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Investigating role of community college and student responses towards awareness on electric vehicles as a solution to environmental problems

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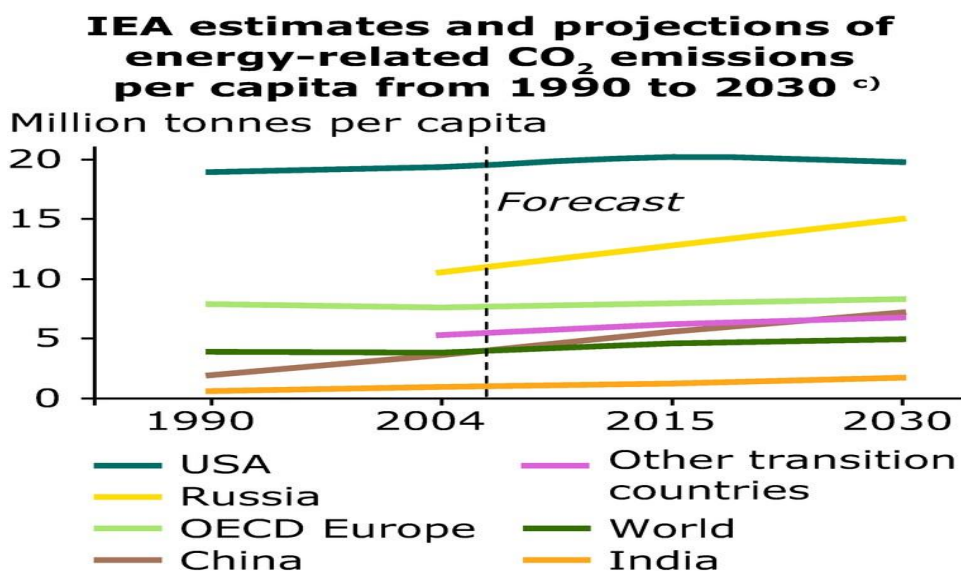
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Abstract---Environmental concerns have emerged as burning issue worldwide. Transportation sector is the major contributor causing environmental damage. Adopting electric vehicle can possibly address the issue with its potent benefits. Community colleges play crucial role in disseminating knowledge and creating awareness about environmental issues among youngsters. The present study is qualitative in nature and aims to explore the efforts of a private university and steps taken by the institution in creating environmental awareness through educational transformation among future leaders. The data was collected through conducting in-depth interviews and using observations. The findings of the study revealed that the students had fair understanding of environmental problems and university provide enough support facilitating quality courses and conducting expert sessions and workshops. The results of the study are likely to transform and address the major challenges of environment protection encouraging students through disseminating conceptual and technical knowledge towards sustainable transportation.

Keywords---environment, electric vehicle, community college, awareness, student, environmental problem.

Introduction

Hundreds of millions of cars emitting greenhouse gases on the road worldwide are evident indicator of improving economies and increasing population. Transportation sector is growing fast and contributing majorly in global greenhouse gas emissions (Hassan, Rahman & Abdullah, 2010). China, India, United States and European Union are the top global transport market emitting majority of vehicle emissions impacting health. The highest number of deaths (approx 70 percent) attributed to total air pollution were from these four countries in the year 2015. United States is the largest producer of transportation emissions worldwide, contributed roughly twice of CO₂ emissions by second largest emission producer China, with a total of 1.76 billion metric tons of carbon dioxide in the year 2018 (Statista, 2021). Transportation emissions have led a surge in Asia-Pacific owing to rapid economic development in countries like China and India. In recent decades dramatic increase has also seen in transportation emissions in Africa and the Middle East. Out of total transport emissions worldwide, road transport contributes roughly forty five percent. With more than a billion sheer cars on the road, this is not a surprise. Approximately 1.8 billion metric tons of CO₂ emitted worldwide by just 64 million heavy-duty and medium-duty trucks in the year 2020. Transport sector accounts for 25% of total carbon dioxide (CO₂) emissions globally from fuel combustion (IEA, 2020). In comparison to previous years an increase by less than 0.5% has been witnessed in global transport emissions in 2019 which can be attributed to improvements in efficiency, increased use of biofuels and electrification. Still, 24% of direct CO₂ emissions from fuel combustion attributed to transportation. Around three-quarters of transport CO₂ emissions are coming from road vehicles. Nevertheless, aviation and shipping emissions are rising continuously.



Source: EEA, <https://www.eea.europa.eu/legal/copyright>

Transport sector is going through a very significant transition highlighting the need for sustainable transportation to save mankind and environment from this grave problem of pollution majorly caused by emissions from transport sector. Economies worldwide are moving towards sustainable mobility and India is not an exaggeration. In order to reduce energy demand and increasing efficiency, the existing measures must be extended for Sustainable Development Scenario (SDS) compliance. A significant attention of policy makers and academicians has been drawn by Sustainable Development Goals (SDGs) in United Nations 2030 agenda to deliver various environmental benefits, health and economy those living in urban areas especially. It is estimated that more than two-thirds of the population will reside in urban areas by 2050 (DESA, 2018). The Secretary-General of United Nations in September, 2019 urged society to put efforts in order to address global issues (UN, 2020). Many countries across the world experiencing problems like increasing population, harsh weather, climate change, air pollution, emissions, inadequate infrastructure and resources (Salmond, Tadaki, Vardoulakis, Arbuthnott, Coutts, Demuzere & Macintyre, 2016; Vardoulakis & Kinney, 2019). Various initiatives have been taken by Indian government in order to curb its fossil fuel consumption. Two major initiatives aiming to reduce emission include National Electric Mobility Mission Plan (Government of India, 2014b) and Faster Adoption and Manufacturing of Electric vehicles (FAME).

About the University

Chitkara University is a private university and located in the northern region of India. The founders of the university are Dr. Madhu Chitkara and Dr. Ashok Chitkara, present Pro- Chancellor and Chancellor of the University respectively. Considered as one of the best in its league, the university is 'Unique' providing excellence in teaching and learning offering graduate, post graduate and doctoral programs in the field of management, hospitality, nursing, engineering, pharmacy, art and design and health sciences. Since its inception in 2010, it has been recognized as teaching institute and now going through a transition from being recognized as a teaching to research oriented university. Owing to its impressive infrastructure, teaching and research excellence the university is being recognized by various reputed national and international rating agencies. The university has the onus of featuring in the list of the Times Higher Education Impact Rankings 2020, the single university from North India. This institution is the first in the region to offer an M.Tech program in Automotive Engineering and specialization in Hybrid and Electric Vehicles.

Electric vehicle (EV) Landscape

An electric vehicle (EV) is an automobile powered on electric power either partially or fully instead of an internal combustion engine. As, electric vehicle uses less or no fossil fuel it can replace the current-generation automobile. Respective governments worldwide are encouraging the use of electric vehicles in order to curb the GHG (Greenhouse gases) emissions emitted and reduce pollution levels. In 2019 with 21 out of the 301 most polluted cities in the world, India held the worst pollution record (6 out of the 10 most polluted cities). India's air pollution

levels (average) in various cities were 8-11 times above the permitted level by World Health Organization causing over 2 million deaths annually (IQAir, 2019). In order to limit the emissions, Indian government had imposed various regulations over the years such as introducing automotive catalytic converters, National Electric Mobility Mission Plan 2020 (NEMMP) as a roadmap for the faster manufacture and adoption of EVs in India but the emissions have continued to rise from transport sector. Electric vehicles are emerging as a change for the transport sector to experience noteworthy reductions in emissions and clean technology for the future of mobility. Rapid urbanization and migration were the major factors causing vehicular congestion and air quality deterioration in India's post-liberalization journey. NITI Aayog, India's Government think-tank encouraging faster manufacturing and adoption of electric vehicle under FAME-II scheme. Two-wheelers automotive market is emerging as the largest market accounting for up to 81 per cent of total automotive sales in FY2020. The largest size of automotive market is indicator of its potential for EV adoption.

In order to generate investment and attract investment various state governments in India have introduced specific policies on electric vehicles focused on supply-side incentives. Delhi, capital of India is engaging youth being the future of India, by launching awareness campaign 'Switch Delhi' to educate and encourage them to adopt electric vehicle as their first vehicle. Transport Minister, Kailash Gahlot addressed the youth in the city and encouraged them to adopt electric vehicle.

Literature Review

Over the last two decades energy demands of the transport sector has escalated and this sector still continues to be a major contributor to CO₂ emissions worldwide (Harring, Jagers, Matti, 2017). Most promising economies are dedicated and working towards reducing their carbon footprints, making it high time to realize and understand the mechanisms influencing consumers adopting cleaner and greener vehicles, thereby providing sustainable solution for decreased dependence on fossil fuel and reduction in carbon emissions (Song & Ko, 2017). Emerging countries has been promoting environmental awareness for their younger citizens launching education program specific to environmental knowledge, awareness and Sustainable Development. Various non-profit organizations and governments across countries are developing eco-friendly communities providing environmental skills and knowledge (Lim & Lee, 2012). Previous studies investigated about student's knowledge and awareness level regarding environmental problems and found high levels of environmental knowledge and lower levels of awareness among students towards environment issues (Said, Yahaya, Ahmadun, 2007). Students were found to have knowledge about their local environmental problems. On the other hand, some students have shown their moderate concern about environmental issues (Osman, Bachok, Ibrahim, 2011) but not reflected in their behaviors (Hassan, Rahman, & Abdullah, 2010). Earlier research confirmed educating youngsters about environmental issues can be an effectual strategy for preparing them to understand, mitigate and slower down environmental degradation (Incekara, Tuna, Dogan, 2011). Previous studies found that students' develop interest and positive attitude towards environment, if provided with ample

opportunities to learn and innovate (Aminrad, Zakariya, Hadi, & Sakari, 2013). Students found to have fair understanding of environmental issues (Hassan, Shaw, Shiu, Walsh & Parry, 2013). Earlier research identified that proper students get influenced to conserve the environment, if they have proper understanding of environment issues (Omran & Gebril, 2011; Said, Shamsudin & Ahmadun, 2016). In emerging countries, business school students develop their understanding and conceptual clarity of eco-friendly business processes in order to internationalize their products or businesses to potential consumers attracted by eco- friendly products and having higher level of awareness regarding environment issues particularly in developed nations. Many educational institutions across counties dedicated to provide formal education and professional development program in electric vehicle technology. For instance, Germany's Showcase Regions, British Columbia provides funding for electrician training and Gateshead College and Sunderland University in the UK offers certification technology related to electric vehicle. Moreover, institutions provide opportunities for research in the said area and provide training as well for future leaders such as the University of California-Davis. Similarly, Chitkara University provides training to future workforce in technology related to electric vehicles and offers specialization in hybrid and electric vehicles.

Aim of the Study

The present study aims to find out the students understanding about environmental problems and electric vehicles as one of the solution to these problems, role of community colleges or educational institutions towards building student's awareness and adoption of electric vehicles. This study also identified the different measures which an educational institute can opt in contributing towards adopting electric vehicle and addressing environment concerns. As the study engaged youth, the study bring out major factors to be considered by policymakers in order to implement the framed plans by respective government about electric vehicle adoption.

Youth education and professional development

Transportation infrastructure is one of the indicators of nation's development worldwide enhancing one's quality of life either in urban or rural areas (Trumper, 2010). Problems such as increased pollution, climate change, dangerous emissions impacting health faced by people globally, evidently transport sector being major contributor. Youngsters being flag bearers of future will be in charge of ensuring the planet's survival ultimately. The future generation can conserve, preserve and sustain the environment if provided with environmental education and awareness (Harring, Jagers, & Matti, 2017). Most of the emerging economies have large numbers of young people and eventually large workforce with few exceptions of course. Young students demonstrate high interest level in learning and addressing environmental issues (Harring & Jagers, 2017). Students are considered as future managers leading future society towards eco-friendly products. Their awareness and education towards eco-friendly products is crucial ensuring

the planet survival. Willingness to accept the change is more in case of young students and they will influence the future.

Methodology

Data Collection

For the purpose of data collection interviews has been conducted via Telephone and Face to Face by the author between April 2021 and July 2021. For the present research, author considered to follow mixed interviews approach as it allowed the respondents to completely express and convey their experiences and perceptions from their homes over telephones and face to face (Ross & Squires, 2011).

Table 1. Demographic profile

S. NO.	Participants	M/F	Age	Interview Mode
1	Student	Female	18	One to One
2	Student	Male	22	Telephonic
3	Faculty	Male	35	One to One
4	Student	Female	22	Telephonic
5	Faculty	Male	29	One to One
6	Faculty	Male	38	One to One
7	Faculty	Female	41	Telephonic
8	Student	Female	22	One to One
9	Faculty	Male	25	Telephonic
10	Faculty	Female	45	One to One
11	Student	Male	22	Telephonic
12	Student	Male	18	One to One
13	Faculty	Male	32	Telephonic
14	Student	Female	21	Telephonic
15	Faculty	Female	19	One to One
16	Student	Male	22	Telephonic
17	Student	Female	20	One to One
18	Faculty	Female	47	One to One
19	Student	Male	25	Face to Face
20	Student	Male	21	Telephonic

Source: Author compilation

Participants

Using purposive sampling technique, a total of 26 participants were selected for the study. Students and faculty at Chitkara University were the participants. The author was able to approach only 20 participants due to connectivity issues. Hence, twenty semi-structured interviews were conducted having time duration of 17 to 25 minutes.

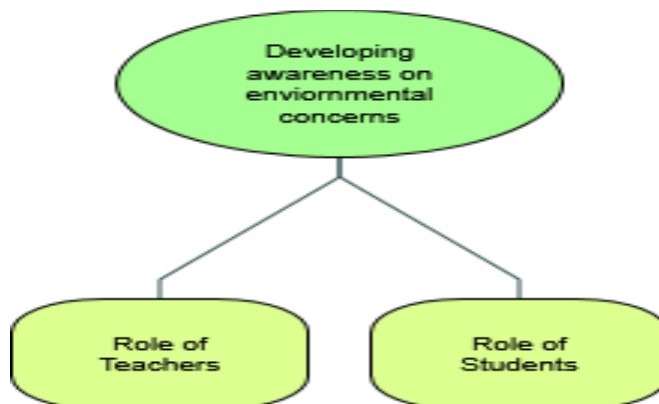
Data analysis Instrument

In order to analyze the qualitative data author used NVivo Pro, tool which assists in managing information especially useful for the qualitative research. NVivo comprises of two qualitative softwares namely NVivo Transcription and NVivo 12 for the purpose of data transcribing and analyzing the data respectively. NVivo Transcription was utilized to convert the recorded interview files into MS- Word format and NVivo 12 was used to analyze the transcribed data. In analysis stage, firstly we imported transcribed files to NVivo and then various analysis techniques were applied on the data such as Word cloud, Mind Map, Word Frequency, Word tree were and Text Search Query etc. offered by NVivo. A word cloud is basically a cluster or collection of words a shown in different sizes and colors. The words which appear more frequently in the dataset will appear bigger and bolder. At the initial stage of this research, a mind map is created to explore the initial theories. Words or concepts occurring more often in the dataset are shown by Word Frequency query. Text search queries depict all occurrences of a Phrase or word in the dataset. In order to find out each and every instance of alphanumeric text strings particularly, Word Frequency Query is commonly used feature in NVivo. Word tree is a feature in NVivo which is used for data visualization and Tree maps are frequently used in NVivo to make comparisons on the basis of an attribute value or to explore coding.

Results and Discussion

In order to explore the expectations of researcher we created a mind map using Nvivo12. Mind map is a true reflection of thoughts on a particular topic included all the variables around which the collected data shall be interpreted.

Figure1. Mind map

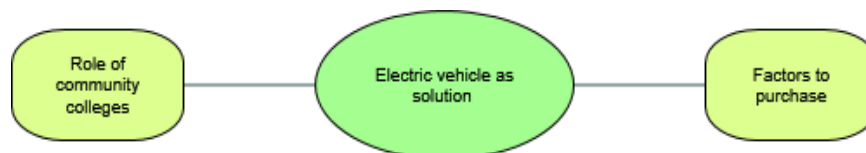


Source: QSR Nvivo

Awareness on environmental concern

Under this broad component of developing awareness on environmental concern, it would reflect the role of teachers and students in developing the understanding and awareness on environmental issues in the university during to ensure that faculty and students have fair understanding of such issues and both faculty and students contribute in creating awareness for the same.

Figure 2. Mind map

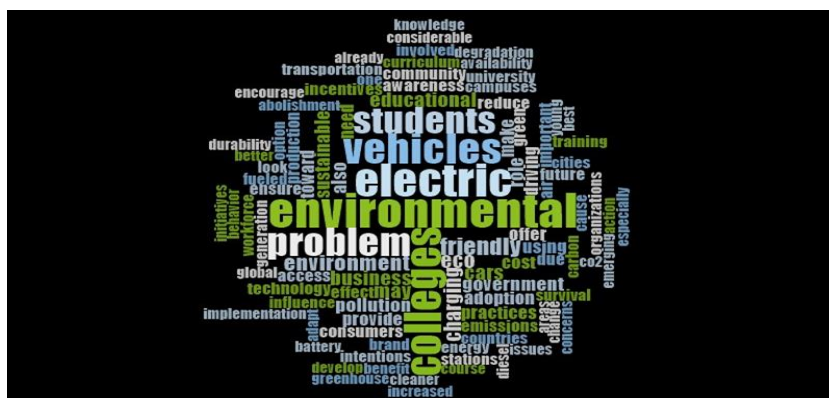


Source: QSR Nvivo

Electric Vehicle as solution

This section provides insight into electric vehicle as a solution to such grave environmental problems and in this the role of community colleges or educational institutions is being discussed as a component as such institutions lays foundation by providing knowledge, expertise and enough infrastructure for making electric vehicles as a big solution to big problems. It will also throw light on the various factors that faculty and students may find crucial for purchasing an electric vehicle for making a contribution to the environment. Data analysis and interpretation is being depicted through below figures, using NVivo12. In –depth interviews were conducted for collecting the data from the participants. The core areas of the study were identified namely; ‘Awareness on environmental concern’ and ‘Electric vehicle as solution’. Before discussing the results, it is apt to discuss the basic understanding and awareness of the participants on environmental problems or issues.

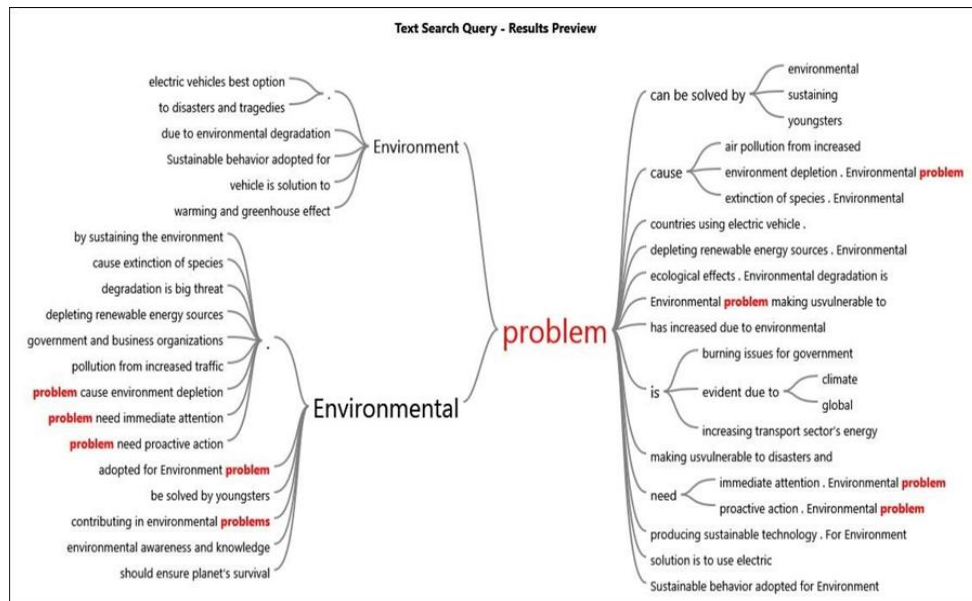
Figure 3. Word Cloud showing frequently used words by respondents



Source: QSR Nvivo

This word cloud captures the complete view of responses in a single display. Figure 3 presents commonly used words by the participants during interviews. It is evident that interviewees focused upon words and phrases such as, 'Environmental problem', 'Electric Vehicle', 'Students', 'Colleges', 'Eco-friendly', 'Pollution' etc. Environmental problems and Electric Vehicle as a solution is at the center clearly. The framework provides noteworthy view of the required course of action in environmental problems with the help colleges and students. Figure 3 represents the most common words or phrases used by respondents during interviews in the form of text search query conducted for the term 'Environmental problems'

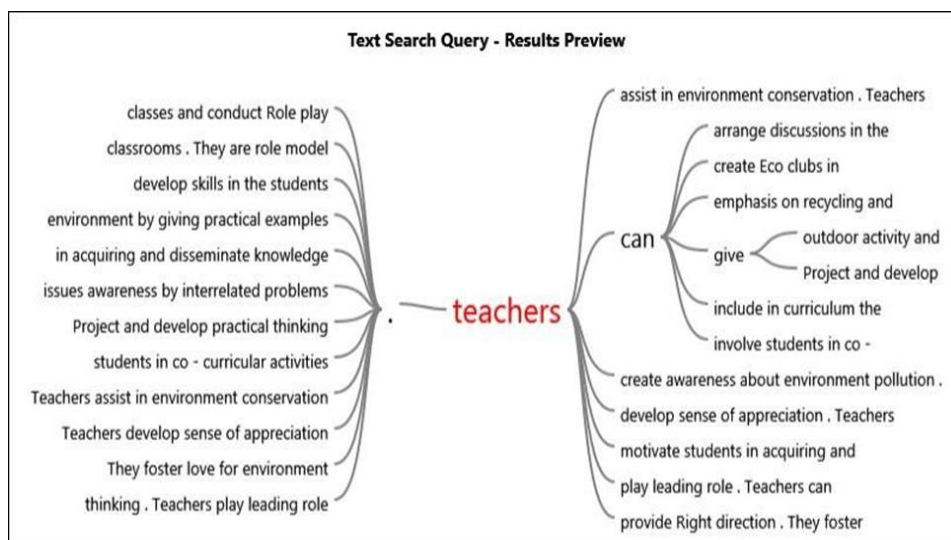
Figure 4 Text search query for the term 'Environmental Problems'



Source: QSR Nvivo

Figure 4 presents the word tree generated by text search query for the term 'Environmental problems' in Nvivo. Several association can easily be drawn from word tree like 'burning issue', 'depleting renewable energy sources', 'extinction of species', 'sustainable behavior to be adopted', 'increasing air pollution', 'pollution from increased traffic' and 'use of electric vehicle' etc.

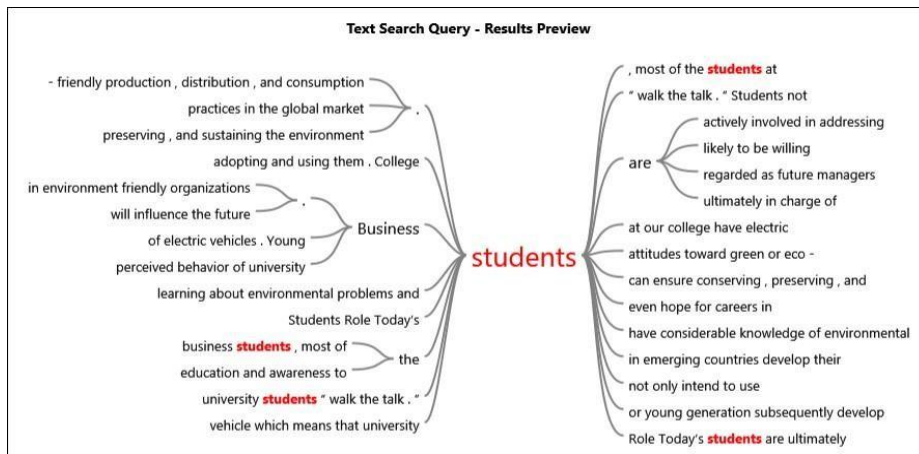
Figure 5 Text Search Query 'Teachers'



Source: QSR Nvivo

The faculty in an educational institution plays a very crucial role in developing awareness among students regarding environmental problems and their solutions. Teachers are the pillars of the society and role model for the students. In this consideration many significant inferences can be drawn from the above figure such as 'teachers can provide right direction', 'motivate students', 'arrange co-curricular activities', 'develop practical thinking by creating Eco-clubs' 'conducting quiz and debates in classroom' 'assisting in environment conservation' 'focusing on recycle and reuse' 'conducting field trips and outdoor activities' etc. While it is significant to make students aware about environment by making it a part of curriculum and on the same line, Chitkara University has made it compulsory to study a course on 'environmental studies' in every semester for each and every programme. Chitkara University has even adopted nearby villages namely, *Ramnagar, Thuha, Kalo Majra, Jansla and Fatehpur Garhi* and keeps on conducting such green practices in these five villages by giving various projects to students. It helps in disseminating the knowledge and creating awareness in these rural areas and reinforces student's understanding as well.

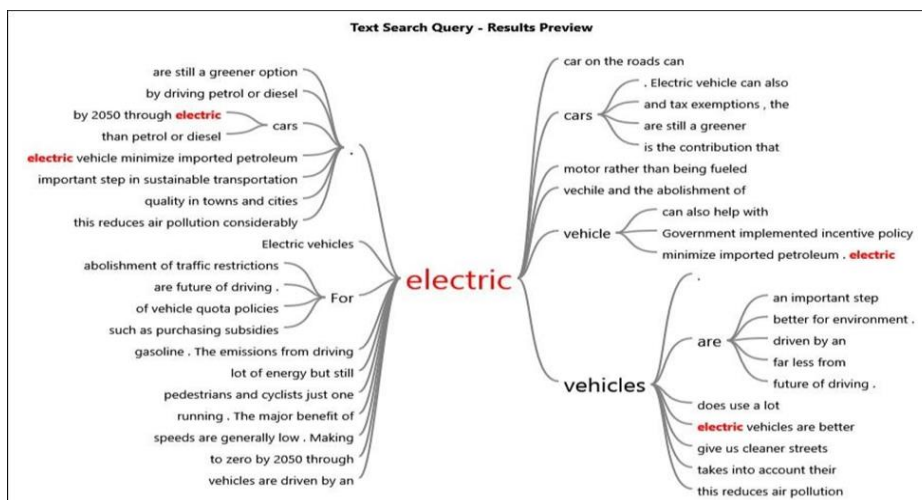
Figure 6 Text search query for the term 'Students'



Source: QSR Nvivo

The students of Chitkara University found to have fair understanding on environmental problems and teachers/faculty also contribute in different methods to make them aware about such issues (discussed in figure 5). So, the students have used various phrases in their interviews depicting their understanding and contribution towards such big issues. In this consideration various significant inferences can be drawn easily from this text search query such as 'actively involved in addressing such issues', 'using electric vehicle' indicating 'walk the talk' 'using environment friendly products' 'ensuring conservation' 'likely to willing serve eco-friendly organizations' 'future generation is responsible' etc. Out of those interviewed six students and four faculties were already using electric vehicle replacing their vehicles running on petrol or diesel.

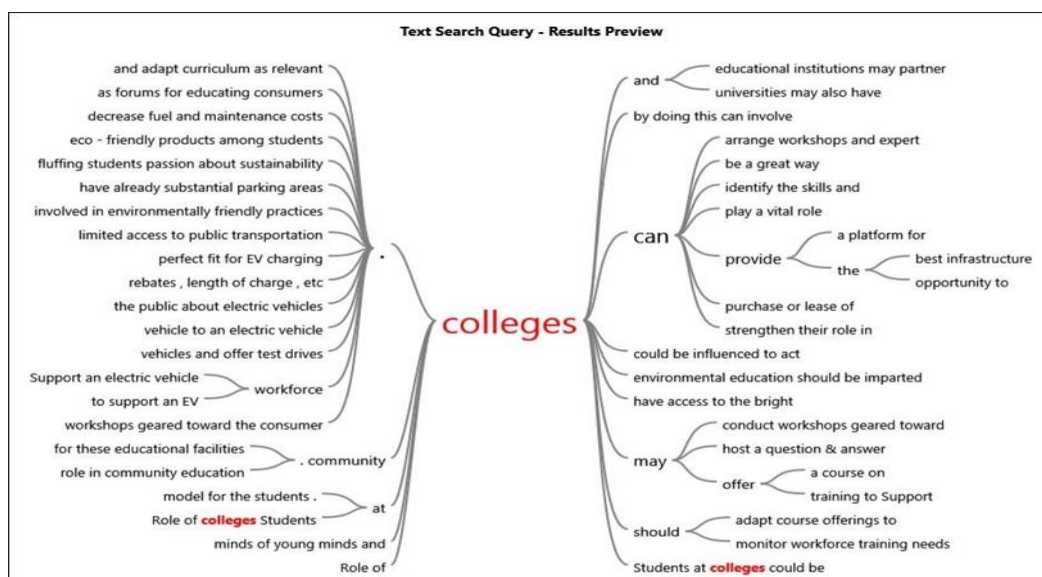
Figure 7 Text search query for the term 'Electric vehicle'



Source: QSR Nvivo

Using electric vehicle can contribute solving environmental problems to a larger extent. In the interviews students and faculty of Chitkara University discussed about various benefits of using electric vehicles. The above figure depicts their understanding and views on preferring such vehicles as a solution to environmental problems. Major inferences can be drawn from this figure about electric vehicle such as 'sustainable transportation' 'minimizing imported petroleum' 'better air quality in towns and cities' 'reduce air pollution' 'with electric vehicles we can achieve zero emission by 2050' 'tax exemption' 'greener option' 'better for environment' and most importantly 'future of driving'. Students, being future generation are responsible for protecting and conserving the environment. It can be depicted from the inferences drawn that students are realizing the potential of electric vehicle as a solution to environmental issues and bring out some major points like 'incentives and subsidies' offered by government for increasing the sale of electric vehicles but still the growth in the sale of such vehicles is at lower pace.

Figure 8 Text search query 'colleges'

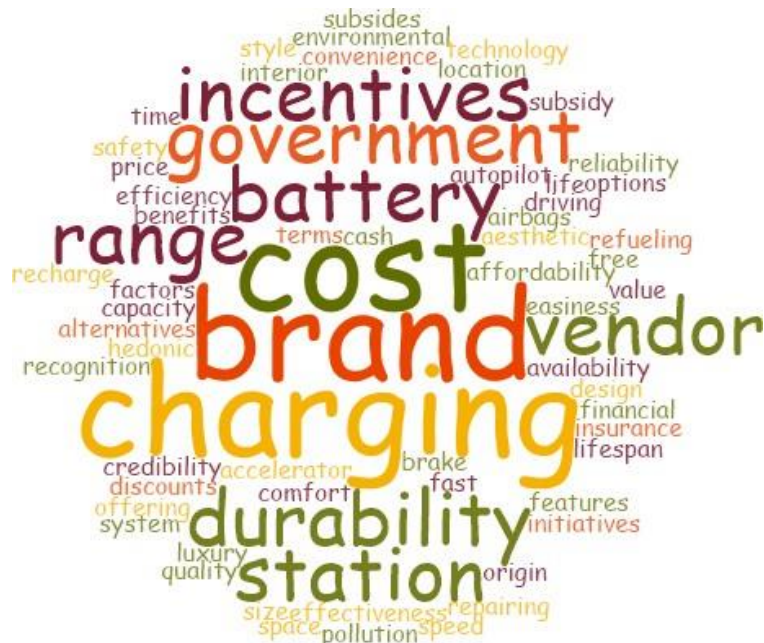


Source: QSR Nvivo

The above figure is depicting vital role of community colleges or educational institutions about electric vehicles and the faculty and students given their insights that how such institutions can provide assistance in terms of providing workforce, training, infrastructure, disseminating knowledge etc. The above figure depicts the relevance of colleges in making electric vehicles a big hit. Significant inferences from above figure are 'identifying skills' 'develop understanding' 'awareness' 'providing facilities' 'perfect place for charging stations' 'environmental education' 'conducting workshops' and expert sessions' 'professional knowledge' 'offering test drive to students and staff' 'large number of potential buyers' bright students as future workforce' 'influence to act' 'course offerings in the area' 'parking area' 'partnering with

dealers for promotion' 'arranging question and answer session with experts of EV' 'providing training' 'monitoring needs' etc.

Figure 9 Word cloud presenting factors considered for an electric vehicle purchase



Source: QSR Nvivo

This helped in capturing the overall view of responses in a single sight. Figure 8 shows the most common factors effecting the purchase decision of an electric vehicle by faculty and staff at Chitkara University. It can be seen that the respondents focused upon words and phrases like, 'Cost', 'Brand', 'Charging', 'Technology', 'Battery', 'Range', 'Vendor', 'Durability' 'Government incentives' etc.

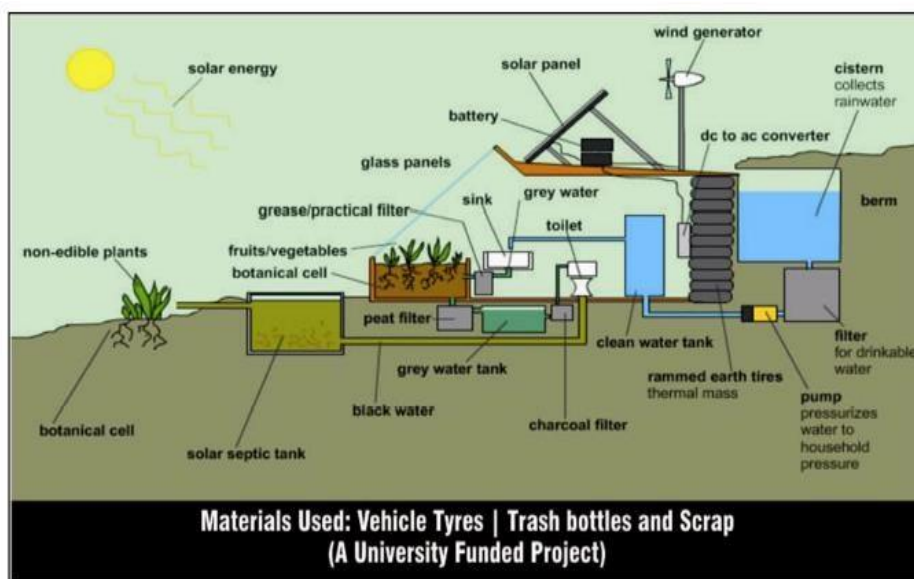
Overview

Developing awareness on environmental issues: WALK THE TALK

Undoubtedly it is essential to develop awareness on environmental issues in order to preserve and protect the environment and educational institutions can play a vital role in creating awareness on this. Colleges which are practicing and providing such education not only making their enrolled students and staff aware but also future generation. Students and staff of Chitkara University had clear knowledge on environmental issues and working on addressing them properly. It is evident from the university's actions as well; it has been ranked among the top 10

Indian universities for achieving the individual Sustainable Development Goals (SDGs) in the prestigious Times Higher Education (THE) IMPACT Rankings -2021. Additionally, in the 'Affordable and Clean Energy' category of the SDGs, the university has also been ranked among the Top 100 globally. Indenting to minimize the ill-effects of waste on humans, aesthetics and the environment, university has an efficient Waste Management System and instituted in its campus the LED lights, solar panels to save electricity resulting in lower pollution. It has developed an innovation centre named CURIN providing assistance to students and faculty in innovating eco friendly inventions and CEED promoting Entrepreneurship Education and Development. With their minds par excellence and indomitable ethos the young inventors at Chitkara University, have developed a Paper Recycling Project. Furthermore, the students at university organize and run several green events and activities such as plantation drives, green talks etc. and established eco clubs as a central part of the cleanliness monitoring team. The Chitkarians also took initiative in the reduction of the number of trees suffering from Cuscuta in Chandigarh as an active member. The young inventors of Civil Engineering Department at the university completed green home project named "Bio- Tecture" by using waste material like trash bottles and old tyres etc. in collaboration with ACC Cement Ltd.

Figure 10 Project Bio-Tecture



Source: Chitkara University

Electric vehicle as a Solution

People especially young generation worldwide has realized the relevance of using electric vehicle for reducing dangerous emissions from transport causing air pollution leading to health problems and even death. On the same line students and faculty of Chitkara University are awakening the society as

a whole. The institute is continuously working on providing knowledge and creating awareness through conducting various workshops and seminars on the same. The university offers professional certification named 'Specialization in Hybrid and Electronic Vehicles'. Chitkara University in order to promote electric vehicle use electronic cart in the campus for various purposes.

Figure 11 University's contribution



Source: Chitkara University, Punjab, India

Practical Implications

The study provides some extremely useful insights into the role community colleges can play in developing better understanding, creating awareness, professional certification, skill enhancement and providing infrastructure for electronic vehicles as a solution for ever increasing traffic pollution. As the saying goes *Charity begins at home*, educational institutions can adopt electronic vehicles in their campus and motivate students; the future generation for adopting such vehicles for environmental betterment. The study highlights how awareness can be created among students in an educational institution by teachers practicing various practical methods as part of their curriculum and daily practice. The research can be further subjected to analysis to find out better ways to enhance the awareness among students at school level and to identify the challenges that people are facing in adopting electric vehicles. This study provides significant insights to the governments, marketers, academicians, social workers, environment preservers, general public, students and policymakers in order to protect and preserve the environment as well as health by reducing emissions dangerous emissions coming from transport sector.

Conclusion

The practices undertaken by the university to awaken the youth not just inculcating those in curriculum but also applying them in campus is exemplary. Effective curriculum along with conducting co-curricular activities for making students, faculty and nearby people aware on environmental problems is

highlighted throughout the study. As a result, the students and faculty found to have a good understanding of such issues and clearly able to identify the role of students, faculty and colleges to tackle these problems and adopting electric vehicles as a solution.

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