklihal, Utnur, Palavoy, etc. the nearby source of water and dryland ecology made this zone convenient for animal husbandry and the evidence of cattle pens, hoof marks and 'ash-mounds' attest the same. Other finds include circular and wattle-daub huts, hearths, storage areas, charred grains of millet, barley, horse gram, etc. Ash mounds were the places where dung of domesticated animals was collected. The entire area was later set afire either for a ritual purpose or simply for cleaning the area for the next season. Some scholars have opined that at the time of migrating or moving out along with the cattle, the settlers would have burnt down the accumulated dung. Whatever may be the reason, these 'ash-mounds' certainly indicate the prevalence of animal domestication of an organised level with cattle-pens and even a place designated to collect the waste and dung. Hoof marks of domesticated cattle have been found on some of these 'ash-mounds'.

Conclusion

The above discussion of the various zones of Neolithic culture in the Indian subcontinent reinforces the argument that the developments of Neolithic cultures in the Indian subcontinent were neither homogeneous nor an offshoot of the Mesopoatmian or western developments. The Neolithic phase of Indian history needs to be seen in a larger and local dynamic. It also needs to be emphasised that while some zones, for example the north west were much ahead chronologically and were gradually inching towards metal based civilization, the ones in south and east were still experiencing a transition from Mesolithic to Neolithic. The broader parameters of the Neolithic include tools suited for agricultural activities, settled habitations, elaborate burials, cattle pens, crafts, pottery, domestication of plants and animals and of course a more balanced and stable environment.