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Environmental Research needs Interdisciplinary Approaches in broad range of Disciplines to tackle Climate Change- An Investigation to Compare the Percentage of Awareness results of Green technology Innovations, Green Synthetic routes, Green Management and Marketing Among UG & PG Students

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Abstract : In recent decades and years there is much emphasis on Green practices to reduce the green gases emissions to control global warming and Climate Change. The Industrial Sector, through its role in Society has contributed significantly to pollution and exploitations of the environment. The impact of Climate Change in the future will be a challenge in order to maintain Sustainability. Despite innumerable warnings and evident signs, humans are still continuing towards potentially Catastrophic “**Climate Change**” by adding to green house gases by their daily activities of combustion and emissions.

The Increasingly interdisciplinary nature of modern Research makes it essential for researchers of different backgrounds to have at least a minimal understanding of neighboring Sciences, if they are to communicate effectively. Harnessing of renewable energy sources to replace fossil fuels is widely regarded as a long –term mitigation strategy that requires the synthesis of knowledge from engineering, technology, and natural and social sciences.

In the present study a comparison percentage of awareness results of green technology innovations, Green synthetic routes in Chemistry, Green business, Green Management and Marketing is projected. Good Institutions, Public Universities, Deemed Universities, Government & Private Colleges were selected for the study. The awareness of UG, PG and Research students in different disciplines was monitored through Questionnaires prepared in the respective fields with objective and basic ideas. The results were analyzed by Chi square method and a hypothesis was tested.

There is a need to review the Basic elements of Curriculum including logic ,objectives contents Teaching methods and assessment to make future generation Professionals Well aware of interdisciplinary Green practices and how to utilize them in their respective disciplines.

Key Words : synthetic Green Chemistry; Sustainability; Interdisciplinary research in Climate and Energy Sciences ,Renewable Technologies, Green and Clean Technology innovations and Green Management. Green House Gases GHG, Paris Summit of Dec.2015 on Climate Change. Inter –governmental panel on Climate Change (IPCC).

Introduction:

Alternative energy systems that meet the needs of current generations while ensuring the ability of future generations to meet their needs is one of the great challenges of our time and central green chemistry challenge. If discussions of alternative energy futures are to be realized, whether based on Solar energy, Bio fuels, sustainably produced hydrogen, or other alternatives and combinations of the above, the materials that will be required for these systems will be designed by Chemists who need to ensure that the new materials do not introduce unacceptable problems of toxicity persistence, bio accumulation and depletion of finite resources as they seek to solve our immediate energy issues [1].

Nature provides a limited freedom to man for conducting his exploitation activities. Man is a part of nature and hence cannot exert control over nature on the basis of his free-will. When he tries to break the natural laws of nature he is bound to face the serious consequences [2].

To create a cleaner, safer and healthier energy future, it is time to choose renewable first green practices and policies. Green Chemistry has undoubtedly been one of the most noteworthy advancements in the chemical sciences of late and is recognized worldwide to describe the development of more sustainable chemical products and processes [3-4]. In recent decades and years studies on the Consumers attitude and awareness toward green products have been carried out and reported [5-8] Green computing is considered as a gate way to Green Business [9-11].

The understanding that we are immersed in a sea of renewable energy needs to be engrained. Our future energy approaches should be focused on the Capture and conversion of these existing energy reservoirs rather than the so-called generation of energy from Combustion-based depletion of finite sources and should be recognized as central to Green chemistry challenges. The most challenging problem with super critical CO₂ carbon dioxide is to develop chemistries which will allow carbon dioxide CO₂ to be used as both solvent and feed stock for the generation of high value chemicals. There is also a need to develop "greener" organic solvents which can be derived from renewable feedstock's or can be designed at the molecular level to have reduced environmental impact [12]. Due to the Complex nature of climate change Interdisciplinary research approaches involving knowledge and skills from broad range of disciplines have to be adopted for studying changes in the climate systems as well as strategies for mitigating climate change (i.e.; greenhouse gas emissions) and adapting to its impacts on society and natural systems [13]. The complex challenge for green chemistry may only be possible with the collaboration of other disciplines such as toxicology and ecosystem biologist Basic research in collaboration with other disciplines will be needed to develop the beginnings of heuristic design rules for safer chemicals to be used by chemical designers.

A landmark Climate change report released by UN Government has warned that the World is on the brink of disaster and could face cataclysmic consequences if the steps are not taken immediately to drastically cut carbon emissions [14]. The report by the UN Intergovernmental Panel on Climate Change is the first one to be commissioned under the 2015 Paris Agreement which sought to combat climate change by limiting global rise in temperature to 2 degrees Celsius above pre-industrial levels. However, the report notes that disastrous consequences await the Earth by 2040, if global temperature rise cannot be limited to 1.5 degrees Celsius. To limit the global temperature rise to 1.5 degrees Celsius and prevent catastrophe, the world economy would have to be transformed at a speed and scale that has "no documented historic precedent". Notably, by 2030, global greenhouse gas emissions have to be cut by a whopping 45% from 2010 levels. By 2050, greenhouse gas emissions would have to be reduced by 100%.

To enable emissions cuts and limit the global temperature rise, the report notes that coal would have to give way to renewable energy. Use of coal as a source of electricity would have to be reduced from around 40% today to 1.7% by 2050, while use of renewable energy in the electricity mix has to increase from around 20% today to 67% by 2050.

The report noted that if the world failed to meet the afore mentioned requirements within stipulated deadlines, climate change could well become beyond human control. It painted a dreary vision of the world in 2040, which would be plagued by worsening food shortages spiraling wildfires, extreme heat and extreme weather events, climate change-induced exoduses, and extinction of coral-reefs.

"Climate-related risks to health, livelihoods, food security, water supply, human security and economic growth are projected to increase with global warming" the report said, adding that the world's poor are more likely to get hit hardest.

What seems to be nigh impossible as of now is generating the political will around the world and sparking collective action required to bring about such sweeping changes.

With US President Trump still believing climate change to be a hoax and the US threatening to pull out of the Paris Agreement, the world's greatest superpower is setting a poor example for others. While the US is the second –largest greenhouse gas emitter behind China, is poised to exit the Paris Agreement, Brazil the world's seventh-largest greenhouse gas emitter, is poised to elect a new president who might also pull out of the Paris Agreement. Other nations too especially developing nations might be unwilling to reduce emissions as it would mean prioritizing global needs over national growth. Of course, national interests apart, the extremely rich and powerful fossil fuel lobby is another major obstacle to collective action against climate change.

We know what we have to do; we just have to do it. It should be noted here that no voluntary action on part of consumers such as reducing plastics will bring any lasting change.

With time running out the Scientists urges people and Governments to act on war footing. It suggests 13 environmentally sustainable alternatives to help mitigate the crisis. Among others it encourages the use of contraception, renewable energy, and consumption of plant-based diets.

According to the UN report in October 2018 by an international panel of scientists, preventing an extra single degree of heat could make a life-or-death difference in next few decades for multitude of people and the echo systems on the fast-warming planet. But they provide little hope the world will rise to the challenge. The Nobel Prize –winning intergovernmental panel on Climate Change issued a gloomy report at a meeting in Incheon, South Korea.

In the 728 –page document, the UN organization detailed how Earth's weather, health and ecosystems would be in better shape if the world's leaders could somehow limit future human

Caused warming to just 0.9 degrees Fahrenheit (a half degree Celsius) from now, instead of the globally agreed –upon goal of 1.8 degrees (1 degree C).Among other things.

-Half as many people would suffer from lack of water.-There would be fewer deaths and illness from heat, smog and infectious diseases.- Seas would rise nearly 4 inches (0.1 meters) less.-Half as many animals with back bones and bones and plants would lose the majority of their habitats.-there will be substantially fewer heat waves, downpours and droughts.-The West Antarctic ice sheet might not kick into irreversible melting.- And it just may be enough to save most of the world's coral reefs from dying."For some people this is a life –or death situation Without a doubt" said Cornell University climate scientist Natalie Mahowald, a lead author on the report.[15]

But meeting the more ambitious goal of slightly less warming would require immediate draconian cuts in emissions of heat –trapping gases and dramatic changes in the energy field.

The recent UN Climate Conference "Climate Meet" at Polish city of Katowice which started on 2ndDecember and lasted till December 2018. As many as 197 countries met at Katowice to discuss the implementation of the Paris climate change treaty roadmap. India hopes for progress on funding." Finance is going to be a sticking point at CoP24 both in terms of availability of money and reporting mechanism" [Climate meet: India hopes for progress on funding by Kalyan Ray.[Deccan Herald Volume 71 No 333 ,December 3,2018].]

Among the key achievements in Katowice was an agreement on how countries should report their greenhouses gas emissions and the efforts they're taking to reduce them. Poor countries also secured assurances on getting greater predictability about financial support to help them cut emissions, adapt to inevitable changes such as sea level rises and pay for damages that have already happened.

Chatham House work on climate change includes research on global warming, climate action and climate policy, the impact of live stock and animal agriculture, EU climate policy, and the Paris Climate

Agreement. The livestock sector accounts for 15 percent of global emissions, equivalent to exhaust emissions from all the vehicles in the world. A shift to healthier patterns of meat-eating could bring a quarter of the emissions reductions we need to keep on track for a two degree world.

In addition, the shift to more sustainable model of economic growth requires a circular economy in which products are recycled, repaired or reused, and waste from one process is used as an input into others.

The major programmatic focus of this work for Chatham House is carried out by the Energy Environment and Resources Department and its projects, and The Hoffman Centre, headed up by Bernice Lee.

A broad range of projects is offered by the academic staff in the Climate Change Research Centre (CCRC) at the University of New South Wales [16]

Materials and Method :

The Awareness data of Green Practices and Clean technology innovations for sustainability obtained from students selected from different categories of institutions offering professional courses in different disciplines were analysed for mutual correlation. Few good institutions of Bangalore with good grades from NAAC (National Assessment and Accreditation Committee) were selected under the following categories:

(1) Public & Deemed Universities, (2) Autonomous Colleges, (3) Government and Private Colleges. The Data were collected from the students of the above mentioned Institutions through the questionnaires prepared by the investigator for the various professional courses namely Green Chemistry, Green Business and Marketing, Green synthetic routes in Chemistry and Green Management and Marketing. The Questionnaires consisted of 35 Questions and being the multiple choice had four answers for each question. The students were provided with OMR sheet to circle their correct answers. Before giving the questionnaire to the students of respective courses a brief presentation about the Green practices and the Clean technology innovations in the respective fields were highlighted to the students by the investigator.

The Questionnaires were designed in such a way it covered all the basic questions needed for the awareness of Green practices and clean technology Innovations in the respective professional Disciplines for sustainable tomorrow.

Sample Size:

The sample consisted of graduates and post graduate levels students from professional courses of various disciplines from different categories of Organizations. The number of students combined from different disciplines namely Green Chemistry, Green

Business and Marketing, Green Synthetic routes in Chemistry, Green Management and marketing. The no of Student in each category and total no of students is shown in Table-1

Table-1 Sample Size Number of Students from different Categories of Institutions

SL No	Organization	Course	Subjects	No of Students	Total students
1	IISc;	UG B.Sc+PG/Res.Chemistry, MBA/Res.	Green chem+Green Synthetic Routes+Green Management & MKT	58+61+22	141
2	Deemed Universities	UG B.Sc, B.Com+ PG Chemistry, MBA	Green chem+Green Business+ Green Synthetic Routes+Green Management & MKT	10+124+40+95	269
3	Autonomous Institutions	UG B.Sc, B.Com+ PG Chem. +MBA	Green chem+Green Business+Green Synthetic Routes+Green Management & MKT	69+250+77+71	467
4	Govt+Pvt. Colleges	UG B.Sc+B.com+PG Chemistry	Green chem+Green Business+ Green Synthetic Routes	110+371+90	571

Total Number of Students= 141+269+469+571 =1448
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Experimental Investigation:

In the present investigation the awareness levels of 1448 students from professional courses of various disciplines have been analyzed. Out of the total 1448 students 268 were the post graduate students of M.sc; Chemistry. They were examined through a Questionnaire on awareness of Green Synthetic routes in Chemistry. 188 Students from MBA /research course were examined through questionnaire on awareness of Green Management and marketing. 247 students were 1 year degree B.Sc Science course they were examined through a questionnaire in n Green chemistry. The remaining 745 students out of 1448 were from Commerce degree course. They were examined through a questionnaire on awareness of Green Business and marketing. The results were analysed and the levels of awareness of total 1448 students have been tabulated in Table-2

Table-2 Awareness Levels of total 1448 students from various Professional Courses

SL No	Well Aware	Fairly Aware	Partly Aware	Poorly Aware	Total Students
1	191	369	752	1336	1448

It can be seen from the above Table-2 that the results are categorized under four levels of awareness as follows:

Well aware level: Students who obtained percentage between 100-65% by getting 35-23 correct answers.

Fairly aware level: Students who obtained percentage between 64-52 % by getting 22-18 correct answers.

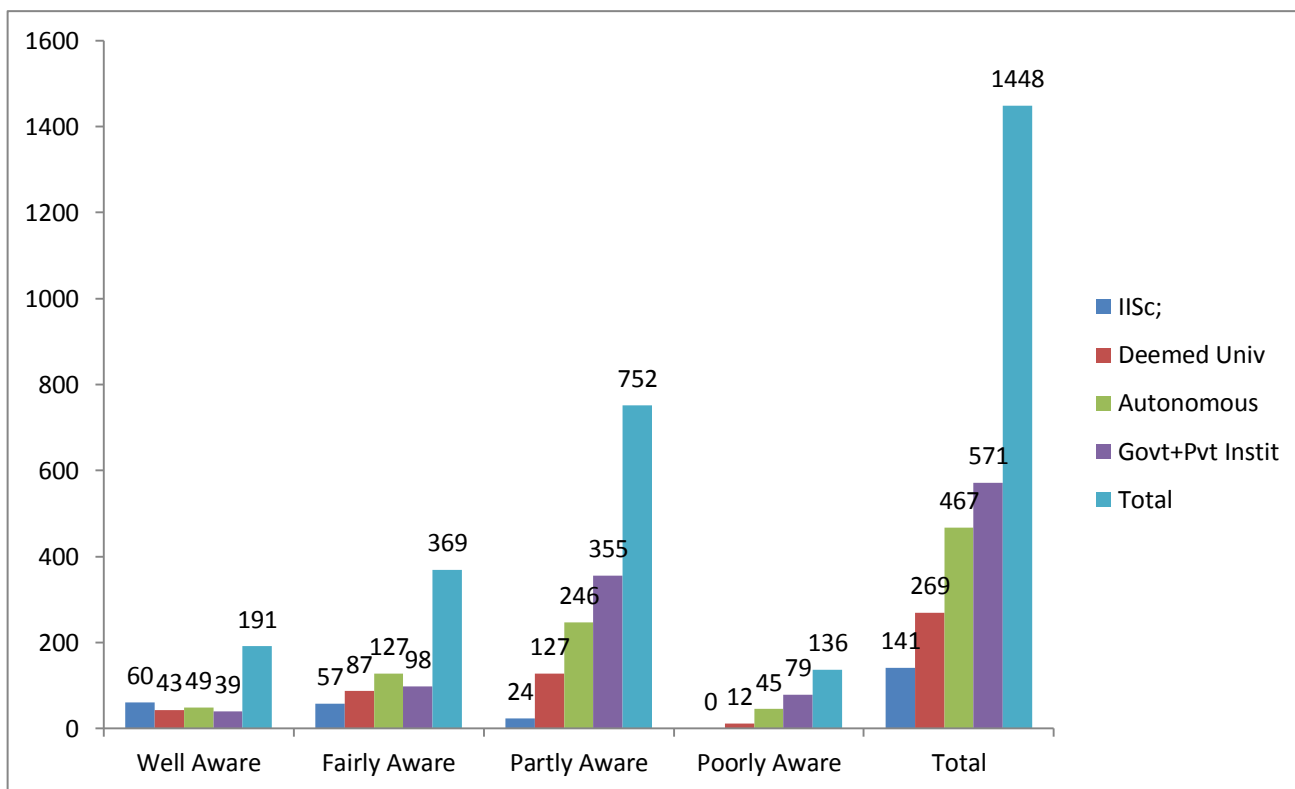
Partly aware level: Students who obtained percentage between 51-31% by getting 17-11 correct answers from the questionnaire.

Poorly aware level: Students who obtained percentage between 30-20% by getting 10-7 correct answers from the questionnaire.

Table: 3 Students Results in various Awareness Levels of Different Organizations

S L N O	Organization	Well Aware	Fairly Aware	Partly Aware	Poorly Aware	Total
1	IISc;	60	57	24	0	141
2	Deemed Univ	43	87	127	12	269
3	Autonomous	49	127	246	45	467
4	Govt+Pvt Institutions	39	98	355	79	571
Total Number of Students=141+269+469+571 = 1448						

It can be seen from Table-3 that the Well aware level is highest with Indian Institute of Science IISc; Students number which is 60 and percentage being 43% , next is Deemed Universities which shows 43 students and percentage of 16% in Well aware level. Autonomous institutions shows 49 students in Well aware level which accounts for a percentage of 11%,Govt+Pvt reveals 39 students well aware level which accounts for a percentage of 7%.the number of students of Fairly Aware ,Partly Aware and poorly level can be seen from Table-3.It can be observed that Deemed Universities ,Autonomous and Govt +Pvt reveal higher number of students and percentage in Partly Aware level which is 47%,53% and 62% respectively where as IISc; shows the lowest partly aware level being just 17%. The graphical representation of the students awareness results of different organization is shown in Graph.1.



Graph-1 graphical representation of students awareness results of different organizations

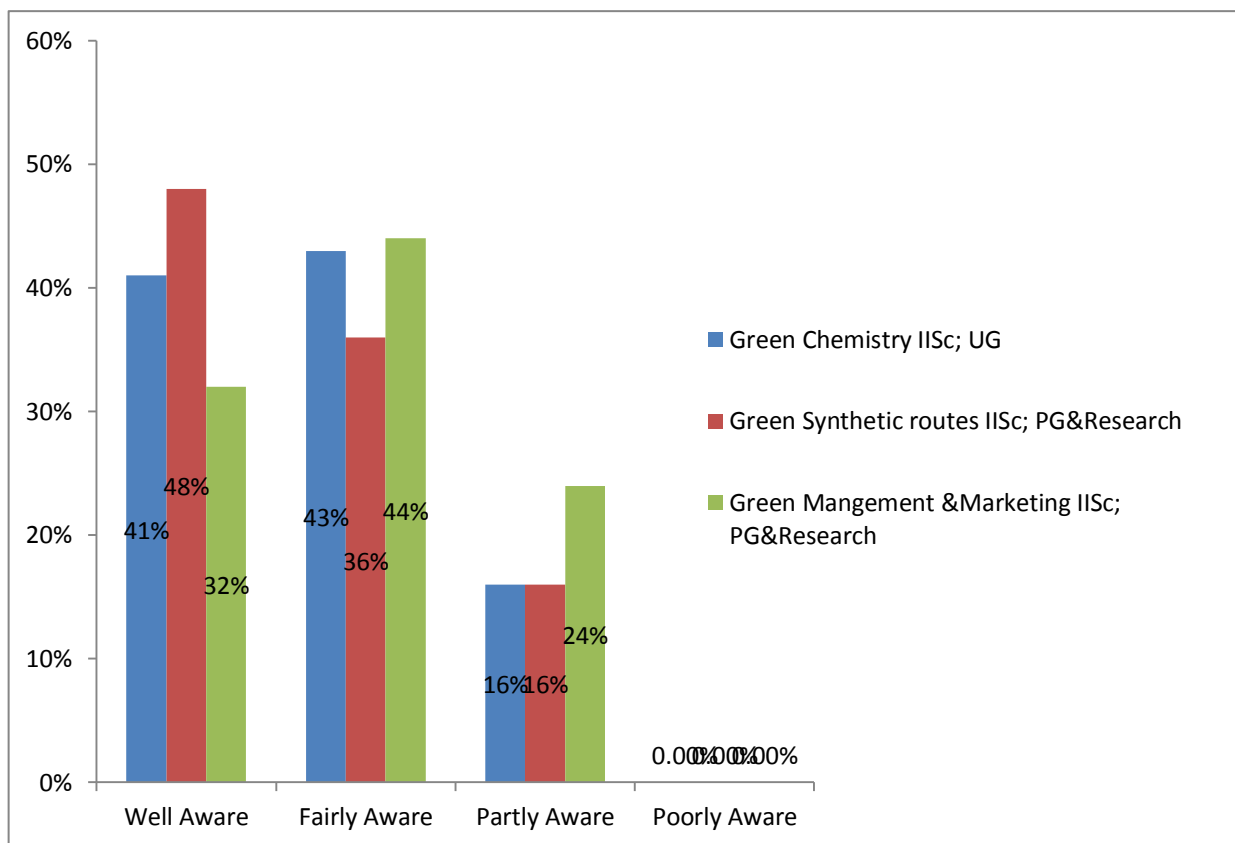
The percentages of awareness of different levels of Institutions under different Categories can be seen from tables and Graphical representations of Institutions under different categories can be seen from the following tables and Graphical representations.

The percentage results of IISc; students in various disciplines of Professional courses is shown in Table -4 as shown below:

Table -4 percentage results of IISc; students in various disciplines of Professional courses

SL NO	Subject	Organization	Students	Well Aware	Fairly Aware	Partly Aware	Poorly Aware
1	Green Chemistry	Indian Institute of Science IISc;	UG B.Sc.	41%	43%	16%	0%
2	Green Syenthetic Routes	Indian Institute of Science IISc;	PG+ Research	48%	36%	16%	0%
3	Green Management &Marketing	Indian Institute of Science IISc;	PG+ Research	32%	44%	24%	0%

The Graphical representation of the percentage results of IISc; students in various disciplines of Professional courses is shown in Graph-2



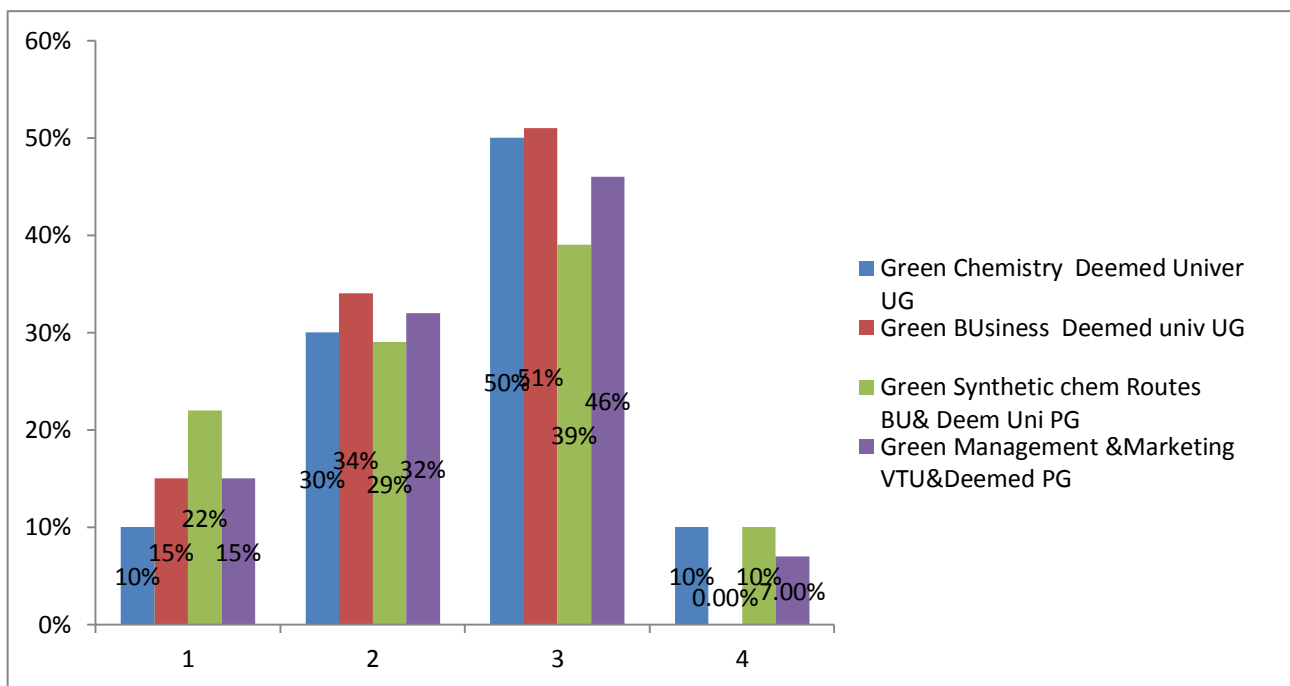
Graph-2 Percentage results of IISc; students in various disciplines of Professional courses .

The percentage result of Deemed Universities students in various disciplines of Professional courses is shown in Table -5 as shown below:

Table-5 Percentage results of Deemed Universities in various disciplines of professional courses

SL NO	Subject	Organization	Students	Well Aware	Fairly Aware	Partly Aware	Poorly Aware
1	Green Chemistry	Deemed Univer.	UG	10%	30%	50%	10%
2	Green Business	Deemed + BU Univer.	UG	15%	34%	51%	0.0%
3	Green Synthetic Routes	Deemed Univer.	PG	22%	29%	39%	10%
4	Green Marketing &Business	VTU Deemed	PG	15%	32%	46%	7.0%

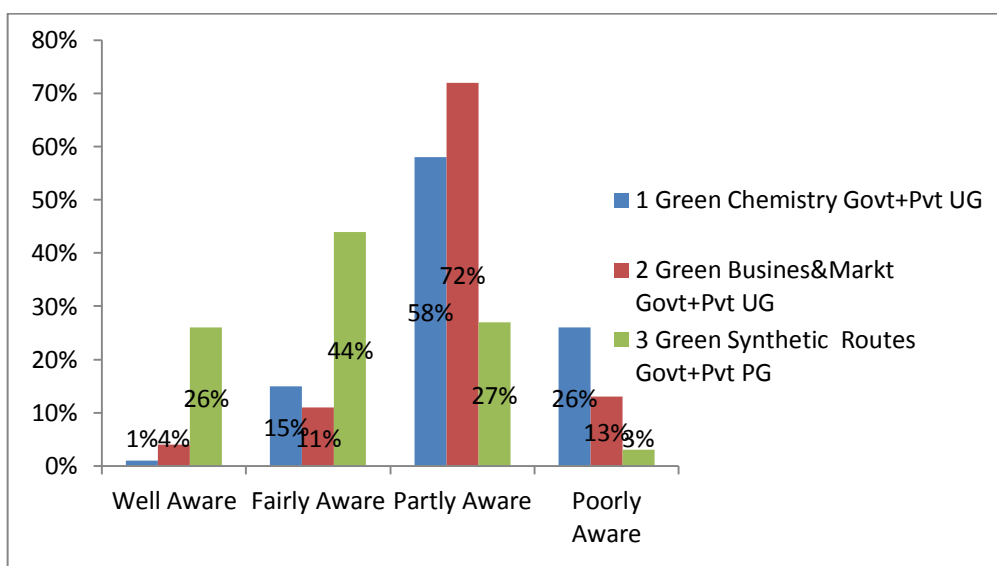
The percentage results of Deemed Universities students in various disciplines of Professional courses is shown in Graph -3 as shown below:



Graph-3 The Percentage results of Deemed Universities Students in various disciplines of Professional courses.

Table-6 Percentage results of Autonomous Institutions in various disciplines of courses

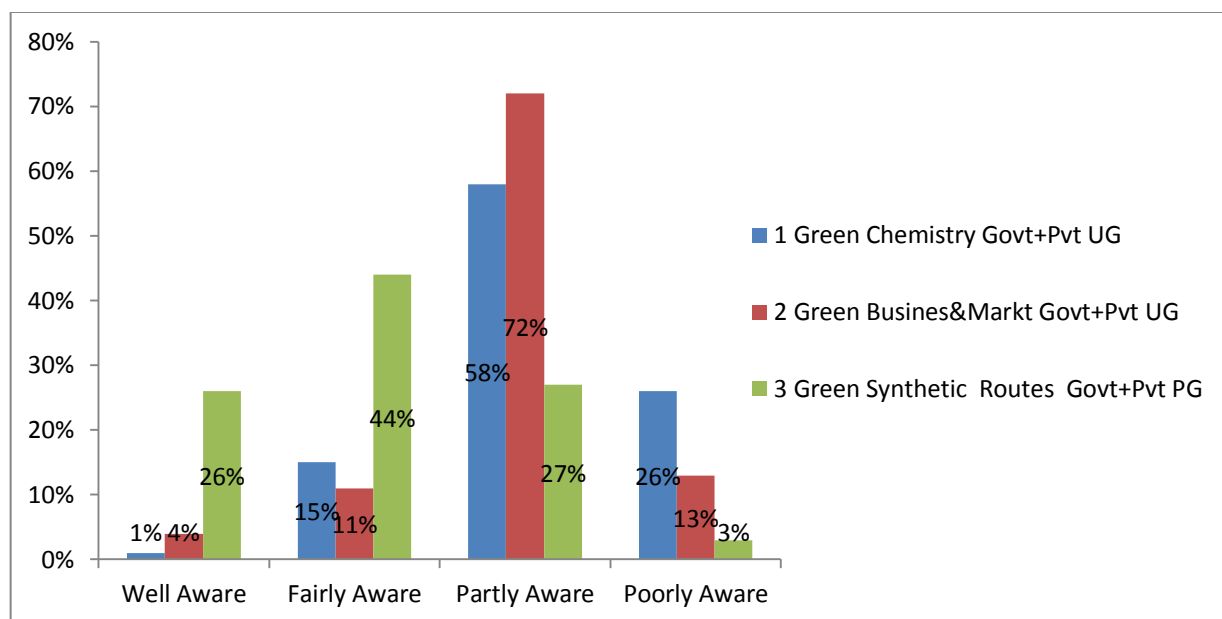
SL No	Subject	Organization	Students	Well Aware	Fairly Aware	Partly AWARE	Poorly Aware
1	Green Chemistry	Autonomous	UG	3%	26%	60%	11%
2	Green Business	Autonomous	UG	7%	30%	58%	5%
3	Green synthetic Chem Routes	Autonomous	PG	26%	37%	26%	11%
4	Green Management & Markt.	Autonomous	PG	12%	9%	56%	23%



Graph-4 The Percentage results of Autonomous Institutions Students in various disciplines of Professional courses.

Table-7 Percentage results of Government and Private Institutions Students in various disciplines of professional courses

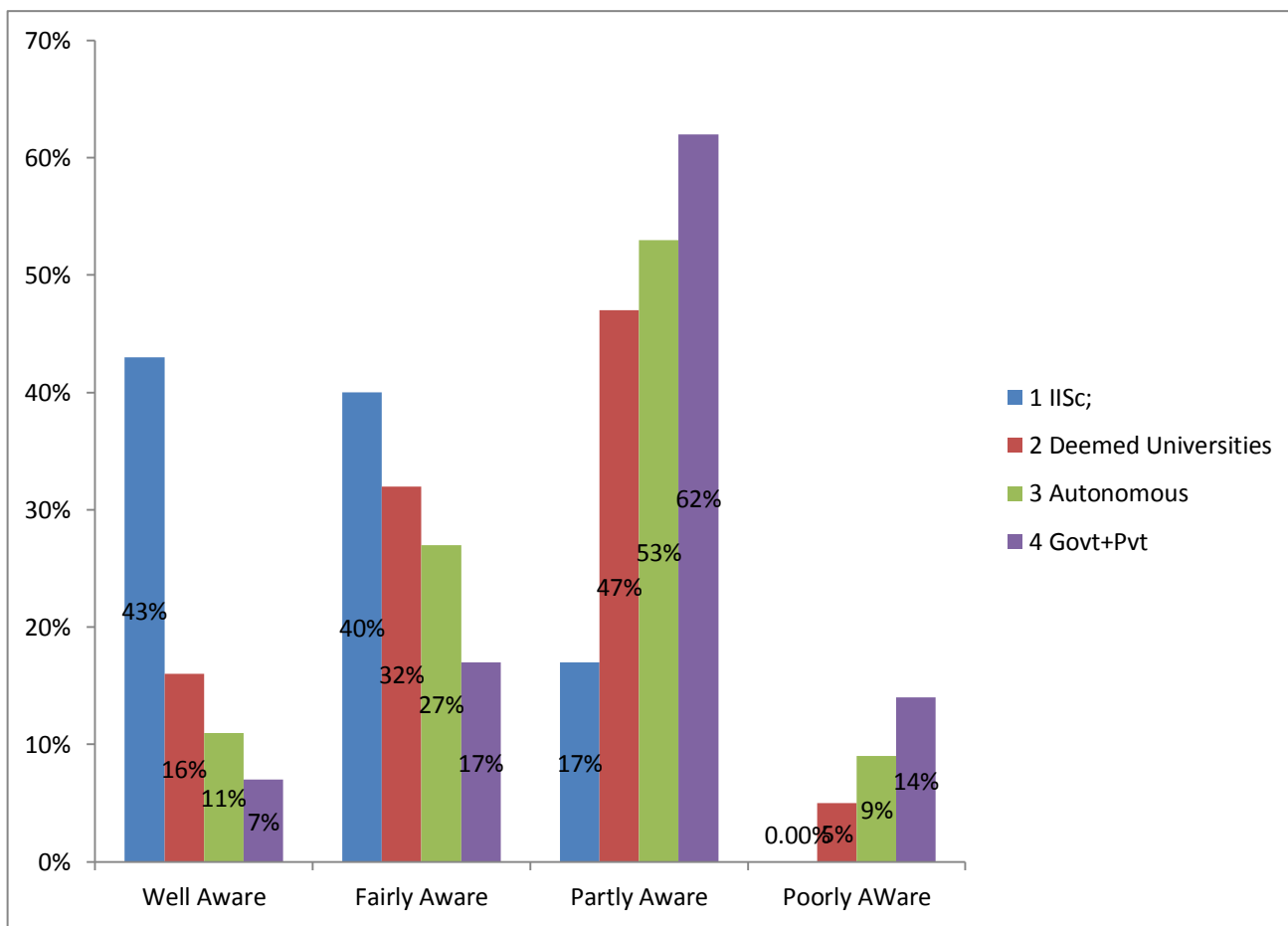
SL NO	Subject	Organization	Students	Well Aware	Fairly Aware	Partly Aware	Poorly Aware
1	Green Chemistry	Govt+Pvt	UG	1%	15%	58%	26%
2	Green Busines&Markt	Govt+Pvt	UG	4%	11%	72%	13%
3	Green Synthetic Routes	Govt+Pvt	PG	26%	44%	27%	3%

**Graph-5 The Percentage results of Government and Private Institutions Students in various disciplines of Professional courses.**

The overall results of awareness levels combined from the different professional courses of Institutions under different categories are shown in Table -8. This table reveals the number of students in different awareness levels and the Graph-6 reveals the percentage of various levels of awareness of Institutions under different Categories as follows:

Table-8 The Overall Percentage Results of various levels of awareness combined from different Professional Courses of Institutions under different Categories.

SL NO	Organization	Well Aware	Fairly Aware	Partly Aware	Poorly AWARE
1	IISc;	43%	40%	17%	0.0%
2	Deemed Universities	16%	32%	47%	5%
3	Autonomous	11%	27%	53%	9%
4	Govt+Pvt	7%	17%	62%	14%



Graph-6 The Overall Percentage Results of various levels of awareness combined from different Professional Courses of Institutions under differentCategories.

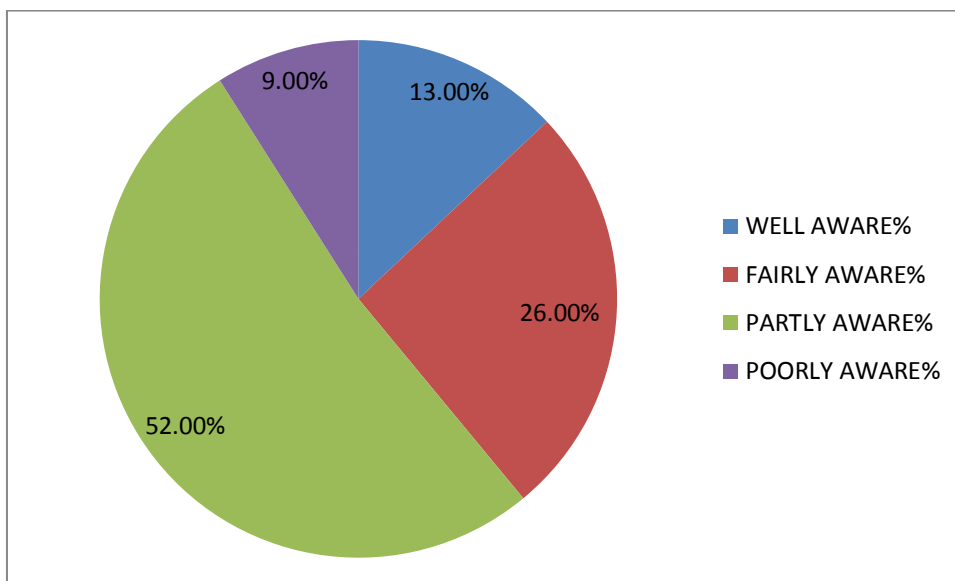
It can be clearly seen from Graph-6 which reveals the overall percentages of various levels of awareness of Institutions under different Categories combined from different disciplines that Indian Institute of Science shows the highest Percentage of awareness in Well aware level which is 43% deemed Universities reveals 16% ,the autonomous Institutions shows 11% and the Private &Govt institution shows only & 7% in Well aware level. In the Fairly aware level again IISc : students have the highest percentage of 40% next is Deemed Universities with 32% where as Autonomous Institutions reveals 27% and the private and Govt institutions shows 17% in fairly aware level.In the partly aware level IISc; students show the least percentage of 17% where as the Private and Govt Institutions has the highest percentage of 62% the autonomous institutions reveals 53% and Deemed Universities shows 47% in the partly aware level.Finally in the Poorly aware level IISc; shows 0.0% ,Deemed Universities 5% ,Autonomous Institutions 9% and Privateand Govt Institutions 14%

The overall percentage of results of different awareness levels combined from all the professional courses of different Disciplines from combined institutions of different categories is shown in table -9 and represented by Pi graph number 7 as follows.

Table-9 The overall percentage of results of different awareness levels combined from all the courses of

SL NO	WELL AWARE%	FAIRLY AWARE%	PARTLY AWARE%	POORLY AWARE%
1	13.0%	26.0%	52.0%	9.0%

Different Disciplines from combined institutions of different categories



GRAPH-7 Pie graph of The overall percentage of results of different awareness levels combined from All the Courses of Different Disciplines from combined institutions of different categories.

Results and Discussions:

Statistical computations by Chi-Square Test have been used for the results analysis. The Chi-Square(X^2) measures the difference between observed (O) and expected (E) frequencies of nominal variables in which subjects are grouped in categories or Cells. The Chi-Square uses the formula as follows:

$$X^2 = \sum (O-E)^2 / E$$

Where the letter O represents the observed frequency, the actual count in a given cell. The letter E represents the Expected frequency, a theoretical count for that cell. Its value must be computed. The more O differs from

E, the larger X^2 is. When X^2 exceeds the appropriate critical value, it is declared significant.

The chi-square Tests can be used on actual numbers and not on percentages.

There sults of number of students in different awareness levels of various institutions categories in present study are calculated and are shown in Table-10 as follows:

Table-10 Results of number of students in different awareness levels of various institutions under different Categories

SL No	Organization	Well Aware	Fairly Aware	Partly Aware	Poorly Aware	Total Students
1	IISC;	60	57	24	0	141
2	Deemed Universtis	43	87	127	12	269
3	Autonomous	49	127	246	45	467
4	Govt+Pvt Institutions	39	98	355	79	571
No of Students		191	369	752	136	1448

The above table shows the **number of students** in various awareness levels of different institutions categories.

The data tabulated in the above Table-10 was subjected for carrying out the **Chi-Square Test** for testing the Hypothesis.

Hypthesis: Hypothesis to be Tested: Awareness depends on type of Organization/ Institution

The computation of X^2 test statics data obtained for testing the for Hypothesis are tabulated in Table-11 as follows:

Table-11 Cross Tabulation between awareness levels and type of institutions

Type of Institution	Awareness Levels				Total
	Well aware	Fairly aware	Partly aware	Poorly aware	
Public University	103 (25.1)	144 (35.1)	151 (36.8)	12 (2.9)	410 (100.0)
Autonomous	49 (10.5)	127 (27.2)	246 (52.7)	45 (9.6)	467 (100.0)
Govt + Pvt Institutions	39 (6.8)	98 (17.2)	355 (62.2)	79 (13.8)	571 (100.0)
Total	191	369	752	136	1448

Figures in parenthesis are expected counts/frequencies

Chi-Square Tests

Pearson Chi-Square Value = 155.200

Asymptotic significance = 0.000*, * Significance at 5 %

Interpretation:

As observed from table 11, the chi-square value of 155.200 and a p-value of 0.000 ($0.000 < 0.05$) indicating that the null hypothesis of no association between the type of institution and level awareness is rejected statistically at 5% level of significance. In other words, there is evidence (statistically) that there is an association between type of institution and level of awareness. In other words, the level of awareness among students definitely depends on the kind of institution the students are enrolled.

Summary of findings and conclusions

1. he awareness depends on the type of Institution, thus IISc has the highest percentage of 43% in well aware level combined from different Interdisciplinary professional courses .The Fairly aware level and Partly aware level show 40% and 17% respectively with 0% in Poorly aware level. The Deemed Universites reveals 16% in well aware level combined from different professional courses. The Fairly,partly and poorly awareness levels being 32% ,47% and 5% respectively. The Autonomous, Govt and Pvt.Institutions have higher percentage in partly aware level combined from all professional courses being 53% and 63% respectively .The well aware level percentage being 11% and 7% respectively. The fairly level reveal 27% and 17% respectively with Poorly level being 9% and 14% respectively.

Overall awareness combined from all the interdisciplinary professional courses of all the institutions under different categories show 13% in Well aware level ,26% in Fairly aware level, 52% in partly aware level and 9% in poorly aware level.

2. Thus IISc ; can start interdisciplinary research in climate and energy sciences to tackle global warming and Climate change. Even the deemed and Autonomous institutions can Focus on Intedisciplinary courses for Environamental studies .The Govt. Institutions can receive good amount of funds from government and Initiate interdisciplinary courses for Environment and Climate change studies.
3. It is important that students from various areas of science be exposed to green chemistry, as many innovative science discoveries are made today through interdisciplinary collaborative work.
4. Sustainable solutions to nation's material and energy needs must consider environmental, health, and social impacts while developing new technologies. Building a framework to support interdisciplinary interactions and incorporate sustainability goals into the research and development process will benefit green chemistry and other sciences.
5. There have long been calls from industry for guidance in implementing strategies for sustainable development. The *Circular Economy* represents the most recent attempt to the conceptualize integration of economic activity and environmental wellbeing in a sustainable way.

Future Needs and Conclusions

1. Copenhagen leads Climate Change fight by 2025 ,this once –grimy industrial city aims to be net Carbon neutral, as it plans to generate more renewable energy than the dirty energy it consumes.

Can city cancel out its greenhouse gas emissions? Copenhagen intends to. Here ‘s why it matters to the rest of the world .half of humanity now lives in cities ,and the vast share of planet –warming gases comes from cities.The big fixes for climate change need to come from cities, too. They are both a problem and a potential source of solutions.

The Experience of Copenhagen, home to 624,000people,can show what is possible ,and what is tough, for other urban governments on warming planet.

2 .New Technology could slash carbon emissions from aluminium production. Technology has been unveiled that could drastically cut greenhouse gas emissions from aluminium production, in a development that could transform the way one of the world’s most common materials is made.

The Canadian government and two of the world’s biggest aluminium producers, Alcoa and Rio Tinto, hailed a “breakthrough” technology that they said would remove carbon dioxide from the smelting process. Executives from the companies said it was “the most significant development in aluminium in a century”.

The companies said the change would reduce carbon dioxide production by 6.5bn tonnes a year in Canada alone, where it is first being rolled out. That is equivalent to taking about 1.8m vehicles off the road. The technology would also reduce operating costs by about 15%, the executives said.

Carole Ferguson, the head of investor research at the Carbon Disclosure Project, which rates businesses and sectors on their performance in reducing carbon, said: “This is very important. It is fantastic to have this technology that reduces carbon and eliminates it from the [smelting process].”

‘New method to produce Green Steel Reported from Massachusetts Institute, USA .The researchers have a new method through which steel melting, one of the World leading Industrial source of Green House effects can be made completely Green and Carbonfree. The results were published in International Journal NATURE.(2013).

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