Original Research Article

Education for Sustainable Development: A Study on the Attitude and Concerns on Climate Change Issues among Elementary School Teachers of Odisha, India

ABSTRACT

From fatal heat waves and cruel droughts to devastating floods and fast depleting water tables, climate change is the greatest destructor in the current time creating a threat to all living organisms including human being. Teachers being the agents of social change have an important role to play in moulding the behaviour of children to cope with the climate change stress. The present study was carried out with 462 (222 pre-service and 240 in-service) elementary school teachers taking a Likert type five point attitude scale with 30 items having six dimensions viz., science of climate change, causes of climate change, impacts of climate change, mitigation, national initiatives and policies and politics of climate change

From the study, it was noted that through both pre-service and in-service teachers had favourable attitude towards climate change issues, pre-service teachers had higher level of concern than in-service teachers as reflected from their attitude scores. Dimension wise pre-service and in-service teachers had favourable attitude towards science of climate change, causes of climate change, impacts of climate change and mitigation, and negative attitude towards national initiatives and policies and politics of climate change. Urban teachers were more favourable than rural teachers in first four dimensions studied.

However, among in-service teachers rural teachers were more concerned on issues such as impacts of climate change, causes of climate change than as science of climate change, mitigation, national initiatives, policies and politics of climate change. Among pre-service teachers, there was no significant difference in the attitude scores between science and arts teachers, and male and female teachers. However, urban teachers had more favourable attitude than rural teachers. Among in-service teachers, there was significant difference in

the attitude scores as far as subject (science/arts) and residence (urban/rural) are concerned. Rural in-service teachers had more favourable attitude than urban teachers.

The correlation between knowledge and attitude showed a positive relationship which reflected that with increase in knowledge there was increase in concern. The relationship between age and attitude showed that with increase in teacher's age concern for climate change increased.

Keywords: Sustainable Development, Climate, Attitude, Elementary school teachers, concern

1. INTRODUCTION

One of the major concerns that mankind faces today is the threat from global climate change. Rapid consumption of coal and fossil fuels in industry and transport has led to building of green house gases (GHGs) such as CO_2 leading to fast rise in temperature. World Commission on Environment and Development [1] in its report "Our common future" reflected that the current trend of economic development and environmental degradation are unsustainable and there is an urgent need to look into the health of the global environment for the future of mankind. As such United Nations Conference on Environment and Development (UNCED, 1992) popularly known as earth summit has called for reorientation education towards sustainable development [2], of the 17 goals set for agenda 2030 to attend a sustainability, goal no 13 calls for climate action [3].

Teachers being the agents of social change do play an active role in moulding the behaviour of learners [4] to promote desired quality for Sustainable Development. It is their level of concern, commitment and devotion that determine the future society and its development in terms of climate change issues. Education is an input as well as a dynamic force besides promoting knowledge, and understanding and disseminating information helps to change the learner's attitude by giving stress on ethics and morality. In International research, education has been found [5] to increase agricultural productivity, enhance status of women, improve their health, reduce fertility, enhance environmental protection and increase industrial production which has implications for sustainable development. Very little work has been done on environmental sustainable development. Most of the studies to find out the level of environmental knowledge and attitude have been conducted from USA [6, 7], Australia [8] and UK [9]. Other studies' pertaining to knowledge and attitude has also been conducted by many others [10, 11, 12, 13].

Reliable instruments such as environment science test and environmental attitude inventory to measure knowledge and attitude of high school students of California, taking ecosystem, natural resources, pollution etc., as basic parameters [10]. From a sample of 15,000 students, it was noted that they had low cognitive information and positive attitude [7]. From Australia, students were found to have inadequate knowledge but positive attitude towards environment [8]. From a sample of 11,000 students in England, it was noted that they had not only good understanding on environmental concepts but also positive attitude [9].

A survey on environmental awareness among students carried out in Gujarat, most of the students were noted to have low level of environmental awareness [14]. Working on various issues on environment such as pollution, conservation of wildlife, forest, sanitation, etc., many workers observed a positive relationship between environmental knowledge and attitude [15, 16, 17, 18]. From a study on student's knowledge and attitude towards conservation of natural resources, it was noted that girl students were more knowledgeable and had a stronger positive attitude than boys [15].

From a survey among scientists and engineers, it was observed that most of the respondents favoured for promoting environmental protection and more than 87% of the respondents agreed that environmental protection and economic development can go side by side by selecting appropriate technology [19]. Under this background, the present study was conceptualised to study the attitude and concern of elementary school teachers towards climate change.

1.1. Objectives of the Study:

The specific objectives of the present study are:

i) To assess and compare the attitude of pre-service and in-service elementary school teachers towards climate change issues and its different dimensions.

ii) To compare the attitude of pre-service and in-service school teachers towards climate change issues with relation to their subject background, place of residence and sex.

iii) To find out the relationship, if any between Age and Attitude towards climate change among in-service male and female elementary school teachers.

2. METHODOLOGY

The present study tries to find out the attitude towards climate change issues and for its different dimensions, *viz.,* science of climate change, causes of climate change, impacts of climate change, mitigation, national initiatives, and policies and politics of climate change.

2.1 Design of the Study

Survey method was followed in the present study. The sample was divided into two main groups (Pre-service and In-service) on the basis of teacher training programme and teaching experience of elementary school teachers. Under each main group, (2x2x2) sub-groups (teacher categories) were put on the basis of residence (Urban and Rural), sex (Male and Female) and subject background (Science and Arts) subject combination/discipline the teacher pursued during his/her last education.

2.2 Sample

The study was carried on 462 (222 Pre and 240 In-service) elementary school teachers. Stratified random sampling was followed in the study. For stratification, subject combination, sex and residence variables were taken into consideration.

2.3 Tools

In absence of any attitude scale to measure attitude towards climate change issues and further attitude being culture specific, an attitude scale was developed for collection of required data in the present study. A Likert type five point attitude scale with 30 items was developed following the formal procedure. The items were phrased in such a way as to generate strong reactions among the respondents. Both positive and negative statements keeping climate change concepts in view were prepared. In the construction and editing of the items, all formal criteria [20, 21, 22] were taken into consideration. After getting it reviewed by five experts, the reliability of the attitude scale was established using the test-retest method and the co-efficient of correlation was 0.66 which showed moderate reliability. The scale had content validity as evident from the way of its development.

2.4 Data Collection and its Analysis

Questionnaires were distributed to the pre-service and in-service teachers who were requested to fill up the necessary information desired about them. They were asked to read the questions/statements and give their response independently. Further the teachers were encouraged to write their opinion /suggestion, if any at the end of the questionnaires. For pre-service teachers, the investigator distributed the questionnaire in their classroom and collected back after they answered those. In the attitude scale, each item had five possible answers, *viz.,* Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (D) and Strongly disagree (SD). For positive item, the strongly agreed response was given a weight of 5, the agree response a weight of 4, the undecided response a weight of 3, the disagree response a weight of 2 and strongly disagree response a weight of 1. For negative statements, the scoring system was just opposite to the positive items. The total score of all items of a dimension formed the score for that dimension and the scores added up for all the dimensions gave the total attitude score. Analysis of variance (ANOVA) was carried out [23] for each set of data separately following a Factorial design and the treatments were separated by alphabets following Duncan's Multiple Range Test (DMRT) using CROPSTAT (97-2003) software. To find out relationship among age and attitude linear regression was carried out in the excel worksheet.

3. RESULTS

3.1 Analysis of Variance on Attitude towards Climate Change Issues

Analysis of variance of attitude scores of elementary school teachers towards climate change issues using factorial design, showed service types was significant at 5% level. There was no significant difference among categories of teachers. The interaction between service types and categories of teachers was also insignificant.

3.2 Attitude towards Climate Change Issues of different categories of Pre-service and In-service Teachers

There were a total of 30 items divided into six dimensions of climate change on attitude scale. A score of 90 represents neutral attitude, any score of more than 90 was considered as a positive/favourable attitude and similarly any score of less than 90 was considered as an indicator of negative/unfavourable attitude towards climate change issues of elementary school teachers.

From the mean attitude scores, it was observed that, all the pre-service and in-service teachers had positive/favourable attitude towards climate change issues. In general the average attitude mean score of pre-service teachers had higher than in-service teachers which mean the pre-service teachers had more favourable attitude than their in-service counterparts. There was significant difference among Arts Urban Male pre-service and in-service teacher's categories at 1% level of significance. Among pre-service teachers, the Science Rural Female and Arts Urban Female teachers showed the significant difference at 5% level of significance. Among pre-service teachers, there was no significant difference between Science Rural Male and Arts Rural Male; Science Urban Female, Arts Urban Female and Arts Rural Female; Science Urban Male and Science Rural Female categories of teachers. Similarly there was no significant difference among Science Urban Male, Science Urban Female and Science Rural Female, and between Science Rural Male and Arts Rural Female in-service teacher categories (Table 1). Attitude scores of pre-service and in-service teachers have been depicted in Fig 1.

A combined attitude scores of pre-service and in-service elementary school teachers showed that the science teachers had more favourable attitude than arts teachers (Fig 2). Looking into place of residence for both urban and rural teachers, the urban pre-service teachers had more favourable attitude than the rural pre-service teachers and the rural in-service teachers were having more favourable attitude than urban in-service teachers (Fig 3).

3.3 Attitude of Pre-service Teachers on different Dimensions of Climate Change Issues

In the dimension of science of climate change, almost all the teacher categories had a positive attitude with the score ranged from 15.70 to 16.70. There was no significant difference among Science Rural Male, Science Urban Female, Science Rural Female and Arts Rural Female category teachers. Similarly there was no significant difference among Science Urban Male, Arts Urban Male, Arts Rural Male and Arts Urban Female category teachers (Table 2).

In the dimension of causes of climate change, the highest attitude score was with Arts Urban Male (20.88) category teachers whereas the lowest was with Arts Rural Male (16.87) teachers. In the science category teachers, there was no significant difference among Science Urban Male and Science Rural Female teachers whereas with arts background teachers, the difference among Arts Urban Female and Arts Rural Female teachers was statistically insignificant. All the elementary school teachers had favourable attitude towards the causes of climate change (Table 2).

Looking into the impacts of climate change, the attitude score ranged from 16.99 to 18.74 (Fig 3) and all the teachers had favourable attitude reflecting their high concerns. The Science Urban Male and Science Rural Female teachers showed similar attitude score of 18.74 which had no significant difference with Science Urban Female and Arts Rural Female teachers.

In the mitigation dimension, all the pr-service teachers had positive attitude with score ranged from 16.74 to 19.47 (Fig 4). There was no significant difference in the scores among Science Urban Female, Arts Rural Male, Arts Urban Female and Arts Rural Female teachers. Similarly there was no significant difference in the scores among Science Urban Female, Science Rural Female and Arts Urban Male teachers.

In the dimensions of national initiatives, except Arts Urban Male (15.80) teachers, all other had negative attitude. There was no significant difference in the scores among Science Urban Female, Arts Rural Male and Arts Urban Female category teachers. Similarly there was no significant difference between Science and Arts Rural Female teacher categories.

Looking into the policies and politics of climate change dimension, all elementary school teachers had unfavourable attitude with value ranged between 13.33 and 14.50. The average attitude score for arts teachers was better than science teacher categories. There was no significant difference in the scores among Science Urban Female and Science Rural Female teachers.

In general, average mean attitude score of science teachers was better than arts teachers. In dimensions such as causes of climate change, impacts of climate change and mitigation, the science teachers were more positive in their attitude than the arts teachers.

On gender basis, the male pre-service teachers were more favourable attitude than female teachers in the dimension of science of climate change, causes of climate change and mitigation. On the other hand female teachers were more favourable attitude than their male counterparts in the dimension of impacts of climate change, national initiatives, and policies and politics of climate change.

The pre-service elementary school teacher's attitude scores in descending order were causes of climate change > impacts of climate change > mitigation > science of climate change > national initiatives > policies and politics of climate change (Fig 4).

3.4 Attitude of In-service Teachers on different Dimensions of Climate Change Issues

In the dimension of science of climate change, the attitude score of in-service teachers ranged from 16.23 to 17.40 reflecting their positive attitude. There was no difference in the scores among Science Rural Male, Science Urban Female and Arts Rural Male, and Science Rural Female and Arts Urban Male teachers. Similarly there was no difference in the scores among Science Urban Male, Arts Urban Female and Arts Rural Female teacher categories (Table 3).

In the causes of climate change dimension, the average attitude scores of Science teachers were higher than their Arts counterparts. The scores of science and arts teachers varied from 18.40 to 19.00, and 16.57 to 18.90 respectively. There was no significant difference in the scores among Science Urban Male, Science Rural Male, Science Urban Female, Arts Rural Male, and Arts Rural Female teachers.

Looking into the impacts of climate change, the mean score on attitude towards climate change issues was positive with a range from 15.33 to 19.57. The science teachers had more favourable attitudes than arts teachers. There was no significant difference in the scores among Science Urban Male, Science Rural Male and Arts Rural Male teachers. Similarly the difference among Science Urban Female, Science Rural Female and Arts Rural Female Teacher categories was statistically insignificant.

In the mitigation dimension, the highest attitude score was with Science Rural Male (17.37) and the lowest was with Science Rural Female (14.10). Except Science Rural Female teachers, all other teachers had almost a positive attitude towards mitigation.

The attitude score was the highest with Arts Urban Male teachers in the dimension of national initiatives. This is the only the group with positive attitude whereas all other teachers had unfavourable attitude.

In the dimension of policies and politics of climate change, the attitude score of in-service elementary school teachers ranged from 13.27 to 14.63 reflecting their negative attitude.

In general, science and arts in-service teachers showed similar trend as in case of pre-service science and arts elementary school teachers (Fig 5). The rural teacher's attitude score was more than the urban teachers in the dimension of causes of climate change, impacts of climate change, and policies and politics of climate change. Similarly the urban teachers had more favourable attitude than their rural counterparts in the dimension of science of climate change and national initiatives. Almost the same attitude mean score was noticed in the mitigation dimension of urban and rural teachers. The descending order of attitude score of in-service teachers for different dimensions was causes of climate change > impacts of climate change > science of climate change > mitigation > national initiatives > policies and politics of climate change (Fig 4).

3.5 Attitude on Climate Change Issues with relation to Specific Variables

3.5.1 Pre-service teachers

3.5.1.1 *Subject orientation*

Looking into subject background, both the science and arts teachers had favourable attitude and the average scores were 99.05 and 99.34 respectively. There was no significant difference in the scores of science and arts pre-service elementary school teachers (Table 4)

3.5.1.2 *Sex*

On gender basis, the male teachers had favourable attitude as compared to their female counterparts. Though both male and female teachers had favourable attitude, there was no significant difference in the scores between the two groups.

3.5.1.3 *Residence*

Both urban and rural teachers had positive attitude towards climate change. The attitude mean scores were 100.32 and 98.08 for urban and rural teachers respectively. There was significant difference in their attitude scores at 1% level of significance (Table 4).

3.5.2 In-service teachers

3.5.2.1 Subject orientation

Both the science and arts in-service elementary school teachers had favourable attitude and the mean scores were 98.26 and 97.03 respectively. The science teachers had more favourable attitude than arts teachers and there was significant difference in their scores at 1% level of significance (Table 5).

3.5.2.2 Sex

The male and female teachers had favourable attitude and the mean scores were 97.38 and 97.91 respectively. Female teachers had higher attitude scores than their male counterparts, though there was no significant difference in the scores between the two groups.

3.5.2.3 Residence

Looking into the residence, both urban and rural teachers had favourable attitude with scores of 96.25 and 99.03 respectively. The rural in-service teachers had more favourable attitude than urban teachers. There was significant difference in the attitude scores at 1% level of significance.

3.6 Relationship between Age and Attitude of Male and Female teachers towards Climate Change Issues

The relationship between age and attitude towards climate change was found to be positive for both male and female in-service elementary school teachers. The R^2 values for male and female teachers were 0.897 and 0.963 respectively. The concern increased with increase in age in years. With an increase of one year in age, there was an increase of 0.98 and 0.95 units for male and female in-service teachers respectively (Fig 6 & 7).

3.7 Correlation between Knowledge and Attitude towards Climate Change Issues

The correlation between knowledge and attitude scores showed a positive relationship both for pre-service (Fig 8) and in-service teachers (Fig 9). It reflected that with increase in knowledge there was an increase in attitude for both the groups of teachers.

4. DISCUSSION

Global climate change caused fast rise in green house gasses (GHGs) in the environment has damaged the ecosystem, reflected through scarcity of water resource, melting of ice caps, rise in sea level, flood, drought, cyclone, social conflicts, etc.

Now the challenge [24] is to live sustainably and well within the material limits of the finite planet. In what is known as the Paris Agreement (2015), the countries around the world promised to limit the rise in temperature to 2^{o}C above the pre industrial age. Further all efforts are being made to limit temperature rise to 1.5^{0}C by 2030 failing which could lead to irreversible destruction, may be extinction of all life forms including human being. In order to ensure that the planet is liveable and to keep the global temperature under 1.5^{o}C by 2030, it is realised that the world must reduce global CO_2 emissions by 45 percent of the levels that were in 2010 and make it absolutely zero by 2050. Sustainable life style of the individual can lead to sustainable communities to sustainable nations and then to a sustainable globe.

As teachers act as agents of social change, they have very important role to play in moulding the behaviour of children (Future citizens of the country) through changing their life style to cope with the changing climate. Sustainable life style of the individual can lead to a sustainable communities to sustainable nations and then to a sustainable globe [4].

From the present study, it was noted that both pre-service and in-service teachers have a positive attitude towards climate change. Pre-service teachers have higher concern than in-service teachers. This could be due to the facts that all people in the society indicating teachers have environmental concerns as realised in daily life. The issues are highlighted in the media, print and non-print regularly. Pre-service teachers realise the environmental issues more than in-service teachers. This could be due to their understanding of environmental problems and climate change issues as it is a contemporary concern and forms a part of school and college curricula currently [25]. Low level of the knowledge among in-service teachers could be either due to lack of initiative by the teachers to keep themselves abreast of the contemporary concerns/developments or having a lack of training or both.

It was further noted that science teachers had a higher level of concern than arts teachers. This possibly is due to that all science curricula carry the concepts relating to environment, ecosystem, and environmental problems at school and college level. Further urban pre-service teachers had a strong concern as compared to their rural counterparts. This possibly due to that urban teachers have high level of exposure to polluted environment, dust, traffic jam, heat waves, foul smell, etc., that makes them restless. Similar observations have been made by others [26] in-service teachers with rural background were found to have more favourable attitude than urban teachers contrary to pre-service teachers.

Regarding different dimensions of climate change, pre and in-service teacher had a positive attitude towards causes of climate change, impacts of climate change, science of climate change and a negative attitude towards national initiatives and policies and politics of climate change. This could be possible due to that teachers understand and realise the causes and impacts of climate change in their day to day life. They have also studied the concepts of weather and climate in their school and college career in the science and social science text books. Poor knowledge in national and international policies such as Kyoto protocol, IPCC, carbon emission by developing and developed countries, green energy, United Nations Framework Convention on Climate Change (UNFCC), National climate change action plan, etc., had build a negative attitude in their mind. In the current study we have also observed that with increase in education there is an increase in their concern and attitude. Similar observation has also been made in earlier studies [27]. Thus there is an urgent need to provide orientation and training in the areas of environment, climate change and sustainable development to in-service elementary school teachers. This will enhance their knowledge leading to rise in concern and care for the nature and natural resources. From the study it was also noted that with increase in age of the in-service teachers there was increase in their attitude towards climate change issues. This possibly could be because of exposure to hazardous situation and experience with changing climate leads to realisation of the problems.

Though a lot of studies have been carried out on science of climate change, studies on climate change education are very limited. A study by Synuvate global [28] across 21 countries in the world observed that Canadians were the most concerned about climate change. After Canadian, Australians (84%) and Americans (57%) showed concerned about climate change. Most of the people blame the USA for climate problems. However, Canadian people prepared to take global lead in tackling climate issues.

A study [29] on Colorado public school teachers in 2007 on the topic of climate change instruction reflected that majority of science teachers were in favour of including climate and climate change in their courses. However majority of other teachers only informally discuss about climate change. Certain miss-conceptions about climate change area were wide spread among teachers. From the study, it was found that science teacher should benefit from professional development that focuses as on climate science best practice in climate instructor and communication.

From a study on climate change on knowledge and attitude of pre-service and in-service Novascovia teachers [30], it was noted that teachers had high level of concern about the impacts of climate change as noted in the present study and reported relatively low levels of self perceived climate change knowledge. In spite of having good knowledge on recent science and climate specific questions, teachers had a number of climate change misconceptions and misunderstandings. At the same time, they showed strong support for additional learning opportunity and reported that they presently received a little climate change information from University courses or government sources or professional studies. Teachers generally support strong action on climate change including government led, individual and community based action.

A study on the assessment of the knowledge, attitude and practices on climate change education among secondary school teachers in Tehran, Iran reflected that teachers are equipped with appropriate knowledge and moderate levels of attitude but their practices were weak. Male teachers were having better knowledge and attitude than female teachers. However female teachers were having better practices than their male counterpart [31]. From a study on 400 voluntary individuals from Turkey it was noted that 94% of individuals had good knowledge on climate change issues [32].

The study from Israel [33] on teacher's knowledge and attitude showed gap on climate change consequences and misconceptions about the causes of climate change. The anthropogenic cause of climate change was well understood. There was a significant correlation between knowledge and attitude about the consequences of climate change and readiness to handle those.

In a study among USA students and teachers on climate change and beliefs, it was observed [34] that (Stevenson, *et. el.,* 2016) almost all students and teachers believe that climate change is happening but only few students believe that it is anthropogenic. Teachers believe the global warming had no relationship with student outcomes.

From Philippines [35] it was reported that knowledge, attitude, practices and action on climate change in 22 villages. It reflected that the villagers had a moderate level of knowledge. Their environmental awareness did not translate into involvement in environmental conservation and protection

Very limited study has been carried out in India. A study on senior secondary school students of Kochi, Kerala [36] it was noticed that all students had concerned for the degrading environment. The attitude for protecting environment was high among majority of the students. About 53% of students had a poor level of practice concerning the environment.

CONCLUSION

As climate change and global warming are global issues, there is an urgent need to organise orientation and training programmes in the areas of environmental education, and climate change for the in-service teachers in order to improve their knowledge, promote participation in environmental conservation and bring change in their life style. There is a need for change the pre-service teacher training curricula putting stress on climate change and green life style as classroom teaching needs to be linked to life in the outside world.

CONSENT

As per international and university standard, participants written consent has been collected and preserved by the author (s).

Table 1: Mean Score on Attitude towards Climate Change Issues of different Teacher Categories of Pre-service and In-service Elementary School Teachers of Odisha

Teacher Category	Percent Score		
	Pre-service	**In-service**	**Difference**
SUM	100.26[c]	98.23[c]	**2.02 ns**
SRM	96.26[a]	98.90d[e]	**2.63 ns**
SUF	98.79[b]	98.70[c]	**0.09 ns**
SRF	100.89[c]	97.20[c]	**3.69***
AUM	103.89[d]	93.40[a]	**10.49****
ARM	97.00[a]	98.96[d]	**1.96 ns**
AUF	98.33[b]	94.66[b]	**3.66***
ARF	98.13[b]	101.06[e]	**2.93 ns**

In a column, means followed by a common letter are not significantly different at the 5% level by DMRT

For a row,

** Significant at 1% level,

* Significant at 5% level,

ns= Not significant

S=Science, A=Arts, U=Urban, R=Rural, M=Male and F=Female

Table 2: Mean Score on Attitude towards different Dimensions of Climate Change Issues among Pre-Service Elementary School Teachers of Odisha

Pre-Service Teacher Category	Dimensions					
	Science of Climate Change	**Causes of Climate Change**	**Impacts of Climate Change**	**Mitigation**	**National Initiatives**	**Policies and Politics of Climate Change**
SUM	16.55[b]	19.31[e]	18.74[c]	19.47[d]	12.06[a]	14.12[c]
SRM	15.70[a]	19.00[d]	16.99[a]	16.74[a]	14.51[b]	13.33[a]
SUF	15.88[a]	18.44[c]	18.48[c]	17.85[bc]	14.44[b]	13.70[b]
SRF	16.03[a]	19.36[e]	18.74[c]	18.14[c]	14.66[c]	13.96[b]
AUM	16.49[b]	20.88[f]	17.65[b]	18.67[c]	15.80[d]	14.41[c]
ARM	16.70[b]	16.87[a]	17.23[b]	17.47[b]	14.52[b]	14.22[c]
AUF	16.07[b]	17.57[b]	17.60[b]	17.53[b]	14.43[b]	15.13[d]
ARF	16.00[a]	17.63[b]	17.90[bc]	17.17[b]	14.93[c]	14.50[cd]

In each column, means followed by a common letter are not significantly different at 5% level by DMRT.

S: Science Teacher, A: Arts Teacher, U: Urban, R: Rural, M: Male, F: Female

Table 3: Mean Score on Attitude towards different Dimensions of Climate Change Issues among In-Service Elementary School Teachers of Odisha

In-Service Teacher Category	Dimensions					
	Science of Climate Change	**Causes of Climate Change**	**Impacts of Climate Change**	**Mitigation**	**National Initiatives**	**Policies and Politics of Climate Change**
SUM	17.40^{c}	18.53^{b}	17.17^{c}	17.17^{c}	14.70^{b}	13.27^{a}
SRM	16.43^{a}	18.40^{b}	18.10^{c}	17.37^{c}	14.13^{a}	14.47^{b}
SUF	16.30^{a}	18.53^{b}	19.27^{d}	16.60^{b}	13.90^{a}	14.10^{b}
SRF	16.90^{b}	19.00^{c}	19.00^{d}	14.10^{a}	13.67^{a}	14.53^{b}
AUM	16.73^{b}	16.57^{a}	15.33^{a}	15.77^{a}	15.40^{c}	13.60^{a}
ARM	16.23^{a}	18.90^{b}	18.03^{c}	16.87^{b}	14.73^{b}	14.20^{b}
AUF	17.13^{c}	16.63^{a}	16.80^{b}	15.17^{a}	14.67^{b}	14.27^{b}
ARF	17.33^{c}	18.83^{bc}	19.57^{d}	16.37^{b}	14.33^{a}	14.63^{b}

xxx

Comment [Ma1]: Indicate the source of the data presented

In each column, means followed by a common letter are not significantly different at 5% level by DMRT.

S: Science Teacher, A: Arts Teacher, U: Urban, R: Rural, M: Male, F: Female

Table 4: Sample Size (N), Mean Score (Mn) in percent, Standard Deviation (SD) and 't' value about Attitude on Climate Change Issues of Pre-service Elementary School Teachers of Odisha

Teacher Category	Sample size (N)	Mean Score (Mn)±SD	't value'
Science	108	99.05±2.06	
			0.83 ns
Arts	114	99.34±3.09	
Male	108	99.36±3.49	
			0.90 ns
Female	114	99.04±1.27	
Urban	111	100.32±2.52	
			7.29**

Rural	111	98.08±2.03

**= Significant at 1% level

*= Significant at 5% level

ns= Not Significant

Table 5: Sample Size (N), Mean Score (Mn) in percent, Standard Deviation (SD) and 't' value about Attitude on Climate Change Issues of In-service Elementary School Teachers of Odisha

Teacher Category	**Sample size (N)**	**Mean Score (Mn)±SD**	**'t value'**
Science	120	98.26±0.76	
			3.66**
Arts	120	97.03±3.60	
Male	120	97.38±2.67	
			1.62 ns
Female	120	97.91±2.68	
Urban	120	96.25±2.62	
			9.95**

Rural	120	99.03±1.52

**= Significant at 1% level

*= Significant at 5% level

ns= Not Significant

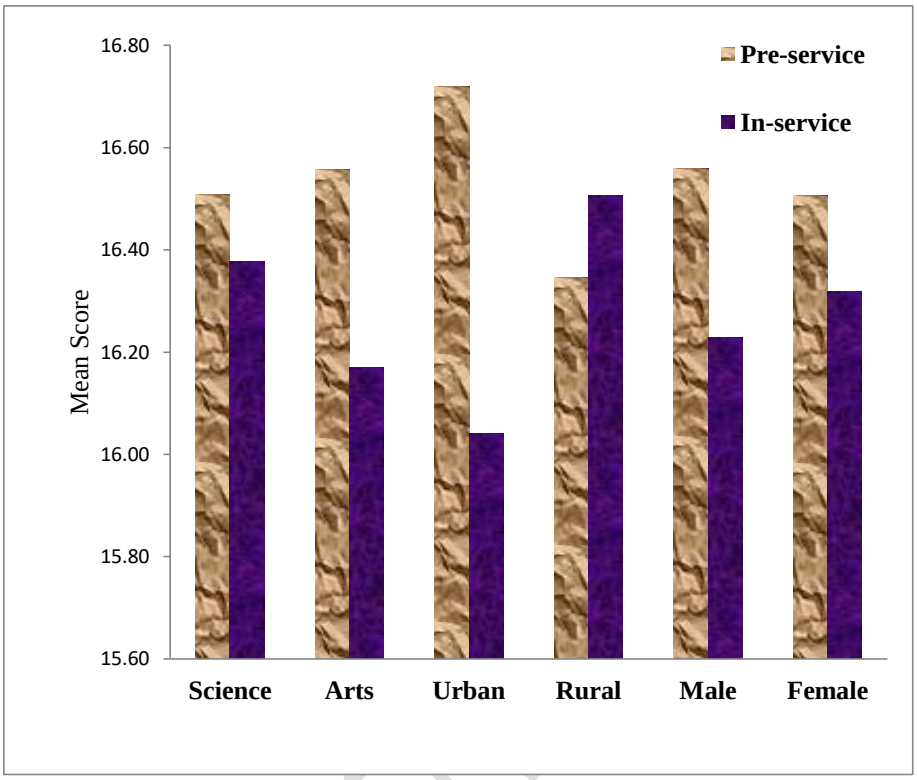

Fig 1: Mean score in Attitude on Climate Change Issues of Pre-service and In-service Elementary School Teachers (Science and Arts; Male and Female; Urban and Rural) of Odisha

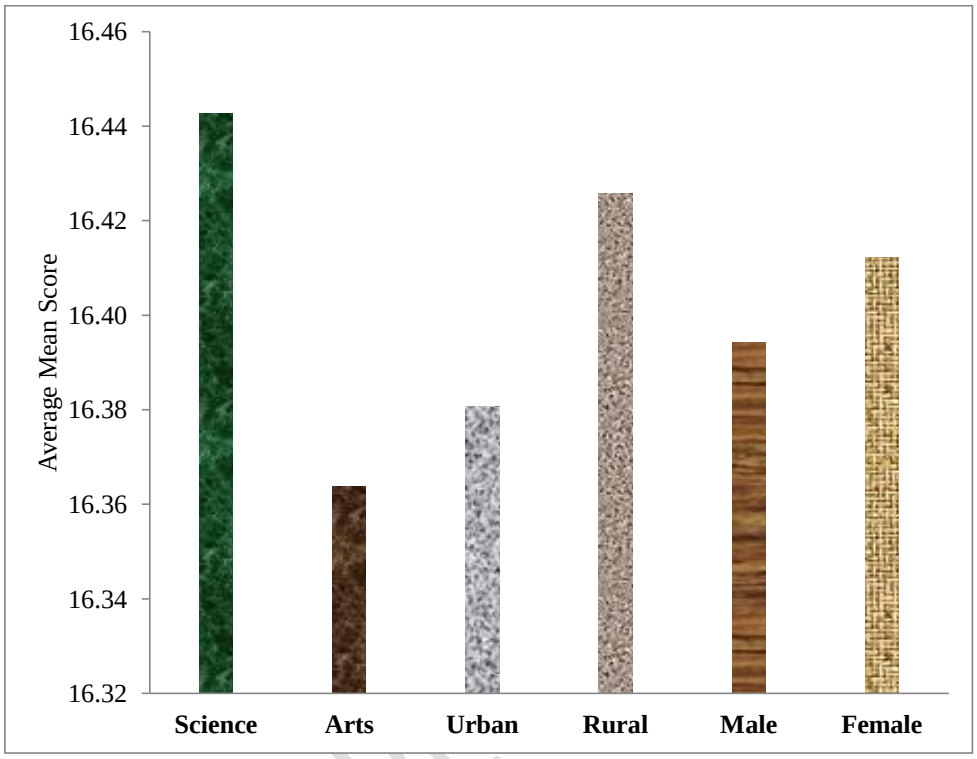

Fig 2: Average Attitude Score on Climate Change Issues of Pre-service and In-service (PS+IS) (Science, Arts, Urban, Rural, Male and Female) Elementary School Teachers of Odisha

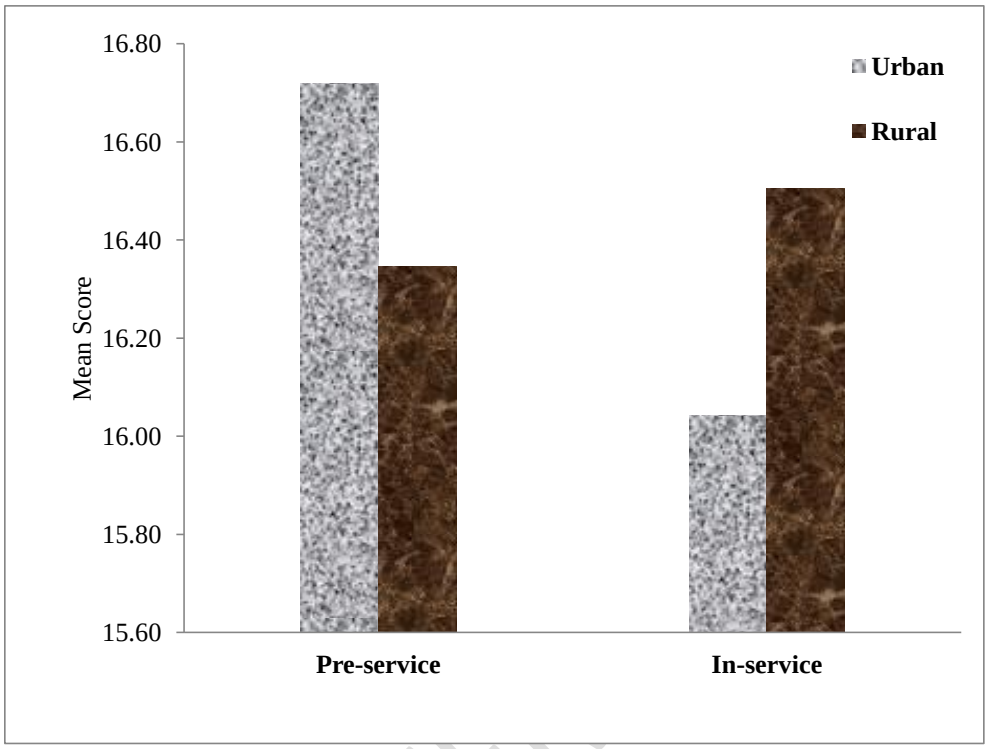

Fig 3: Mean score in Attitude on Climate Change Issues of Pre-service and In-service (Urban and Rural) Elementary School Teachers of Odisha

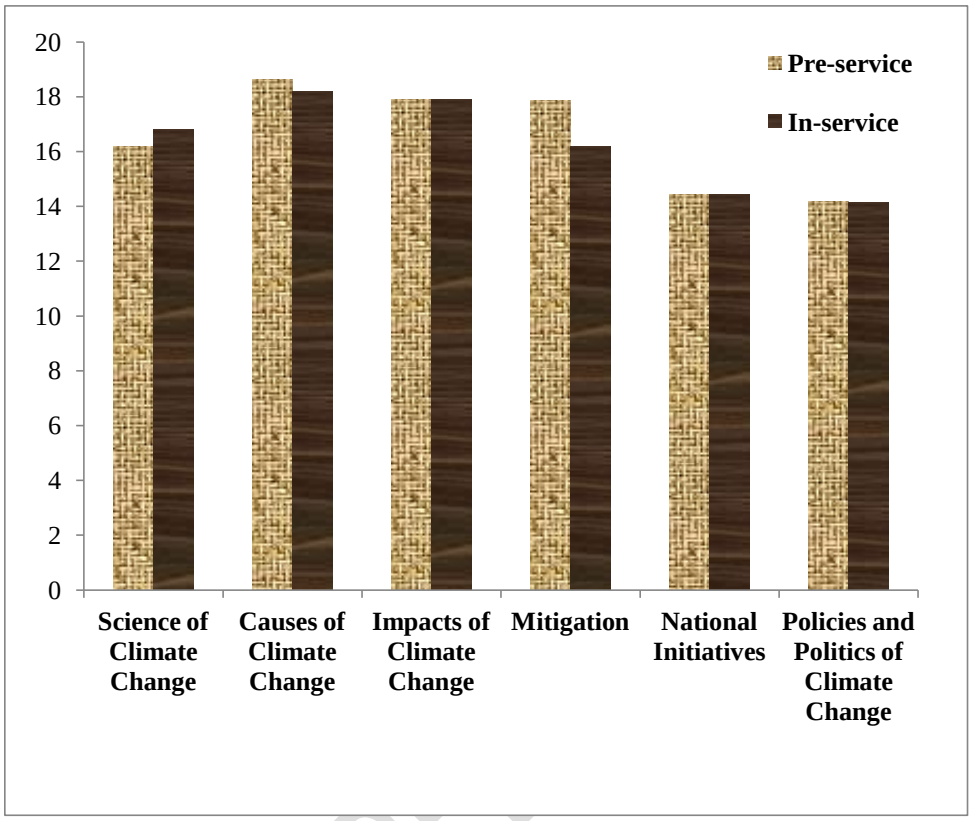

Fig 4: Average Mean Score on different Dimensions of Attitude towards Climate Change Issues of Pre-service and In-service Elementary School Teachers of Odisha

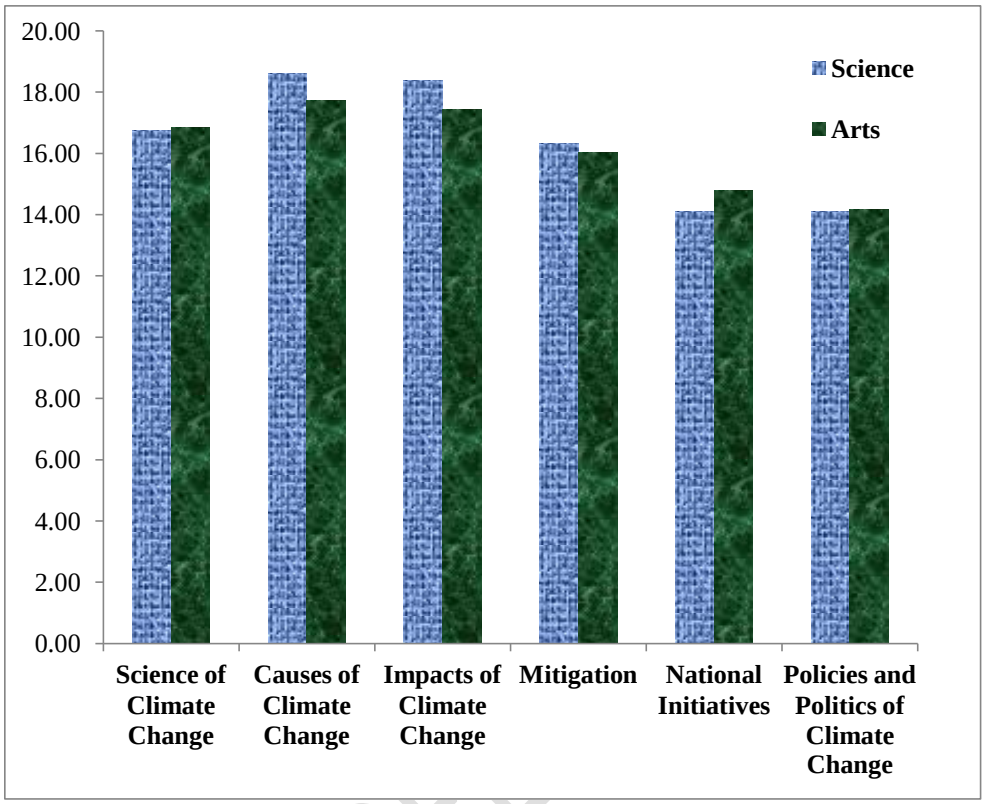

Fig 5: Average Mean Score on different Dimensions of Attitude towards Climate Change Issues of In-service (Science and Arts) Elementary School Teachers of Odisha

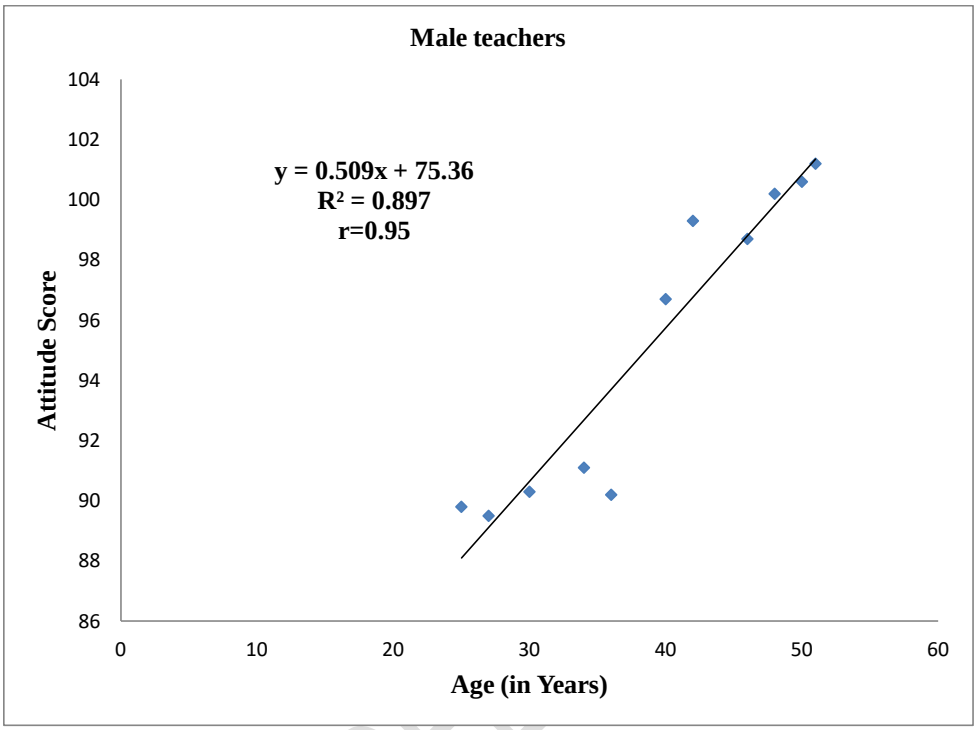

Fig 6: Relationship between Age (in years) and Attitude on Climate Change for In-service Male Elementary School Teachers of Odisha

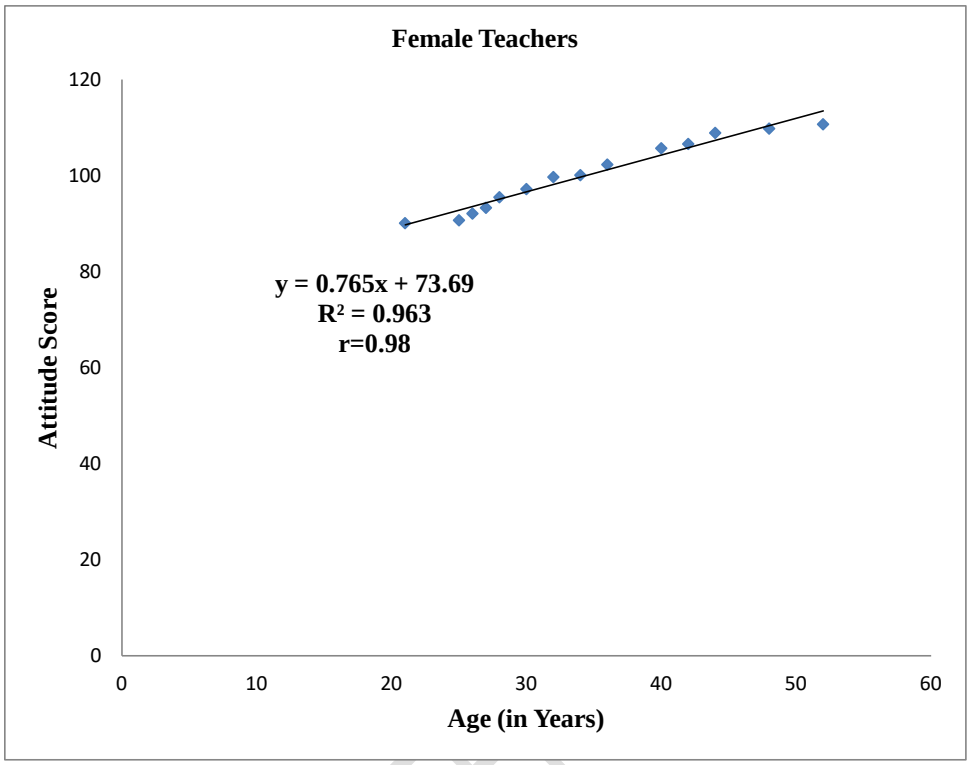

Fig 7: Relationship between Age (in years) and Attitude on Climate Change for In-service Female Elementary School Teachers of Odisha

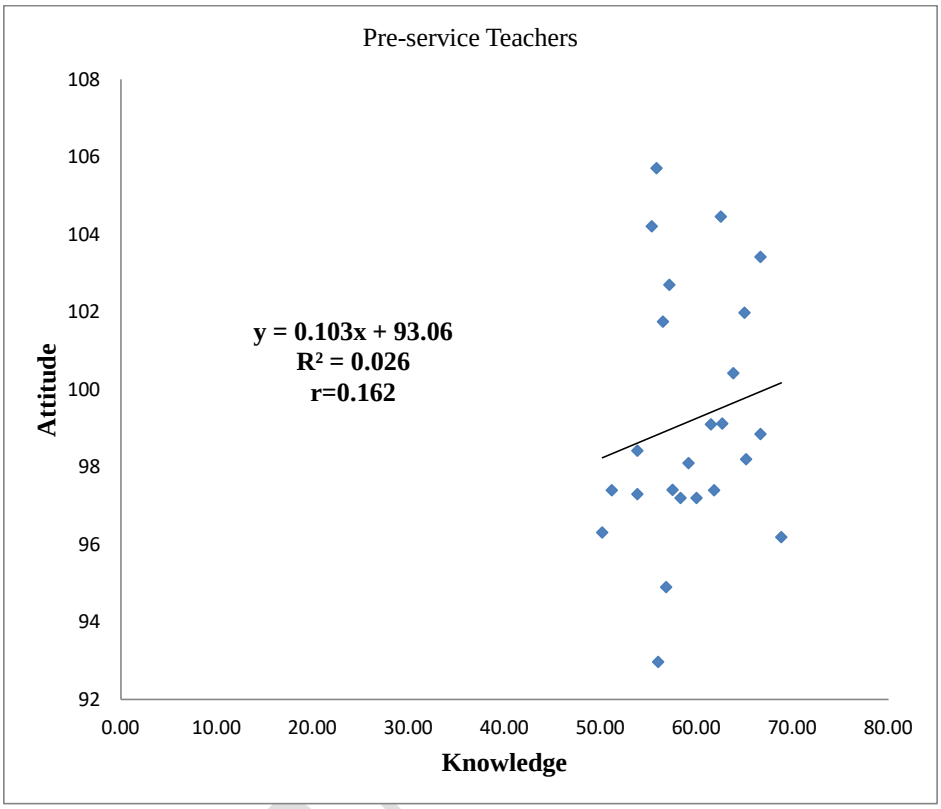

Fig 8: Correlation between Knowledge and Attitude towards Climate Change issues for Pre-service Elementary School Teachers of Odisha

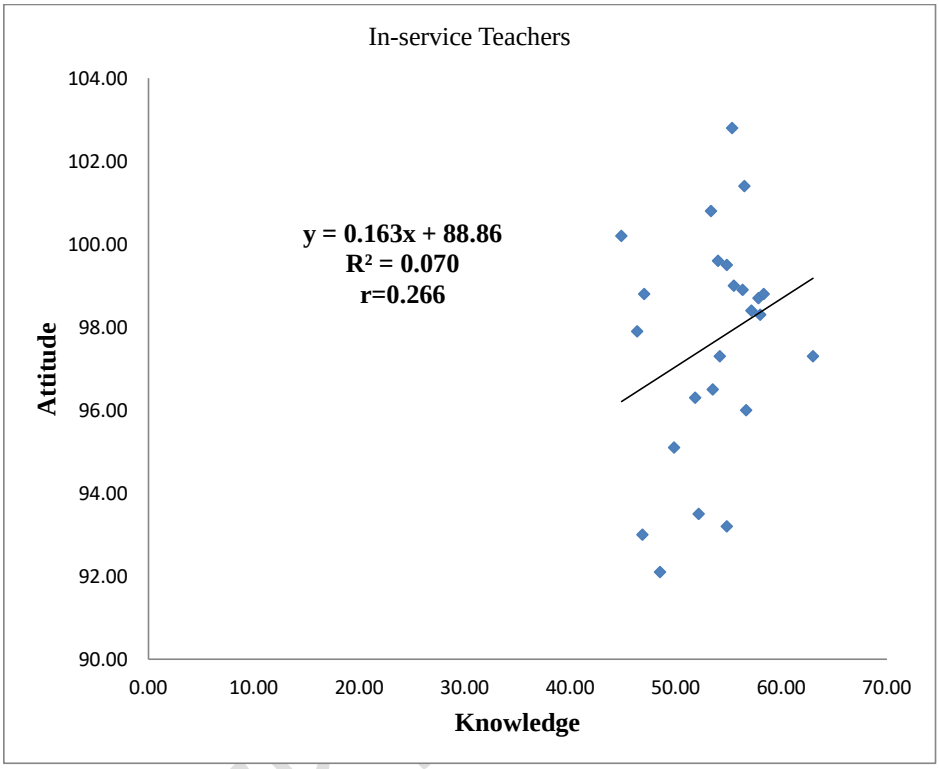

Fig 9: Correlation between Knowledge and Attitude towards Climate Change issues for In-service Elementary School Teachers of Odisha

REFERENCES

Comment [Ma2]: Adapt the APA format and highlight the titles of the referenced materials

1. WCED (World Commission on Environment and Development). Our Common Future, Oxford University Press, New York; 1987.

2. Khoshoo TN. Sustaining Development in the Developing Countries: A commentary, Current Science. 1998; 75(7): 652-660.
3. Annonymous , Unews. 2016; XII(7): 28 p
4. Satapathy MK. Education, Environment and Sustainable Development. Shipra Publication, New Delhi; 2007.
5. Heyn ML, Myers C. Education and Economic Development: Sustainability, thresholds and equity, in report of the third UNESCO-ACEID, International Conference, Educational Innovation for Sustainable Development, Bangkok, Thailand. 1-4 December, 1997.
6. Perkes AC. A survey of environmental knowledge and attitude of tenth and twelfth grade students from five great lakes and six far-western states, Dissertation Abstracts International, February. 1974; 4914-Ap
7. Bhol WB. A survey of the cognitive and affective components of selected environmentally related attitudes of tenth and twelfth students of six midstern and twelve plains and mountain states, Dissertation Abstracts International. February, 1977; 4717-Ap.
8. Eyers VG. Environmental knowledge and beliefs among grade ten students in Australia, Dissertation Abstracts International. April. 1976; 6626-Ap.
9. Richmond JM, Morgan R. F. A national survey of the environmental knowledge and attitude of fifth year pupils in England, Environmental Education Information Report (The ERIC Science, Mathematics and Environmental Education, the Ohio State University, Ohio); 1977.
10. Fleetwood GR. The development of the environmental science test and the environmental attitude inventory, Dissertation Abstracts International. July, 1973; 121-Ap
11. Baca TP. A study of the environmental attitudes of four different age groups, Dissertation Abstracts International. June, 1976; 7555-Ap.
12. Miles BM. A study of factors affecting environmental awareness and opinions of thirteen college curriculum programmes, Dissertation Abstracts International. December, 1977; 3400-Ap.
13. Jones VA. A comparative study of environmental education competencies of third grade students and their teachers, Dissertation Abstracts International. March, 1977; 5453-Ap.
14. Singh M. Environmental Awareness in Gujarat: A Survey (Vikram A. Sarabhai Community Science Centre, Navrangpura, Ahmadabad), 1984.
15. Singh P. Student's knowledge and attitude towards conservation of natural resources, M. Ed. Dissertation, Bhopal University, Bhopal; 1978.
16. Dubey R. Study of awareness towards social problems in 9, 13, 17 year olds, Report of Project submitted to Bhopal University as part fulfilment of M. Ed. Degree, 1979.
17. Sultan S. Comparative study of environmental knowledge and attitude of environmental vs non-environmental instructed school, M. Ed Dissertation, Bhopal University, Bhopal; 1979.
18. Bharagava A. Study of the effect of learning materials on environmental attitude of VII Grade children, Unpublished Project Report, Bhopal University, Bhopal; 1981.
19. Pruthi SK, Qureshi MA. Human Dimensions of Climate Change: Results of a survey of scientists and engineers, Current Science. 1999; 77 (12): 1589-1598

20. Thurstone LL, Chave EJ. The measurement of attitude, Chicago, University of Chicago Press; 1929.
21. Likert R. A technique for the measurement of attitudes, Arch Psychol. 1932; No. 140
22. Edwards AL. Techniques of attitude scale construction, Vakils, Febber and Simmons, Bombay, India; 1969.
23. Fitz-Gibbon CT, Morris LL. How to analyse data, (Sage Publications, London); 1987.
24. Costanaza R, Cumberland J, Daily H, Goodlard R, Nirgaard R. An introduction to ecological economics. St. Lucie Press, Boca Raton, Florida; 1997.
25. Chalarn KS. Cost implications of the implementation of environmental education, University News. 1991; 32: 6-9.
26. Dash D, Satapathy MK. Public Participation in Environmental Protection: An analysis of the attitude and concern of women of Orissa, Man and Development. 2004; 16: 39-56.
27. Dash D, Mishra B, Satapathy MK. Education for Sustainable Development: A study of the attitude of secondary school teachers, Indian Educational Review. 2008; 44(1): 97-123
28. Anonymous. Canadians among those most concerned about Climate Change Synovative and BBC World unveil global attitudes on climate in new survey, Canada Newswire; 2007.
29. Wise SB. Climate Change in the Classroom: Patterns, Motivations and Barriers to instruction among Colorado Science Teachers. Journal of Geosciences Education. 2010; 58(5): 297-309
30. Baker J, Loxton J. Climate change knowledge and attitudes of pre-service and in-service, Novascovia teachers: An assessment of educators, 2013.
31. Karami S, Seyed MS, Jafari H, Hendi GN. Assessment of knowledge, attitudes, and practices (KAP) towards climate change education (CCE) among lower secondary teachers in Tehran, Iran, International journal of climate change strategies and Management. 2017; 9(3): 402 – 415.
32. Yazici N. Determination of Knowledge and Awareness level on Global Warming (A case study in Isparta Province of Turkey). International Journal of Engineering Science & Research Technology. 2017; 6(2): 260-267.
33. Seroussi DE, Rothschild N, Kurzbaum E, Yaffe Y, Hemo T. Teacher's Knowledge, Beliefs and Attitudes about Climate Change, International Education Studies. 2019; 12(8): 33-45
34. Stevenson KT, Peterson MN, Bradshaw A. How Climate Change Beliefs among U.S Teacher's do and do not translate to Students, Ploson. 2016; 11(9): 1-11.
35. Lubos LC, Lubos LC. Knowledge, Attitude, Practices, and Action on Climate Change and Environmental Awareness of the Twenty-two Villages along the River Banks in Cagayan de Oro City, Philippines: Part II, Acta Scientific Agriculture. 2019; 3(2): 114-125.
36. Kumar A, Jacob A, Paul N, Rakesh PS. A study on KAP regarding environment and global warming in senior secondary school students in Kochi, Kerala. 2019; 6(1): 168-172.